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The distortionary effect of Corporate Income Taxation on the financial policy of Dutch firms

An empirical study

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David Zwagemaker

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1 Introduction

The aim of this thesis is to find empirical support for the hypothesis that corporate income taxation incentivizes firms to finance their activities with debt rather than equity. Although various studies have found ample estimates on the elasticity of corporate debt with respect to taxation, no such study has been carried out using data on Dutch corporations. In this thesis, I will demonstrate that the effect of a recent decline in corporate tax rates on the financial policy of Dutch firms is in line with estimates from studies using data from other countries. Furthermore, I will estimate the behavioural response of Dutch firms to the shift in tax bracket boundaries.

In a classical system of income taxation, profits generated by a firm are subject to two types of taxation. Initially these profits are taxed at firm level, generally in the year in which they arise. When the firm decides to distribute the profits to their shareholders, they are taxed once more, albeit in the form of (personal) income taxation over the dividend payments or capital gains. The fundamental concept of the classical system is that the corporation and its shareholders are regarded as independent and separate entities. Other income taxation systems, such as an imputation tax system, see the corporation as the representative of its shareholders: the firm pays taxes on behalf of its shareholders. Taxes paid at the firm level are therefore regarded as a prepayment for the shareholders' personal income taxes.

One of the most cardinal consequences of the classical view is that money provided by the shareholders, equity, is considered to belong to the firm itself. The allowances for supplied equity, dividend payments, are not considered a cost for the firm and are therefore not deductible for corporate income tax purposes. In contrast, remunerations paid to suppliers of other funds than equity, namely debt, are considered financial costs. As interest payments are deductible from taxable corporate income and dividend payments are not, corporations can create a tax shield by financing their activities with debt instead of equity.

Furthermore, tax arbitrage opportunities have arisen to utilize the debt-equity discrepancy. For instance, numerous hybrid financial instruments have been developed, so investors could receive the benefits of an equity shareholding, while payments made are still deductible at the firm-level. The introduction of profit participating loans, convertible bonds and similar instruments has blurred the distinction between equity and debt. In order to counteract this development, most countries have set certain criteria that distinguish equity from debt. The problem, however, is that these criteria are rather arbitrary and, more importantly, very different from country to country. These international mismatches have increased the planning opportunities rather than reduced them as they allow for 'double dips' where interest payments are deducted from taxable income twice.

The political debate on incentivising the use of corporate debt is soaring[1]. While the literature suggests that it is not a major cause of the recent financial crisis, overleveraging may very well have deepened it (De Mooij, 2011a). Various companies, especially in the financial sector, have gone bankrupt or had to resort to state aided funding due to insufficient equity buffers. Various forms of regulation, such as the Basel capital requirements for banks, have been or will soon be introduced in order to increase such buffers. The fundamental tax-incentive, however, remains largely unaffected, although various measures have been taken to confine this incentive.

The introduction of interest deduction limitation provisions has proven to be one of the most widely-used measures: tax systems in most developed-world countries only allow for the deduction of interest to a certain extent. For instance, thin capitalisation rules may limit the debt-equity ratio a corporation chooses, or earnings-stripping provisions may limit the maximum amount of deductible interest to a certain percentage of a firm's EBITDA. As is the case with aforementioned financial instruments, the variety of interest deduction limitations has evolved over time and between countries. In The Netherlands, the implementation of a special regime for interest income and costs has been debated in recent years. Such a system would tax interest income at a lower rate than the normal corporate income tax rate, but would also grant a deduction for interest expenses at this lower rate.

The effect of corporate income taxation on corporate behaviour and the use of corporate debt in particular have been thoroughly examined by economists, resulting in a myriad of literature. Policy papers, like the Mirrlees Report, discuss improvements to (corporate) taxation systems that could decrease the amount and the scale of distortions current systems bring about. Such improvements may be made by altering the tax base so that corresponding costs and benefits are either both taxed to the same extent, or not taxed at all. When it comes to the debt-equity distortion, two systems are generally favoured to achieve such neutrality: the Allowance for Corporate Equity (ACE) system, which allows for the cost of both corporate equity and debt and the Comprehensive Business Income Tax (CBIT) system, which does not allow for deductibility of financing costs at all.

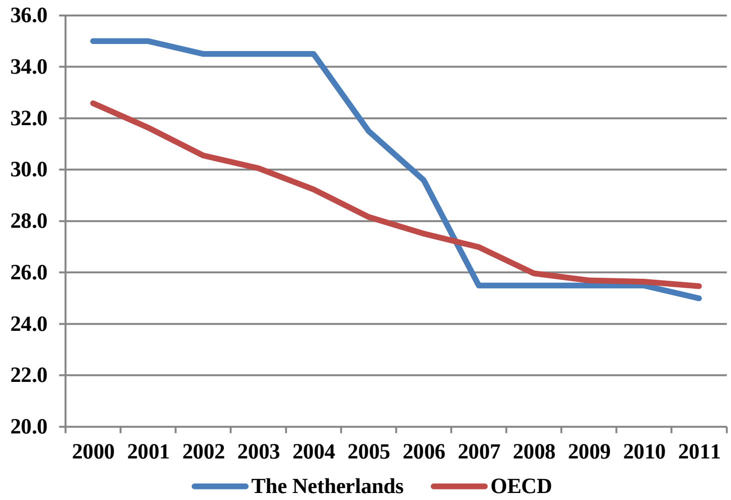
While corporate financial policy in general has been the subject of papers since Modigliani and Miller's (1958) irrelevance theorem, the effect of taxes on the corporate financial structure is a more recent matter in economic literature. Apparently, Myers' (1984) taunting statement that the wait for a study '*clearly demonstrating that a firm's tax status has predictable, material effects on its debt policy (...) will be protracted*', has had the desired effect: in the last decade in particular, economists have found ample evidence on the effect of taxes on corporate financial policy. Various authors have used firm-level data to isolate the effect of changes in corporate tax systems in various countries.

One of the events that may have evoked the recent stream of literature is the worldwide decrease of corporate income tax rates over the last decade. As globalisation greatly increased the

[1] See, for instance, the discussion on interest deductibility for takeover-holdings, as proposed by the Dutch government for the 2012 fiscal plans: http://www.rijksoverheid.nl/bestanden/documenten-en-publicaties/kamerstukken/2011/09/20/belastingplan-2012/nader-rapport-advies-bp2012.pdf.

mobility of capital, countries engaged in a fierce competition to attract such capital. In order to do so, these countries have set attractive conditions for companies to establish themselves within their borders (and thus tax jurisdiction). A key aspect for a company in determining a suitable location for establishment is the effective average rate at which their profit will be taxed (Devereux and Griffith, 1998). Therefore, countries levying lower rates of corporate income taxation typically attract more capital and companies. This has resulted in an overall decrease in corporate income tax rates, as shown in Figure 1.1.

Figure 1.1: Global decrease in corporate income tax rates



The Netherlands have been no exception to the global trend: corporate tax rates in The Netherlands gradually dropped between 2004 and 2009. Besides the overall decrease in tax rates, the rates for small businesses have been lowered especially in recent years so as to incentivise starting up a business. Moreover, the boundaries defining the small business tax bracket were shifted upwards, so that more taxpayers could benefit from the lower rate. For a detailed overview of the rates in the Dutch Corporate Income Tax Act (from hereon: CITA), see Appendix B.

As tax rates decline, the tax incentive to use debt over equity decreases accordingly. Firms facing a lower marginal corporate income tax rates generate a smaller tax shield by financing activities with debt. The recent changes in the Dutch tax rate structure therefore offer a quasi-experiment to examine the responsiveness of corporate leverage in The Netherlands with respect to these tax rates. The research question I will address in this thesis is:

"How have the recent changes in corporate income tax rates in The Netherlands influenced the financial structure of Dutch corporations?

I will use data from the Statistics Netherlands (CBS) database with Dutch firms' corporate income tax returns to analyse the effect of the drop in tax rates between 2004 and 2009. This analysis will consist of two main elements: a regression analysis on the panel as a whole, followed by a regression discontinuity design which focuses on the shifts in the tax brackets. Chapter 2 provides an overview of the literature on the distortions of profit taxation on corporate behaviour. I discuss the methodology used to carry out aforementioned analyses in chapter 3. Chapter 4 comprises information about the dataset, as well as descriptive statistics of the sample used in this research. The results will be discussed in chapter 5, leading to a conclusion in chapter 6.

2 Literature Review

The taxation of corporate income affects business behaviour in various ways. The choice for a specific legal form or place of establishment is heavily influenced by differences in taxation amongst types of legal entities and different countries. Furthermore multinational firms can, to a certain extent, shift profits to more favourable tax jurisdictions. In addition, the decision whether and how to invest funds depends on the taxation of returns generated by such investments (De Mooij and Ederveen, 2008).

Regardless of these diverse effects of taxation on business decisions, the influence of corporate taxation on the financial policy of companies is the main subject of this thesis. Corporate financial policy essentially entails two questions (Auerbach, 2002): (1) how much of the capital structure to support by debt rather than equity and (2) how much of the earnings to retain for internal financing rather than distributing dividends and raising new equity in the market. Although this thesis focuses on the first question in particular, these two questions are closely related. As corporate income taxation systems treat different sources of financing differently, the tax system distorts the optimal capital policy of firms. Nonetheless, this financial policy depends on numerous other non-tax factors as well. This gives rise to the question how substantial the actual effect of profit taxation on financial policy is.

Over the years, the effect of taxes on financial policy has become evident in economic literature. The literature substantiating these effects can (roughly) be divided in two categories: theoretical analyses and empirical evidence. As the theoretical literature on the topic is rather extensive, I will provide a general overview in paragraph 2.1. I will focus on three aspects of the literature that are of particular importance to my analysis: the endogeneity of the corporate tax status, the effect of non-debt tax shields and the influence of personal income taxation on corporate financial policy. Paragraph 2.2 subsequently entails an overview of empirical research on this topic. Finally, policy implications will be addressed in paragraph 2.3.

2.1 Theoretical foundation

Before analyzing the impact of corporate taxation on financial policy, it is useful to lay down a model as a starting point. As in Auerbach (2002), I consider the behavior of a representative firm, whose securities (both equity and debt) are supplied by a representative individual. Firms face corporate income taxation, while income taxation at the level of the investor can be different for different sources of income, such as interest income, dividends and capital gains on shareholdings.

Furthermore, I assume that capital markets are perfectly efficient. This implies that all agents have perfect information and that there are no arbitrage possibilities. Prices, therefore, fully reflect all available information (Fama, 1970). All actors are perfectly rational and neither firms nor investors are bound by liquidity constraints. Finally, the absence of transaction costs (other than, obviously, taxation) is assumed.

The cornerstone of contemporary corporate finance literature is the irrelevance theorem posed by Modigliani & Miller (1958). The first proposition[2] of their paper is that, under the assumption of perfect markets, the value of a firm solely depends on the cash flow generated from its assets. The composition of corporate liabilities therefore has no impact on firm value. When introducing market imperfections, such as taxation, this proposition no longer holds. Modigliani & Miller (1963) have extended their analysis in a follow-up article. As interest payments are deductible from taxable income, firms can create tax shields through the use of debt financing. As the amount of tax payable depends on the financial structure, financial policy may now enhance the value of the firm. The value of a leveraged firm, V_L, therefore exceeds the value of an unleveraged firm, V_U, by the value of its tax shield:

$$V_L = V_U + iD_L\tau_c \qquad (2.1)$$

The value of the tax shield depends on three factors: the amount of debt (D_L), the interest rate (i) and the corporate tax rate (τ_c)[3]. An increase in either factor increases the value of the tax shield, and thus leads to a larger discrepancy between the value of a leveraged firm and its unleveraged equivalent.

The corporate tax variable that affects managers' decisions on how to finance their assets is the marginal tax rate (MTR). This rate is defined as the present value of current and expected future taxes paid on an additional unit of income earned today. As a result of loss compensation provisions, the marginal tax rate faced by a manager may deviate from the statutory tax rate. If a firm has a negative taxable income, an additional unit of income in the current year decreases the compensable losses, reducing the possibility to offset future losses. The MTR is therefore equal to the discounted value of the taxes paid on the marginal unit of income in the first year where the firm is expected to have a positive taxable income again. The marginal tax rate thus depends on the statutory tax rates, the loss absorption clauses and managers' expectations of the firm's future earning potential.

To allow for comparison between firms, a relative measure of the amount of debt is needed. Rather than using the absolute amount of debt, the ratio between the amount of debt and the total assets provides such a measure. This ratio indicates the percentage of assets that is financed through debt financing and is defined as:

$$Debt - asset\ ratio\ (DAR) = \frac{Total\ debt}{Total\ Balance\ Sheet\ Value} \qquad (2.2)$$

[2] The other propositions focus on aspects of financial policy that are not particularly relevant in view of the subject of this thesis.
[3] Modigliani and Miller do not include the interest rate in their formula, as they argue it is independent of the size of the debt. As the tax shield created depends on the amount of interest paid rather than the size of the debt, I have included this factor in Equation 2.1.

The theoretical relationship between a firm's debt-asset ratio and its marginal tax rate is evident from the discussed literature: firms facing a higher tax rate are more likely to have higher levels of debt, as they benefit more from the tax shield generated by interest payments on its debt. A firm's financial policy, measured by its debt-asset ratio, is therefore a function of its marginal corporate tax rate MTR.

Based on aforementioned tax considerations, it would make sense for firms to fully finance their assets with debt rather than equity. Naturally, various other considerations come into play when determining a firm's financial policy. First and foremost, raising debt levels increases a firm's risk of bankruptcy: while firms may choose not to distribute dividends to their shareholders in a certain year, debt holders have a fixed (typically annual) claim on interest payments, irrespective of the firm's profit. As such, firms face a trade-off between forming a tax shield and higher bankruptcy costs.

Furthermore, agency issues may arise between the shareholders and the firm's manager(s). While the shareholders hire managers to maximize firm value, informational asymmetry may induce managers to pursue their own goals. As aforementioned fixed claim by debt holders limits the manager's discretion to pursue projects that foster their own interest, but not necessarily those of the shareholders (e.g. empire building), managers may choose to attract equity investors rather than issue debt. This is also referred to as the free-cash-flow theory (Meckling, 1986).

Finally, the signaling effect of various ways of raising capital may influence the decision on how to raise capital. Assuming that managers act in the shareholders' interests, they will only choose to issue new shares if they think this increases shareholder value. As such, investors will interpret this as a signal of overvaluation, leading to a decrease in share prices, which is obviously not in the best interest of the current shareholders. As such, the pecking-order theory suggests that managers will use internal sources of financing (i.e. retaining profits) over the issuance of debt, while issuing shares is the option of last resort. Auerbach (2002) and Weichenrieder and Klautke (2008) give a concise explanation of each of these theories as well as a general overview of the literature.

2.1.1 Endogeneity of the corporate tax status

In progressive corporate income taxation systems the marginal statutory tax rate that applies to a firm depends on its taxable income. Firms that generate lower profits typically face lower tax rates than firms with larger profits. Such progressivity also exists in the Dutch CITA, as illustrated in Appendix B. Furthermore, a firm's current debt-asset ratio is the cumulative result of many past financial decisions: a firm's current tax status therefore strongly depends on its historical financial policy.

Because of these technicalities, a spurious relationship, or reverse causality problem, may exist between a firm's current MTR and DAR. Graham (1998) illustrates this problem using the following example: consider two firms with identical future cash flows, both of which are, prior to financing, in the highest marginal tax bracket. Suppose that one of the firms increases its debt level to the extent that, because of interest deductibility, its expected marginal tax rate declines either because the firm moves to a lower tax bracket or because it is more likely to experience a loss in the future. The firm with a larger amount of debt is now associated with a lower observed marginal tax rate, while the firm with no debt has a high marginal tax rate. Because of this reversed causality, a regression of debt levels on the marginal tax rate across these two firms will produce a negative coefficient, opposite to the sign predicted by theory.

In order to circumvent this endogeneity problem Graham simulates a marginal tax rate based on methodology derived in his previous articles (1996a, 1996b) and in Shevlin (1990). This methodology involves forecasting taxable income for all years that may be affected by the profit in the current year. In his example, this period equals eighteen years, as the U.S. Corporate Income Tax Act allows for a carry forward of losses for 15 years, and a carry-back of three years. Furthermore, the simulation is based on the firm's Earnings Before Interest and Taxes ($EBIT$) rather than its Earnings Before Tax (EBT), in order to find the tax rate that is "but-for financing decisions". Next, the present value of the total tax bill over all years is recalculated after adding one dollar to taxable income before financing in the current year. The difference between these two simulations represents an estimate of the expected marginal tax rate over an extra dollar earned today. After repeating this process 50 times for each firm in each year, the average is used as a representative marginal tax rate.

Another strategy to avoid endogeneity is by looking at incremental financing decisions of firms rather than debt levels. Alworth and Arachi (2001) state that first-difference regressions on incremental decisions should have a greater power than a test based on cumulative measures of past financial choices, as incremental decisions should not be affected by previous decisions. In order to avoid endogeneity by financial decisions earlier in the current year, they use the MTR that is lagged one period as well as a tax variable that is based on Graham's methodology. The results for both variables are very similar and highly significant, yet small: if the Italian corporate tax rate were to be doubled, managers would have financed their incremental investments with eight percent more debt.

2.1.2 The role of non-debt tax shields

Forming a tax shield to eradicate the taxable profit is not restricted to the use of debt: depreciation allowances or investment credits can also lower the taxable profit. A model introduced by DeAngelo and Masulis (1980) predicts that a firm's debt level is negatively related to the level of such non-debt tax shields, as the use of other tax shields reduces the need for debt tax shields. Their two-period model entails the favourable treatment of equity in corporate income taxation, as well as the effect of personal income taxation on financial policy, which I will discuss hereafter. Furthermore, aforementioned non-debt tax shields are included in their model. These allowances and credits are lost to the firm if and insofar the taxable profit is not sufficiently high to benefit from them[4].

[4] This does not completely hold for Dutch companies, as such allowances may lead to a tax loss over a certain year, which can be offset with profits from preceding or succeeding years. However, if these losses are offset in future years, the benefit of the tax shields must be discounted to (a lower) present value.

Assuming the firm chooses its leverage ratio conducive to maximizing its market value, this ratio is influenced by the non-debt corporate tax shields. If these tax shields will be (partially) lost, the firm's market value declines accordingly. However, the loss of these tax shields and the subsequent market value decrease can be prevented by lowering the amount of debt. Empirical support for the substitution hypothesis is rather tenuous. Various studies dating from the 1980's fail to find significant effects using this strategy[5].

MacKie-Mason (1990) uses the DeAngelo & Masulis model to study incremental financing choices made by firms rather than debt-equity ratios. He argues that these ratios are the result of past decisions and therefore highly autoregressive and lumpy. Using firm-specific data on publicly issued securities (i.e. an incremental decision whether to issue debt or equity) MacKie-Mason does find that non-debt tax shields 'crowd out' interest deductibility: firms with a higher chance of losing the effect of their non-debt tax shields are less likely to issue debt at the margin, a result is also known as the 'tax exhaustion hypothesis'

Trezevant (1992) has tested both the substitution and the tax exhaustion hypothesis using data on U.S. firms before and after the introduction of the Economic Recovery Tax Act of 1981. This act significantly increased investment credits granted and depreciation allowances. Trezevant finds that firms with a higher probability of losing the tax benefit of interest deductions because of the newly introduced credits and allowances were more likely to decrease their debt levels in the relevant period.

2.1.3 The effect of personal income taxes

The fiscal treatment of financing costs at the firm level is only one side of the pendant: income from interest and dividend payments (or capital gains) is typically taxed at the level of the loan creditor or the shareholder. When the returns on equity and interest income are taxed at the same (personal income tax) rate, the firm's financing policy is unaffected by personal income taxation. However, if both types of income are taxed at different rates, the asymmetry at the firm level may either be (partially) offset or amplified.

The impact of personal income taxes on corporate financing policy has been acknowledged by Modigliani & Miller (1963). Recall that the value of a leveraged firm exceeds that of a non-leveraged firm by the value of its tax shield: $\tau_c D_L$. If, however, the income from shares and interest income are taxed at different rates (τ_{PS} and τ_{PB} respectively), this value is denoted by:

$$\left[1 - \frac{(1-\tau_c)(1-\tau_{PS})}{(1-\tau_{PB})}\right] D_L \qquad (2.3)$$

Note that the relative personal income tax rates on equity and interest income affect the value of the tax shield (and thus the incentive to finance operations with debt rather than equity).

[5] For instance, see Bradley, Jarrell & Kim (1984), Long & Malitz (1985) or Titman & Wessels (1988).

The effect of personal taxes on a firm's capital structure is also illustrated by Alworth and Arachi (2001). In their model, the costs of financing by means of equity and debt are denoted by ρ_D and ρ_E respectively. As interest costs are deductible from the corporate income tax base, the financing costs of debt are:

$$\rho_D = (1 - MTR)i \tag{2.4}$$

Taking the perfect markets assumption into consideration, investments in equity and debt should yield equal net returns for investors. Again, τ_{PB} represents the personal income tax rate on interest income. The net return on debt is therefor:

$$R_D = (1 - \tau_{PB})i \tag{2.5}$$

The proceeds received on equity can be divided in dividend payments and capital gains. The personal income tax rates on dividend payments and capital gains are denoted by τ_{PS} and τ_{PCG} respectively. Furthermore, the net proceeds depend on the level of integration of corporate and personal income taxation. Recall that investors and firms are taxed independently in a classical system, while corporate taxation serves as a 'prepayment' for personal income taxation in an imputation system. The term θ equals the amount of dividends a shareholder receives if the firm distributes one additional euro of profit. In a classical system $\theta = 1$, while $\theta = 1 + c$ in an imputation system, where c represents the (partial) tax credit shareholders receive for corporate income tax paid at the firm level. The net proceeds are therefore respectively:

$$(1 - \tau_{PS})\theta\rho_E \quad \text{and} \quad (1 - \tau_{PCG})\rho_E \tag{2.6 and 2.7}$$

Recall that the net return on debt and equity investments should be equal to each other in market equilibrium. Therefore, introducing dividend-payout ratio α, the following condition must be met:

$$(1 - m_b)i = [\alpha(1 - m_p)\theta + (1 - \alpha)(1 - z)]\,\rho_E \tag{2.8}$$

Eliminating i using Equations 2.4 and 2.5 and rewriting the leads to the following condition[6]:

$$\frac{\rho_E}{\rho_D} = \frac{(1 - \tau_{PB})}{(1 - MTR)[\alpha(1 - \tau_{PS})\theta + (1 - \alpha)(1 - \tau_{PCG})]} \tag{2.9}$$

[6] Note that formula 2.9 is endogenous, as the MTR depends on the debt-asset ratio, which is affected by the dividend-payout ratio α. As this formula is not used in the regression, this does not pose a problem.

Using formula 2.9, we can isolate the effects of the corporate and personal income taxes. The term $(1 - MTR)$ measures the effect of the first type of tax on corporate financial policy, while the influence of personal income taxes is accounted for by the remainder of the right hand side of this formula. Again, note that corporate decisions are merely affected by the *relative* personal tax rates on interest income and return on equity: if both are equal the personal income tax system does not evoke any additional distortions. Yet if interest income is subject to lower taxation at the investor level than return on equity, the effect of the asymmetrical treatment at the firm level is amplified.

The taxation of investments under the Dutch Personal Income Tax Act has changed rigorously in a major reform in 2001. Instead of taxing the actual returns on investments, a return of 4% of the average value of all assets held by individuals is assumed; the actual return on investment is irrelevant for taxation purposes. The presumptive return of 4% is taxed at a rate of 30%, effectively resulting in a 1.2% taxation over the average value of assets held by an individual. It should be noted that this taxation regime also applies to other types of 'investments', including money held in bank accounts. As such, one could argue whether the return on investments by Dutch taxpayers is being taxed at all[7].

The main implication of this system of personal income taxation is that investments in debt and equity are treated equally at the investor level. Furthermore, corporations and their shareholders are regarded as separate entities for Dutch taxation purposes: investors do not receive a tax credit for taxes paid at the firm level. It follows that $\theta = 1$ in the Dutch system of income taxation. These two conditions imply that the personal income taxation of investments in debt and equity is perfectly symmetrical in The Netherlands. Assuming the relative tax rates on interest and equity income remained unchanged in other countries where investors are based, or that all equity and debt of Dutch corporations is supplied by Dutch investors, the distortion at the corporate level is therefore amplified nor set off.

2.2 Empirical evidence

The theoretical distortion as described above has been backed up by multiple empirical studies over the last years. Although these studies vary greatly in used methodology, De Mooij (2011b) has compared the different outcomes of the most important studies and constructed a meta sample. Using 267 estimates from 19 different studies, he finds the consensus estimates for the tax elasticity of debt as listed in Table 2.1. These figures indicate the percentage change in the debt-asset ratio in response to a one percentage-point change in the tax rate. A more thorough examination of the results of these studies shows that the majority lies between 0.25 and 0.5, while very few studies report elasticities outside the range between 0 and 1.5. De Mooij also finds that the elasticities seem to increase over time, as studies using more recent data generally find higher elasticity estimates. He subsequently

[7] As the deemed 4% return rate on assets applies irrespective of the actual rate of return, the tax authorities effectively subsidize investments that yield a higher return, while assets yielding a lower return rate are effectively taxed at a higher rate.

constructs a meta-sample of these studies and runs various regressions, estimating an average tax impact on the debt-asset ratio of 0.17 to 0.28. This implies that a 10-percent decrease in CIT rate reduces the debt-asset ratio by 1.7 to 2.8 percent. These averages fluctuate depending on the definition of ‘debt’ used in the various studies: if more financial instruments are classified as debt, the elasticity increases.

Table 2.1: Estimates of tax elasticity of debt by De Mooij (2011b)

Studies	Observations	Mean (Median)	Std. Dev.	Percentage significant
Single country	97	0.78 (0.69)	0.72	75%
Multiple countries	170	0.58 (0.51)	0.43	79%
Total	267	0.65 (0.51)	0.57	78%

As the overview given by De Mooij is rather comprehensive, I will only focus on those papers that successfully circumvent the endogeneity trap and that are similar to the research carried out in this thesis. The first study that documents an unambiguous effect of taxes on corporate debt levels rather than incremental decisions is carried out by Graham (1998). Using simulated tax rates as described in section 2.1, he finds that a change in the marginal tax rate from 0 to 46 percent will, on average, result in a 19.6 percent increase in the firm’s debt-to-value ratio. In accordance with Graham (1996), De Mooij shows that using tax variables that rely on after-financing tax rates leads to estimates with the incorrect sign based on the theoretical relation between debt and taxes.

The research carried out by Gordon and Lee (2001) is very similar to that in this thesis: they use the progressivity of the U.S. corporate income tax rates to estimate the effects of changes in these rates on the debt policies of firms of different sizes. As is the case in The Netherlands, small firms in the U.S. face lower tax rates than large corporations. Using a panel of tax return data ranging from 1954 to 1995 they investigate various changes in the relative tax rates faced by small and large firms. Contrary to the current system in The Netherlands, the U.S. personal income tax system taxes income on equity (e.g. dividend or capital gains) at a different rate than interest income. As such, the tax variable used by Gordon and Lee internalizes both personal income tax rates, as explained under 2.1.3.

At first, Gordon and Lee use the corporate tax rates as measured by the observables in their data in their tax variable. Recall however that the taxable status of a firm depends on its taxable income. Gordon and Lee therefore pose that a firm’s taxable status (τ_{st}) is a function of the corporate tax schedule (τ’), its size (A_{st}) and its rate of return (ρ_{st}). In order to avoid endogeneity they construct an instrument using a profit rate measured net of interest. Furthermore, they use the average return rate for all firms and apply them to each firm, as they consider variation in ρ_{st} an unreliable source of identification. Variation in this variable may be caused by the inflation rate or business cycles, both of which may have independent effects on corporate use of debt.

Furthermore, Gordon and Lee show that firm size strongly affects the amount of debt used by a firm. They find that small firms borrow less than medium-sized firms that are just large enough to face the top statutory tax rate, even though both borrow much more than larger firms. Large firms typically have the ability to collect large sums of money on stock markets, while small firms presumably rely on bank loans for financing. Furthermore, asymmetric information problems are likely to be worse for them as well. The authors therefore control for firm size, which they define as the logarithm of the firm's total assets. In addition, they add time dummies to control for business cycles and add an interaction term as firms of different sizes might respond differently to business cycles. Finally they control for different types of asset composition, as firms with a large amount of fixed assets may be more likely to attract debt, as they can provide good collateral.

The first main outcome of Gordon and Lee's research is that firm size is an essential control variable, as it causes the coefficient for the tax variable to switch from a negative to a positive value, which is in line with theoretical predictions. Although the tax variable coefficient estimate varies with the amount of control variables added, they find that 0.067 is the most likely estimate. This would indicate that a tax structure with brackets of 22% and 48%, as was the case in the 1970's, would induce firms in the higher bracket to finance their assets with only 1.7% more debt[8]. When using the constructed instrument as their tax variable, they find very similar results. Their subsequent time-series analysis produces a coefficient of 0.330, which indicates that a drop in the corporate tax rate from 46% to 34% would lead firms to reduce their debt-asset ratios by 4.3%.

Finally, Dwenger and Steiner (2009) have made an interesting contribution to the empirical evidence supporting the theoretical claims. They use a microsimulation model that can replicate the corporate tax liability for any firm under different tax reform scenarios. The simulated tax rate a corporation would have faced in a particular period had there been no endogenous change of its financial structure is used as an instrumental variable for the observed effective tax rate. Furthermore they use a fixed effects specification and control for various factors such as firm size and risk. As such, they only use changes in the tax law and macroeconomic effects exogenous to the individual corporation to identify the elasticity of debt with respect to the tax rate. Rather than identifying the effects on the debt-asset ratio, they use the debt-equity ratio as the dependent variable in their model. They find that an increase of the tax rate by 10 percent would increase this measure of financial leverage by about 5 percent, on average. Furthermore, small firms and firms that benefit from non-debt tax shields have less responsive debt ratios.

[8] $(0.48 - 0.22) * 0.067 = 0.017$.

2.3 Policy implications

As De Mooij (2011b) points out, the elasticity of corporate debt with respect to taxation has increased over time. The increasing magnitude of the distortion and the behavioral response to it call for stronger policy reaction. Most notably, the Institute for Fiscal Studies has devoted a separate chapter to the taxation of corporate income in its Mirrlees Review. Auerbach, Devereux and Simpson (2010) primarily raise the question whether the unequal treatment leads to an economic distortion. Although the asymmetrical treatment encourages borrowing, they doubt whether it instigates *too much* borrowing. Various non-tax reasons, such as agency problems regarding managers that do not primarily act in the interest of their shareholders, may lead to debt levels that are *too low*. Such a distortion could then be mitigated by incentivizing the usage of debt through taxation systems.

When assuming that the favorable treatment of debt does give rise to an economic distortion, the need for a solution is paramount when taking the possible size of the distortion into account. The two main alternatives are also discussed in the Mirrlees Review: the Allowance for Corporate Equity (ACE) system or the Comprehensive Business Income Tax (CBIT). Both systems take away the disparity in treatment of financing costs, but do so in opposite ways: while the ACE system allows for the deduction of all financing costs, neither source of financing cost is deductible under CBIT.

Assuming an ACE or CBIT system would be introduced while keeping the tax revenue constant, the tax rate would have to be raised or lowered, respectively. While both systems remove the distortive effect of corporate income taxation on corporate financial policy, recall from the introduction of this chapter that taxation affects corporate behavior in other ways as well.

Under the ACE system, the taxable base is eroded by the deductibility of equity financing costs. Depending on the size of the allowance granted, the tax rate should be increased if governments want to keep the revenue from corporate income taxation constant. If the allowance granted reflects a normal rate of return, the ACE system is in effect a tax on economic rents. Investment decisions would therefore no longer be distorted. The higher tax statutory rate would, on the other hand, induce larger distortions on a firm's location choice decision and lead to more profit shifting.

The CBIT system, on the other hand, broadens the taxable income of firms and therefore allows countries to lower their tax rates. As neither form of financing costs is deductible under this system, both normal returns on investments as well as economic rents would be taxed. The distortion on a firm's investment decision is therefore amplified. However, location choice and profit shifting distortions would be reduced.

De Mooij (2011a) has illustrated that the cost of capital varies greatly with the source of financing. Assuming a post-tax return rate of 5%, he shows that debt-financed investments are subsidized at the margin in the USA, Japan and the EU, while the cost of capital for equity-financed investments lies much higher. This induces alternative distorting behavior by firms, such as profit shifting and artificial intercompany financing.

While the different legal characteristics between debt and equity[9] do not justify the different treatment of their financing costs, De Mooij (2011a) argues that there might be an economic rationale for this asymmetry. As suggested in the Mirrlees Review, there is no evidence that this distortion leads to debt levels that are too high: it may offset other market imperfections, such as those discussed in section 2.1, which induce the use of too little debt. Furthermore, the international mobility of debt may be higher, leading to a higher supply elasticity of debt compared to equity. This difference may justify a higher taxation of equity financing, in accordance with the Ramsey elasticity rule. Nonetheless, empirical evidence for both claims is very scarce.

[9] Suppliers of debt typically have a legal right to a fixed return and a prior claim in case of insolvency. Equity investments, on the other hand, typically bear more risk as the return is based on the performance of the firm, while they only have a residual claim in case of insolvency. They do, however, get control (i.e. voting) rights.

3 Methodology

The effect of corporate income taxation on the financial structure of Dutch corporations is estimated in several ways in this thesis. In this chapter I will elaborate on the various methods I used to identify the aforementioned effect. The basic estimation method applied to the panel as a whole will be explained in paragraph 3.1. While estimation is based using ordinary least squares regressions initially, a first-differences and instrumental-variable approach are used to counter the endogeneity of the corporate tax status. These approaches are explained in paragraph 3.2. Finally, some of the cuts in tax rates and shifts in bracket boundaries are examined more closely through a regression discontinuity design, as explained in paragraph 3.3.

3.1 Basic panel estimation methods

Capturing the effect of corporate income taxation on the debt-asset ratio of a firm is the key objective of this thesis. The debt-to-asset ratio, as defined in formula 2.2, is therefore the dependent variable in the regressions. Recall from chapter 2 that a company's DAR depends on many different factors. The main factor of interest in this research is obviously the tax variable.

As the Dutch corporate income taxation system is progressive, the statutory tax rate faced by Dutch firms depends on their taxable income. Furthermore, the Dutch CITA contains loss compensation provisions that allow current losses to be used to compensate profits in earlier or later years. From 2004 to 2007, a loss incurred in a certain year could be offset with profits generated in the three previous years or in any following year. In 2007, these provisions were restricted to profits in the year preceding the 'loss-year' and the nine following years. The initial tax variable in the OLS regression is therefore defined by

$$MTR_{it} = I(\pi > 0) * (B_{low} * \tau_{low} + B_{mid} * \tau_{mid} + B_{high} * \tau_{high}) \qquad (3.1)$$

where I is an indicator variable that equals one if the taxable profit (π) generated in the current year is positive. If the taxable income is negative, I equals zero and so does MTR. B_{low}, B_{mid} and B_{high} are dummy variables that indicate which tax bracket is applicable, after compensable losses from previous years are taken into account. As the data used range from 2004 to 2009, an assumption is made that no compensable losses were present from earlier years.

One of the key assumptions to identify the effect of MTR on DAR is that the independent variables are not correlated with u_{it}. Such correlation can be controlled for by adding other variables to the regression formula that influence both the dependent variable and the independent variables. Paragraph 2.2 suggests that firm size is the most important factors to control for: while size has an independent effect on the amount of leverage used by a firm, larger firms typically generate higher profits and are therefore taxed in the highest tax brackets.

The size of a firm can be assessed in various ways. Typically, the total value of all assets on the balance sheet (BST) is used to measure the size of a firm. This variable, however, is also the denominator of the independent variable in the regression formula. Using BST as a measure for firm size could therefore induce a spurious relationship in the regression. Instead, I use the annual turnover of a firm to determine its size[10]. Firm size is therefore controlled for by adding the natural logarithm of a firm's turnover, $ln(TO)$, to the regression equation.

As the descriptive statistics in Chapter 4 will show, the average debt-asset ratio of Dutch firms has slowly declined from 2004 to 2009. Various factors, such as the introduction of interest deduction limitation provisions may have induced this drop. The use of corporate debt could also vary over time as a result of business cycles or fluctuating inflation rates. These time varying effects are controlled for by adding a time dummy for all periods except 2004, which is deemed the base year.

While observable characteristics like firm size affect a company's debt-asset ratio, there are many influential factors that are not observable or are not present in the used data. It is not unlikely that there are unobserved variables that affect both DAR and aforementioned explanatory variables. The most straightforward way to deal with these variables is to include a firm-fixed-effect (α_i) in the regression equations to correct for time-invariant non-observed firm heterogeneity. This estimator captures the unobserved effects for each firm, assuming that these effects do not vary over time. As this is a rather strong assumption, other possible solutions to such unobserved heterogeneity will be discussed in the next paragraph.

As a result, the basic OLS regression equation is:

$$DAR_{it} = \beta_0 + \beta_{MTR} * MTR_{it} + \beta_{size} * \ln(TO)_{it} + \beta_{time} * \delta_t + \alpha_i + u_{it} \qquad (3.2)$$

As I am trying to prove the influence of corporate taxation on financial policy, the hypothesis of this thesis is clearly that $\beta_{MTR} > 0$. The theoretical and empirical literature discussed in Chapter 2 predicts that this regression coefficient is positive. The value for β_{MTR} indicates the level to which Dutch firms alter their financial policy to tax incentives.

Throughout the research additional variables will be added to the regression formula. These variables describe the impact of specific types of asset compositions on financial policy. An additional variable that which indicates whether a firm has distributed dividends during a particular fiscal year will also be added. These variables will be discussed further in Chapter 5 along with the results. One variable, however, requires a more extensive clarification.

[10] Turnover, however, is not completely exogenous either. Recall that the investment decision is also affected by (the marginal rate of) corporate income taxation (Auerbach, 2002). Assuming that a higher amount of corporate investments leads, ceteris paribus, to a higher turnover, this variable is therefore affected by MTR.

As of January 2004, the Dutch CITA entails thin-capitalisation rules. These rules restrict the financial policy of Dutch corporations that are liable to corporate income taxation. While firms may still choose any level of debt versus equity, interest payments are only deductible if and insofar the debt-equity ratio does not exceed the threshold. This threshold is set at three times the value of the firm's equity, plus €500.000. A dummy variable that indicates whether the total amount of debt exceeds this threshold will be included in the robustness checks.

Based on the data available in the NFO-dataset, it is not possible to capture the effect of the thin-capitalisation rules completely accurately. While the provisions in the Dutch CITA use the average book value of debt and equity over the year, the constructed variable uses the book value by the end of the year. Furthermore, firms may opt for the so-called group ratio if they are part of a group that has a higher leverage ratio as a whole. The dummy variable constructed is therefore not completely accurate and thus a proxy for firms that are actually confined by the thin-capitalization rules. Moreover, the deduction of interest payments is only restricted *insofar* the amount of debt exceeds the threshold, while the amount of interest that is non-deductible is limited to the amount of interest paid to affiliated firms or persons. These aspects of the thin-capitalization rules are not accounted for in the created dummy variable.

3.2 Advanced panel-estimation methods

As discussed in section 2.1, measuring the effect of the applicable statutory tax rate on financial policy will lead to a negative regression coefficient because of the reverse causality problem. Literature suggests two different solutions to this problem: using a first-difference model to capture the effect of taxation on incremental financing decisions or using a simulated tax rate that is not affected by financing decisions to find the effect of taxation on debt levels. In this section I will elaborate on how I applied each method in this research.

By using the first-difference of each variable, the effect of historical decisions that determine the current corporate tax status is mitigated. Incremental decisions on how to finance a certain operation or investment should be made independent of historical financing decisions (Alworth and Arachi, 2000). An increase in the debt level of a firm may, however, still push the taxable profit into a lower tax bracket. The reverse causality is therefore unlikely to be solved by this approach.

The base specification for the first-difference regression is denoted in formula 3.2. Again, I will add certain variables to this specification to measure the effect of specific corporate behaviour, as will be explained in Chapter 5. Note that the fixed-effects parameter, which controls for unobserved heterogeneity, is not included in this equation as it is assumed that this heterogeneity is time-invariant.

$$\Delta DAR_{it} = \Delta\beta_0 + \beta_{MTR} * \Delta MTR_{it} + \beta_{size} * \Delta\ln(TO)_{it} + \beta_{time} * \delta_t + u_{it} \qquad (3.3)$$

The second solution requires the simulation of a marginal tax rate that is independent of financing decisions. Rather than forecasting a firm's profit for future years, I have created a predicted value of the applicable statutory tax rate for each firm-year observation. While the real statutory tax rate depends on the taxable income (EBT), my instrument is based on the most exogenous variable in the database: the firm's annual turnover. In order to construct this instrument, I ran a regression using MTR as the independent variable. The independent variables are the firm's turnover in the current year as well as the previous year. I have added polynomials of the turnover to the regression specification as long as they were statistically significant, as the statutory tax rate is unlikely to be a direct function of a firm's turnover. Finally, I have added time dummies to the specification to capture the effect of declining tax rates over the relevant years. This leads to the following regression formula:

$$MTR_{it} = \beta_0 + \beta_a TO_{i,t}^{a} + \beta_b TO_{i,t-1}^{b} + \beta_{time} * \delta_t + \alpha_i + \varepsilon_{it} \qquad (3.4)$$

Using the outcome of this regression[11], I generated a predicted value of MTR for each observation. This predicted value, denoted $pMTR$, depends solely on the dependent variables in regression 3.3 including the fixed effects estimator α_i: it does not include the residual term (ε_{it}). Assuming that the firm's turnover and the fixed effects estimator are completely exogenous, any spurious relationship between MTR and DAR must be induced by a factor that is included in the residual term.

I use the predicted value for the applicable tax rate in two different types of regressions. First, I use $pMTR$ rather than MTR as a dependent variable in regression 3.1. The results from this regression will serve as a baseline outcome, which will be subject to various robustness checks. I will also estimate the responsiveness for each industry sector by including a separate interaction term for each sector. This leads to the following regression equation:

$$DAR_{it} = \beta_0 + \beta_{pMTRA} * I(Sector = A) * pMTR_{it} + \beta_{pMTRB} * I(Sector = B) * pMTR_{it} + \ldots + \beta_{size} * \ln(TO)_{it} + \beta_{time} * \delta_t + \alpha_i + u_{it} \qquad (3.5)$$

Subsequently, $pMTR$ is used as an instrumental variable for MTR in an IV-regression. Again, the hypothesis is that the regression coefficient for this independent variable is positive in both regressions. In order for an instrumental variable to be effective, it must satisfy two requirements: it must be correlated with the (supposedly) endogenous variable it is substituting, and it should not be correlated with the error term u_{it}. Although I have not carried out a Hausman test to test the latter requirement, the first requirement is met as the correlation between MTR and $pMTR$ is 0.805.

[11] See Appendix C for a full overview of the outcome of this regression.

3.3 Regression discontinuity design

The decline in corporate tax rates between 2004 and 2009 has been executed step by step rather than abruptly: tax rates were lowered gradually while the bracket boundaries were shifted upwards simultaneously. As a result of these concurrent changes, companies on one side of the tax bracket threshold faced a tax rate drop in certain years, while the tax rate for firms on the other side of the boundary remained unchanged. For instance, compare Firm A, which annually generates a taxable profit of 199.000 euro's between 2007 and 2009, with Firm B that gains an income of 201.000 euro's in those years. While the taxable profit for both firms is more or less comparable, the tax rates faced in each year is very different, as illustrated in Appendix B: Firm A's tax rate drops from 25.5% to 20% between 2007 and 2009, while the tax rate faced by Firm B remains unchanged at 25.5%. As a result, Firm A's tax incentive to use debt-financing should have diminished relative to Firm B's position.

The effect of these changes offers a quasi-experiment to examine the responsiveness of the use of corporate debt by firms that operate around these tax bracket boundaries. By comparing the change in debt-to-asset ratios for firms on either side of the threshold, the effect of the lowered tax rate on financial policy can be estimated. The methodology used to carry out this comparison is the so-called *regression discontinuity design*.

In order to capture the effects of a specific treatment, researchers typically use a randomized treatment and control group. Assuming that respondents in both groups are comparable, the only difference between the two groups is the random assignment of the treatment. Different outcomes for the tested variable can then be attributed to the treatment. A regression continuity design is a specific type of (quasi-) experiment: while treatment is generally assigned randomly in experiments, the treatment in a regression discontinuity design is assigned to respondents that exceed an arbitrary threshold for a specifically chosen variable, which is known as the forcing variable. In this research, the (additional) drop in the corporate tax rate can be regarded as a 'treatment', while the taxable income is the 'assignment variable'. The threshold values for assignment of the 'treatment' are the tax bracket boundaries. Note that using MTR instead of the binary treatment variable would import the endogeneity problem again.

When assuming that firms on either side of the cut-off point are considered comparable (apart from the assignment of the treatment), the effect of the treatment can be measured by analysing the difference in outcomes (in this case, the DAR) for both groups. In order to analyse such differences, a control group is used to catch any other effects on theDAR, such as the effect of business cycles, that might apply to both groups of firms. The assumption that firms in both groups are comparable (apart from the assignment of the treatment) is crucial here. By assuming that the DAR has a common trend for both groups, a counterfactual outcome is created for the treatment group: the expected value for the DAR of firms in the control group is estimated based on the trend in the control group[12].

[12] See Angrist and Pischke (2008), Section 5.2 for a more detailed explanation including graphical examples.

Another important assumption in regression discontinuity designs states that respondents are not capable of influencing their value for the forcing variable. This assumption is tested by assessing whether there is any evidence of a jump in the outcomes of the forcing variable (Imbens and Lemieux, 2007). A graphical analysis of these outcomes can be done by plotting a histogram of these outcomes, and assessing whether the value just below (or above) the cutoff value displays an unusual large number of respondents. Although firms have the ability to influence their taxable income to some extent, such grouping on either side of the cutoff value was not found using this graphical analysis[13].

Imbens and Lemieux (2007) show that the regression results can be highly sensitive to the bandwidth choice. First of all, choosing a bandwidth that is too wide can lead to insignificant results, as firms that lie further from either side of the cutoff value are less comparable. Secondly, choosing a group of respondents that are too close to the cutoff value can affect the results, in case these firms have influenced their taxable income in order into drop to the lower tax rate bracket. I will carry out robustness checks by checking the outcomes using several bandwidths.

Based on the mechanisms above, the effect of the lowered tax rate on the debt-asset ratio of firms can be compared. The difference-in-difference regression specification is denoted in formula 3.4. Note that the expected value for a firm's DAR depends on various factors. First of all, the most important control factor in the preceding panel regressions, a firm's size, is added to the regression formula. The coefficient for the time dummy indicates effect of the trend that is common for both the control and treatment group.

$$DAR_{it} = \beta_{size}\ln(TO)_{it} + \beta_{time}D_{time} + \beta_{treatment}D_{treatment} + \alpha_i + u_{it} \quad (3.6)$$

The coefficient of main interest is $\beta_{treatment}$: it measures the effect of the lowered tax rate for groups in the treatment group. As in the previous regressions, the hypothesis is that this coefficient will take on a positive value. The treatment dummy variable switches on for firms that are affected by the drop in corporate tax rates, after the change has occurred. Finally, a fixed- effects estimator and the residual term are included again for each firm.

[13] Unfortunately, i was unable to extract these histograms from the database due to CBS's confidentiality rules, as the number of firms for some values of taxable income (in thousands of euro's) is too small for them to guarantee these firms will not be identified on the basis of such data.

4 Data and Descriptive Statistics

The descriptive power of empirical research ultimately depends on the quality of the data used. Section 3.1 provides essential information on the dataset and the data gathering methods. The process of selecting relevant observations from the dataset is described in paragraph 3.2: First, the database is purged from corporations that display 'abnormal behaviour'. Subsequently, outliers and improbable observations are excluded from the analysis. I carefully document these processes, as modifying the data by removing observations will ultimately change the research results. Paragraph 3.3 provides an overview of the descriptive statistics of the remainder of the observations.

4.1 The database and selection criteria

I retrieved the data used in this research from the Statistics Netherlands (CBS) NFO database[14]. This database comprises annual firm-level micro-data on corporations that are liable to Dutch corporate income taxation. It contains fundamental financial figures such as balance sheet and profit and loss statement accounts, as reported by the firm (or its representatives) in its tax return. Note that these figures have not been checked by the tax authorities prior to the data gathering by CBS. The correctness of some observations, especially those displaying absurd values, can therefore be questionable. These observations will be discussed in the next paragraph.

As the analysis in this thesis focuses on the changes in corporate income tax rates and brackets between 2004 and 2009 (see Appendix B), I have only used data available for to those years. Finally, each firm is tagged with a sector classification number that indicates the field of industry the firm is engaged in. Financial corporations are not included in the database, as their balance sheets and profit and loss accounts are typically very different from other type of firms.

The NFO-database was originally divided into separate database for small firms (SFKO) and large firms (SFGO), where firms with an aggregated balance sheet total (BST) of less than €23 million were regarded as small. As of 2006, both databases were merged into the NFO database. Nonetheless, the distinction between small and large firms is still paramount when it comes to data gathering: the data on small firms is acquired from their CIT returns, while large firms participate in a large scale survey. As a result, the data on small firms are based on Dutch fiscal accounting principles, whereas the reported values for large firms are based on generally accepted (commercial) accounting principles such as IFRS and Dutch or US GAAP.

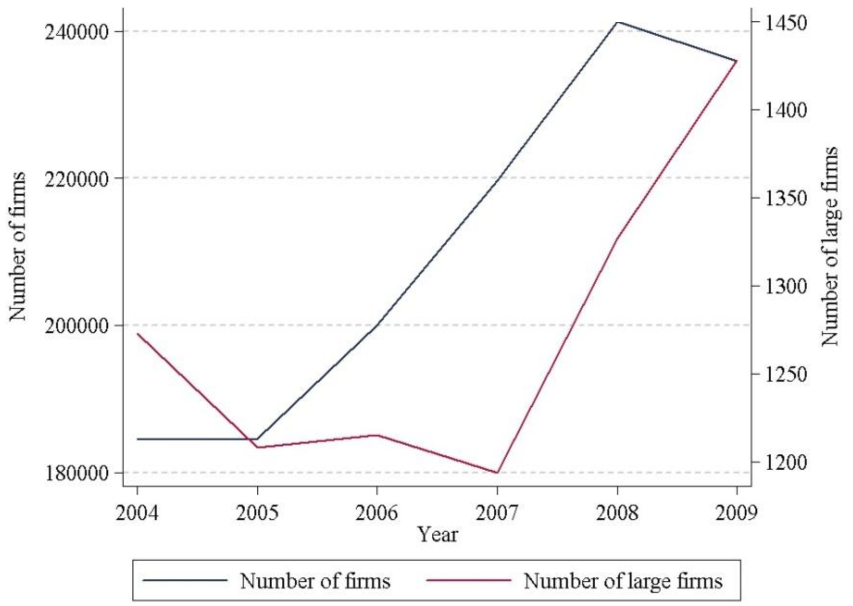
Aforementioned distinction has an important implication for the practicality of the data on both types of firms with regard to this research. As it is of vital importance for the analysis to determine the applicable marginal statutory tax rate, the commercial data reported by large firms is of little use. The numerous discrepancies between the fiscal and commercial accounting principles will typically lead to very different values for some financial figures. As such, it is impossible to determine the marginal statutory tax rate for large firms based on the available data. I have therefore excluded the

[14] http://www.cbs.nl/NR/rdonlyres/AB7BE9A4-62B0-44F0-B313-82CA44B67794/0/nfomicrodata.pdf

firms that were originally part of the SFGO-database from my analysis. Recall that the second part of my research focuses on small firms that operate near the boundaries of the tax brackets (i.e. with annual taxable incomes up to €200.000). The exclusion of firms with a balance sheet total of over €23 million will therefore not have a large impact on those results.

The amount of firms in the NFO-database is one of its main traits: all corporations that are liable to Dutch corporate income taxation are included. Naturally, the number of firms in the database varies throughout the years as new firms are incorporated and others go bankrupt. Also, firms may merge, split or change their domicile. It follows from Figure 4.1 that the total number of firms was steady from 2004, subsequently gradually increased from 2006 to 2008, and finally decreased in 2009. These trends can be explained by looking at the number of start-ups and bankruptcies in those years: from 2006 to 2008, the number of start-ups recorded by CBS was relatively high when compared to 2004, while the number of bankruptcies in The Netherlands reached an all-time record in 2009, breaking the former record set in 2005[15]. Also note that the number of large firms in the database is relatively small (about 0.6% of the total database on average), which again illustrates that excluding these firms from the analysis has little impact on the results.

Figure 4.1: Number of firms in NFO-database



4.2 Data selection

After removing the large firms from the NFO database, the number of firms is still impressive. In the 2004-2009 time span, 342.873 unique firms were registered, totalling 1.258.224 unique firm-year observations. It therefore comes as no surprise that some of these observations report rather unusual values for some balance sheet or profit and loss statement accounts. For instance, most assets and liabilities take on substantial negative balance sheet values for some observations. While negative valuation of assets may be possible under commercial accounting principles, this is very implausible under the Dutch fiscal accounting principles. Specific valuation techniques or (temporary) bank account deficits may lead to negative values for 'Goods in stock' respectively 'Liquid assets'. Negative values for any other asset category are rather inconceivable, and are likely to be mistakes in tax returns. Recall that the data in the NFO-dataset has not been checked by the tax authorities.

[15] http://www.cbs.nl/nl-NL/menu/themas/veiligheid-recht/publicaties/artikelen/archief/2010/2010-012-pb.htm

Correspondingly, liabilities generally should not adopt negative amounts either. Equity, however, is an exception to this rule. Repeated negative results or a substantial, accidental devaluation of a firm's main asset(s) may push the firm into the red digits. Such events are quite common (especially in years of economic turmoil like part of the 2004-2009 time span), which is illustrated by the fact that over 280.000 observations (of over 105.000 unique firms) contain negative equity values. These observations are therefore not removed from the dataset, but will be put aside during robustness checks on the results. Observations reporting negative values for the other aforementioned balance sheet or profit and loss statement categories, on the other hand, are discarded. Table 4.1 summarizes the amount of observations within each discarded category.

Table 4.1: Negative values per balance sheet account

Balance sheet or profit and loss statement[16] account	**Observations[17]**
Total balance sheet value[18]	4.038
Tangible assets	0
Intangible assets	83
Subsidiaries (total)	8.451
Subsidiaries (Dutch)	6.831
Subsidiaries (foreign)	694
Total outstanding loans	1.096
Long-term outstanding loans	2.293
Short-term outstanding loans	341
Trade account debtors	1
Total debt	2.512
Long-term debt	288
Short-term debt	3.514
Provisions	97
Trade account creditors	1.832
Net revenue	4.179
Salary costs	4.096
Depreciation allowances	8
Interest income	1.155
Interest costs	6.680

[16] Profit and loss statement values should be negative for accounts that reflect an expense for the firm, while positive values should be reported for income accounts. Hence, positive values for expense accounts and negative values for income accounts are discarded as listed.
[17] Note that a lot of these observations report negative values for more than one balance sheet account, so that overlap between these observations exists. The total number of observations dropped (34.522) is therefore not equal to the sum of observations dropped for all categories.
[18] Observations with a total balance sheet equaling zero are dropped as well, as this variable is used as the denominator in the dependent variables.

As a result of excluding firms reporting negative values for either of the right hand side parameters in equation 2.2, none of the remaining firms can have a negative debt-asset ratio. However, as negative values of equity are allowed, the BST is (substantially) pushed down for these firm-year observations, while debt levels remain unaffected. As such, the debt-asset ratios may escalate to values higher than 1. Table 4.1 depicts the distribution of all the debt-asset ratio of all firms (i.e. before removing outliers). It illustrates that, although some observations show rather inconceivable ratios, the vast majority of the ratios lie within the 'normal' range between 0 and 1. Nonetheless, approximately 12.5% of the observations have a DAR that exceeds 1. In order to clear the dataset from abnormal data, I have removed the top 1% of the DAR distribution from the database. These 12.366 firm-year observations report a DAR that exceeds 7.521.

Table 4.1: Distribution of DAR

	DAR
Mean	0.986
Min	0
1%	0
5%	0.0016
10%	0.0039
25%	0.136
50%	0.4
75%	0.749
90%	1.121
95%	1.759
99%	7.521
Max	22749

4.3 Descriptive statistics

After removing the aforementioned observations from the database, a total of 1.211.336 observations remain in the sample. In this paragraph I will provide an overview of the main characteristics of this remaining group. The distribution of debt-asset ratios, firm size, taxable incomes and average tax rates will be examined closely in that order. Finally, a breakdown by industry sector is presented. Additional information on all variables in the NFO database and some constructed variables is listed in Appendix D.

The distribution of the dependent variable, the debt-asset ratio, is depicted in Figure 4.2. Notice this figure corresponds with the data from Table 4.1: a large amount of firms that have a very low DAR, while the density gradually drops for higher leverage values. Despite the favourable treatment of debt over equity in the Dutch corporate income taxation system, a lot of firms apparently choose not to attract debt, or are unable to do so.

Figure 4.2: Distribution of Debt-Asset Ratios

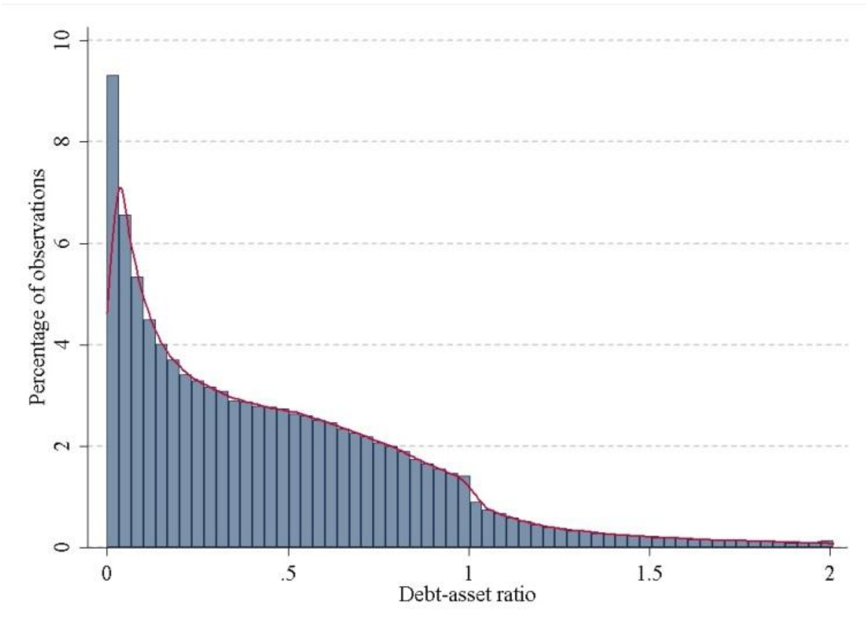
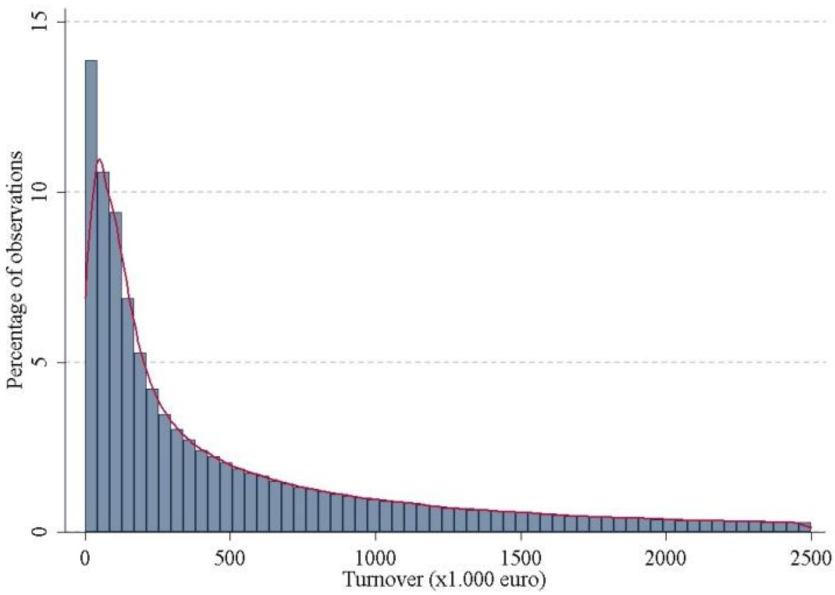


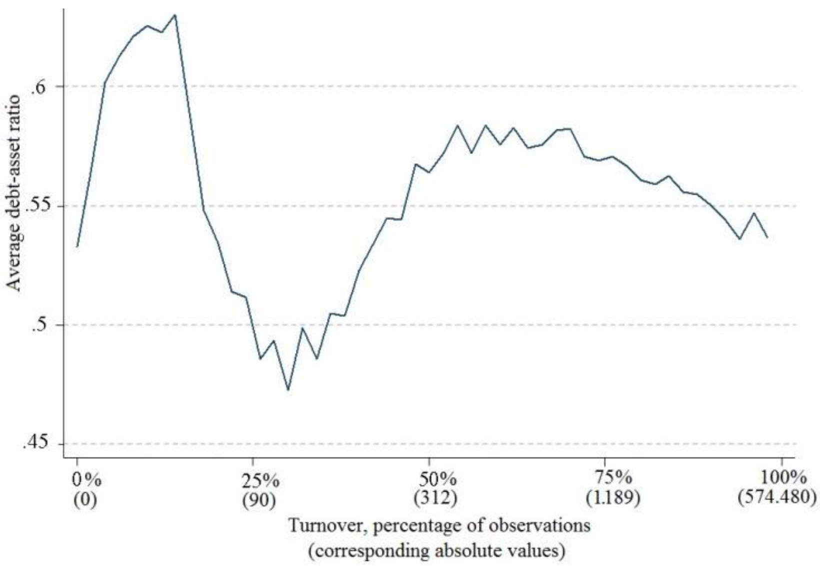
Figure 4.3: Distribution of Turnover



Recall that I use a firm's turnover, rather than its balance sheet total, as a control variable for firm size. I have depicted the distribution of firms with a turnover between 0 and 2.5 million (which allots to approximately 86% of the remaining sample) in Figure 4.3. Note how the shape of the distribution is rather similar to that in Figure 4.2.

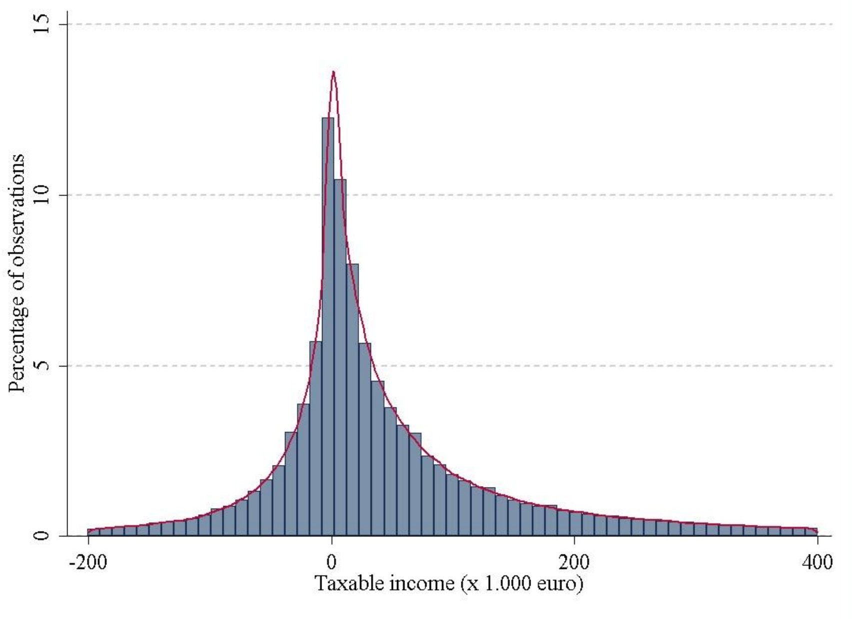
Regardless of the similarity of both graphs, the correlation between the turnover and DAR is approximately zero: -0.0047. This implies that both distributions are virtually independent of eachother. Figure 4.4 shows that average debt-asset ratio's are slightly different for firms in different size categories, but there is no clear relationship. It is specifically interesting to see how the debt-asset ratio varies for firms within a particular tax bracket in each year. This information is included in Table D.2 in Appendix D. First of all, note that the average leverage ratio decreases from 66,2% in 2004 to 53,0% in 2009. Furthermore, this table shows that the DAR is, on average, higher for firms in the lower tax brackets in each year. As the tax rate increases, the firm's level or leveraging decreases.

Figure 4.4: Distribution of DAR; firms grouped by size



This implies that there is a negative correlation between the marginal tax rate and the debt-asset ratio, which is caused by the reverse causality issue discussed in paragraph 2.1.1. Table D.3 provides an overview of the correlation the variables in the database. This table shows that the debt-asset ratio of a firm, on average, drops if the MTR or its predicted counterpart rises. This result is rather counterintuitive and not in line with the literature as discussed in Chapter 2, which states that higher tax rates should lead to higher leveraging.

Figure 4.5: Distribution of Taxable Income



The distribution of Taxable Income, or Earnings Before Tax (EBT) is depicted in Figure 4.5. This graph shows that, while the distribution has a peak around zero, its right tail is considerably thicker than the left. This view is supported by Table 4.2, which provides a breakdown of the distribution of taxable income by year. Note that the percentage of firms that incurs a loss lies around 30% in most years.

Table 4.2: Distribution of Taxable Income by year

Year	Observations	Mean EBT	Std.dev	Median	Losses	%
2004	176.128	75,04	567,94	11	61.086	34,7%
2005	176.327	87,12	592,32	15	56.922	32,3%
2006	191.541	104,69	1181,03	20	56.623	29,6%
2007	210.617	127,83	640,65	27	55.308	26,3%
2008	230.951	101,48	607,36	21	69.132	30,0%
2009	225.772	81,70	542,95	16	74.058	32,8%

The relation between the amount of tax payable and the taxable base is also a noteworthy characteristic for some observations. The amount of tax paid should typically be negative on a firm's profit and loss account, as it is an outflow of cash. The average tax rate is therefore calculated as:

$$Average\ tax\ rate\ (ATR) = \frac{-\ Taxes\ payable}{Taxable\ income} \qquad (4.1)$$

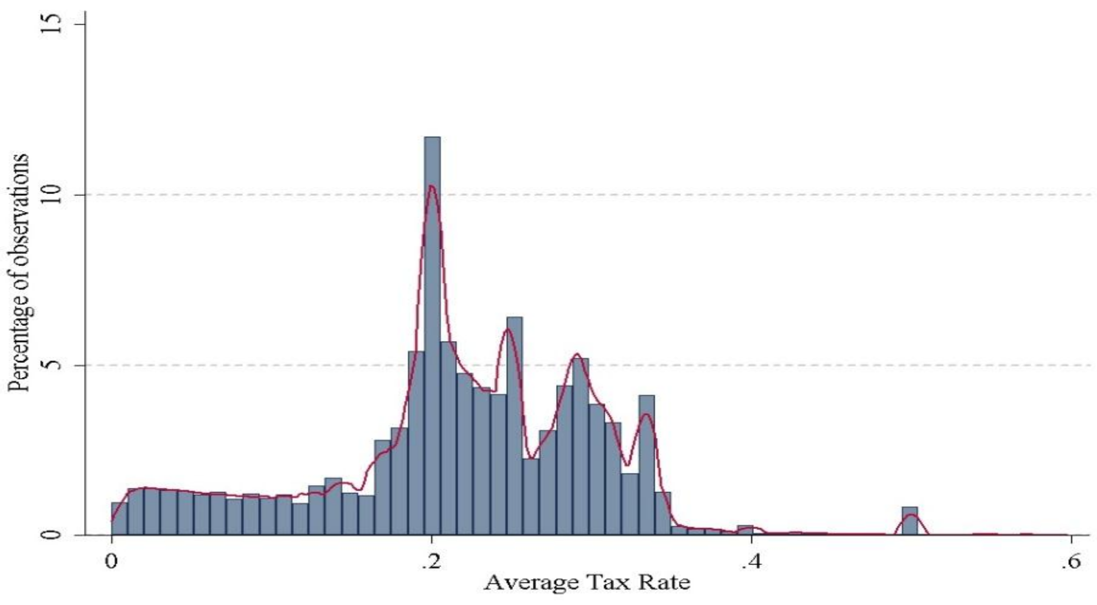
If a firm incurs a loss in a particular year, it may use that loss to offset profits generated in the preceding year or the nine subsequent years, by means of the current loss compensation provisions in the Dutch CITA. When losses are used to (partially) offset taxes paid over profits generated in the preceding year (i.e. carry-back loss compensation), the amount of taxes paid in that year will be (partially) redeemed by the tax authorities. Instead of an outflow of cash, these firms will report an inflow of cash in such years in their profit and loss account under 'Taxes payable', resulting in a negative ATR.

Notwithstanding, there are 7.571 firm-year observations in which a profit is generated by the firm, but a tax refund is reported nonetheless. When taking the loss compensation provisions into consideration, no logical explanation for these refunds comes to mind. These entries might be due to mistakes made by the taxpayer when filing the tax return, or to taxpayers getting an advanced tax ruling with the tax authorities. These agreements address a wide variety of subjects such as the fiscal treatment of certain income components, the calculation of the amount of tax payable or the taxable status in general.

Another phenomenon which is hard to explain is when a firm reports a loss in a particular year, but does pay tax in that year nonetheless. Typically, the amount of tax payable should be zero when the taxable base is equal to or less than zero as well. Although the amount of tax payable is rather small for most of these observations[19], the provisions of the Dutch CITA do not offer a logical explanation for these cases. Again, mistakes when filing tax returns or rulings might be the cause of these cases.

As a result of aforementioned cases, ATR varies greatly for the observations in the dataset. Negative values are present, as well as observations that exceed the top statutory tax rate in the relevant year. Figure 4.6 depicts the distribution of the ATR between 0% and 60%[20]. Note that there are relatively few firm-year observations with an ATR that exceeds 40%. When graphing the average tax rate by year, the effect of the drop in tax rates between 2004 and 2009 is uncovered once again: Figure D.1 in Appendix D shows how the distribution shifts leftward throughout these years.

Figure 4.6: Distribution of ATR



[19] 8.864 observations show an amount of tax paid despite a negative taxable income. For 50% of these observations, the amount of tax paid is 4.000 euro's or less. Some firms, however, report an amount of tax paid of more than E1 million.

[20] Firms with an ATR that equals zero, which make up for approximately 40% of the population, are not included in the figure for graphical reasons. The `blip` at 50% is most likely caused by the fact that all variables, are rounded of in units of 1.000 euro's.

Finally, a division is made by industry sector. The firms in the NFO-database are split up in roughly 80 sector groups according to the 2-digit 2008 Dutch Chambers of Commerce Standard Business Index (SBI) Codes[21]. In order to reduce the number of groups, the 2-digit codes are converted to the 1-digit variant, which contains less subcategories. After aggregating firms in sectors that make up for less than 2.5% of the population, the division of firms over the remaining 11 categories is depicted in Figure 4.6. The numbers in parentheses denote the percentage of the population.

Figure 4.6: Division of firms by industry sector

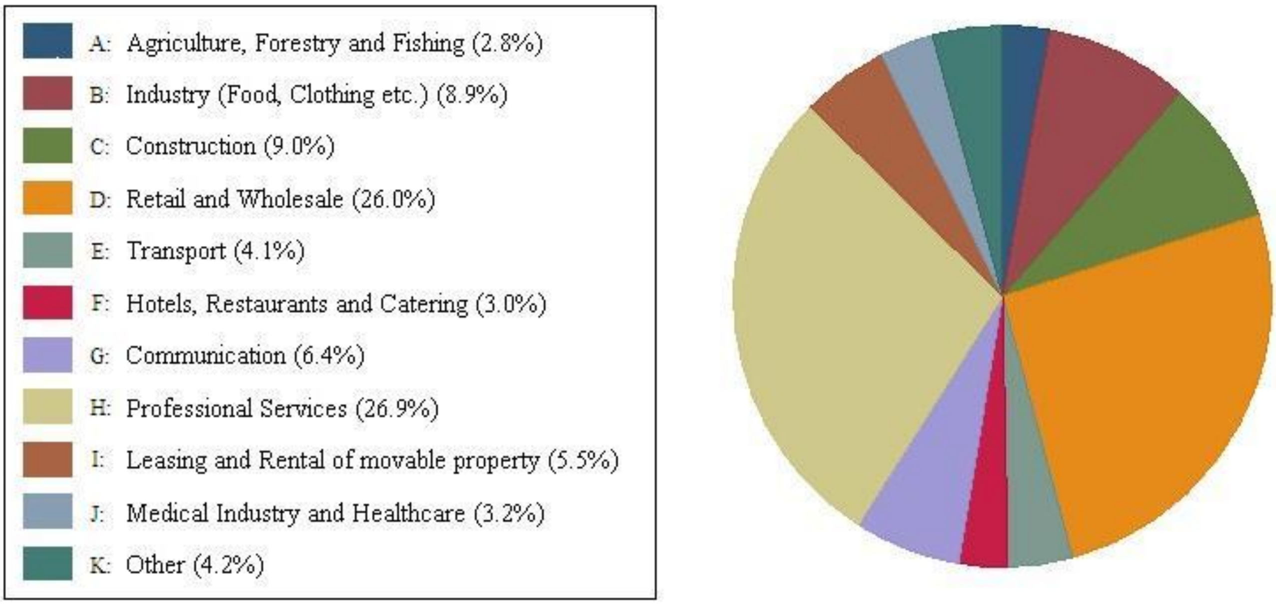


Table 4.2 lists the average leverage ratio for firms in each sector. Note that most sectors have an average DAR that does not deviate much from the overall mean of 0.56. There are, however, three sectors that stand out. Hotel, Restaurant and Catering businesses have significantly higher average debt levels, while firms in the Professional Services and the Medical and Healthcare industries are mostly financed with equity. A

Sector	**Average DAR**
Agriculture, Forestry & Fishing (2.8%)	0.5836
Industry (Food, Clothing etc.) (8.9%)	0.6018
Construction (9.0%)	0.5182
Retail and Wholesale (26.0%)	0.6044
Transport (4.1%)	0.5900
Hotels, Restaurants and Catering (3.0%)	0.7859
Communication (6.4%)	0.6318
Professional Services (26.9%)	0.4446
Leasing and Rental of movable property (5.5%)	0.6628
Medical Industry and Healthcare (3.2%)	0.4115
Other	0.6590

[21] See http://www.cbs.nl/nl-NL/menu/methoden/classificaties/overzicht/sbi/sbi-2008/default.htm for a detailed explanation of the SBI Codes (in Dutch).

5 Results

The various methodological approaches and data, as explained and described in Chapter 3 and 4 respectively, have led to a myriad of statistical results with economic implications. These results will be presented in this chapter. The structure of this chapter is similar to that of Chapter 3. First, the results of the various regressions on the dataset as a whole, which provide a general measure of the responsiveness of corporate debt to taxation, will be presented in section 5.1. Subsequently, the results of the regression discontinuity and difference-in-difference designs that show the effects of some specific cuts in corporate tax rates will be examined in paragraph 5.2.

5.1 Panel regression results

The results for each of the panel regression methods discussed in section 3.1 and 3.2 will be discussed in this section. I will show the importance of each variable in the regressions by gradually adding variables to the regression specification and reporting the effect on the results. Note this build-up in Table 5.1, which displays the results of the initial regressions as specified in equation 3.2: Column 1 reports the results for the simplest possible equation:

$$DAR_{it} = \beta_0 + \beta_{MTR} * MTR_{it} + u_{it} \tag{5.1}$$

This equation is subsequently expanded by adding time dummies (Column 2), a control variable for firm size (Column 3), a fixed-effects estimator (Column 4) and additional control variables (Column 5). The same build-up will be used for other tables in this chapter.

The main outcome of Table 5.1 is that the regression coefficient for the marginal tax rate is highly significant and negative regardless of the specification. Moreover, these results seem to be very robust: dropping various groups of suspicious observations does not drastically affect the results. Furthermore, taking the first-difference of each variable in the regression equation does not seem to change the sign of the regression coefficient either. See Tables E.1, E.2 and E.3 in Appendix G for these robustness checks. This implies firms will decrease their leverage ratio as the tax rate rises.

Although contradictory to economic predictions, the outcomes listed above are in line with the discussed theory on the endogeneity of the corporate tax status. In order to circumvent this endogeneity, I have constructed an instrument ($pMTR$) based on Equation 3.4. Table 5.2 reports the outcome of using $pMTR$ in the regression specification of Equation 5.1. Note that the build-up of Table 5.2 is similar to the one in Table 5.1.

Table 5.1: Results of regressions based on Equation 5.1, using MTR[22]

	(1)	(2)	(3)	(4)	(5)
MTR	-0.527***	-0.692***	-0.682***	-0.436***	-0.351***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
$ln(Turnover)$			-0.007***	-0.027***	0.039***
			(0.000)	(0.000)	(0.001)
$\frac{\text{Tangible Assets}}{\text{Total Assets}}$					0.203***
					(0.067)
$\frac{\text{Intangible Assets}}{\text{Total Assets}}$					-0.205***
					(0.068)
$\frac{\text{Cash}}{\text{Total Assets}}$					-0.220***
					(0.067)
$Dividends$					0.018***
					(0.001)
$Constant$	0.674***	0.837***	0.875***	0.905***	0.948***
	(0.001)	(0.001)	(0.003)	(0.003)	(0.067)
Year dummies?	No	Yes	Yes	Yes	Yes
Fixed effects?	No	No	No	Yes	Yes
Observations	1.211.336	1.211.336	1.201.332	1.201.332	990.542
R^2	0.0682	0.0763	0.0724	0.0384	0.741

Table 5.2: Results of regressions based on Equation 5.1, using $pMTR$

	(1)	(2)	(3)	(4)	(5)
$pMTR$	-1.268***	-2.215***	-2.218***	0.2302***	0.134***
	(0.009)	(0.011)	(0.011)	(0.044)	(0.044)
$ln(Turnover)$			0.007	-0.041***	-0.049***
			(0.000)	(0.001)	(0.001)
$\frac{\text{Tangible Assets}}{\text{Total Assets}}$					0.229***
					(0.067)
$\frac{\text{Intangible Assets}}{\text{Total Assets}}$					-0.189***
					(0.069)
$\frac{\text{Cash}}{\text{Total Assets}}$					-0.240***
					(0.067)
$Dividends$					0.015***
					(0.001)
$Constant$	0.759***	1.003***	1.001***	0.724***	0.932***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.067)
Year dummies?	No	Yes	Yes	Yes	Yes
Fixed effects?	No	No	No	Yes	Yes
Observations	996.778	996.778	989.824	989.824	989.824
R^2	0.0987	0.1054	0.1068	0.0061	0.0297

[22] Standard errors are denoted in parentheses. The extent to which the coefficients are significant is indicated by the asterisks: No asterisks = Not significant at 10% level; * Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level.

The build-up of Table 5.2 clearly shows that simply using $pMTR$ instead of MTR does not change the sign of the regression coefficient: it remains negative initially. Even after adding time dummies and controlling for firm size the sign does not change. The introduction of firm-fixed-effects in Column 4, however, causes the coefficient for $pMTR$ to become positive. This implies that the estimates in Columns 1 to 3 are heavily biased due to unobserved firm heterogeneity. In other words, there are many other factors that influence the financial policy of firms. When we assume that these factors remain constant over time, yet may vary between firms, the effect of corporate taxation becomes clearer. The regression coefficient for $pMTR$ in Column 4 implies that a 10%-rise in tax rate will cause firms, ceteris paribus, to finance their assets with 2.3% more debt.

In order to check this result in Column 4 for robustness, as well as to identify the effect of other particular corporate behaviour, I have added several variables to the specification in Column 5. Recall that Gordon and Lee (2001) find that firms that are capable of offering good collateral to banks typically have higher debt asset ratios. The regression coefficient listed for the variable $\frac{Tangible\ Assets}{Total\ Assets}$ implies the same: firms that have a lot of tangible assets typically have a higher debt-asset-ratio. These assets, such as land, real estate or machinery typically are considered as good collateral and they can also be more easily and accurately valued by people outside the firm.

When intangible assets make up for a larger share of the total assets, firms tend to have lower debt ratios. A straightforward explanation for this outcome is the relatively limited usefulness of intangible assets as collateral for attracting debt-financing (Shalev, 2007). First of all, the value of goodwill is not verifiable as it cannot be sold separate from the firm. Furthermore, the value of goodwill is often measured as a residual value from the purchase price: the part of the sum paid (when a firm acquires another) that cannot directly be attributed to certain assets is deemed to be goodwill. This valuation technique leaves a lot of room for error. Moreover, goodwill has no value in bankruptcy, contrary to tangible assets.

The variable $\frac{Cash}{Total\ Assets}$ is an indicator of the liquidity of the company. Recall the pecking order theory, which states that firms prefer to rely on internal financing as a result of signalling costs. When a firm has a large pool of cash at its disposal, it typically has less incentive to borrow money from outside investors. This expectation is confirmed by the negative regression coefficient. Finally, $Dividends$ is an indicator variable that equals 1 if firms have paid out dividends in the current year. Although small, the effect of dividend payouts on financial policy is highly significant. A possible explanation for this effect could be the fact that a dividend payout is typically signals good financial status of a firm, allowing them to attract loans more easily or at a lower interest rate. Note that these effects of asset composition and dividend payout policy also occur when using the original tax variable MTR.

More importantly for the main analysis in this thesis is the effect of these additional variables on the coefficient for the tax variable $pMTR$. However still positive, the responsiveness of corporate leveraging to taxation has decreased compared to Column 4, which indicates that the specification in Column 4 may suffer from an omitted variable bias. This implies that this model incorrectly leaves out certain independent variables, and that the regression coefficient for $pMTR$ compensates for the missing variable(s).

5.2 Robustness checks on panel results

I have subjected the baseline outcome, as listed in Column 4 of Table 5.2, to robustness checks. The effects of dropping various groups of observations on the regression coefficient for $pMTR$ are displayed in Table 5.3. While the first column indicates which observations have been dropped, the second lists the regression coefficient for the remainder of the sample.

The first row shows that the regression coefficient is reduced considerably by removing firms that report negative equity values. As pointed out in Chapter 4, negative equity values are reported by a large number of different firms (approximately 105.000 out of 340.000 unique firms in the database). This implies that these observations do not necessarily represent ‘abnormal’ firm behaviour. The fact that removing approximately 20 percent of the observations results in a significant decrease of the responsiveness does indicate that the initial results might not be very robust.

Table 5.3: Robustness check on Table 5.2, Column 4

Dropped observations	Coefficient $pMTR$	R^2
Equity < 0	0.064***	0.0241
(207.073)	(0.002)	
DAR > 1 or < 0.01	-0.007	0.0213
(107.880 /35.188)	(0.002)	
EBT < 0	0.370***	0.0211
(298.280)	(0.035)	
Turnover lower 25%	0.579***	0.0478
(235.850)	(0.045)	
Turnover upper 75%	0.061	0.0002
(760.935)	(0.852)	
ATR > Statutory rate	0.252***	0.0055
(51.794)	(0.048)	

The result listed in the second row of Table 5.3 is perhaps most striking: when removing firms with a DAR outside the ‘normal’ boundaries, the coefficient turns negative once again. Although this result implies that these ‘abnormal’ firms are needed to get the expected outcome, this conclusion should be taken carefully considering this coefficient is highly insignificant (P = 0.712). However, the removal of these observations again leads to a very strong change in the regression coefficient, as was the case in the first row. Albeit an insignificant coefficient, this indicates once more that the results may rely heavily on a small proportion of the observations. A possible explanation for this result may be that firms with ‘normal’ debt levels do not engage in active tax planning, whereas the ‘abnormal’ firms heavily do.

The other results listed in Table 5.3, barring the non-significant outcomes, lead to more logical outcomes. When removing firms that incur a loss, the responsiveness increases significantly: while the discarded loss-making firms that have no incentives to use debt to eradicate their profits, the remaining firms do. Removing the smallest 25% of firms in turnover figures also significantly increases the regression coefficient. This indicates that bigger firms are more likely to plan their behaviour, possibly through the use of tax advisors. Finally, removing firms with an average tax rate that exceeds the highest statutory rate, which may be an indication that this firm has agreed upon rulings with the tax authorities, does not alter the regression coefficient significantly.

A first-differences specification of using $pMTR$ in Equation 5.1 leads to results that are comparable to those in Table 5.2. Note that adding the year dummies results in a positive coefficient for the tax variable, as reported in Column 3 of Table E.4 in the appendix. The value of this coefficient is, however, significantly higher than the value listed in Table 5.2, which implies that the responsiveness for incremental debt-equity decisions is higher than the responsiveness of the long-term debt levels. Adding additional values that describe the asset composition yields results that are highly similar to aforementioned outcomes, including the coefficient for the tax variable.

As a final robustness check, $pMTR$ is used as an instrument for MTR in an instrumental-variable regression. As the results in Table E.5 show, the coefficient for the tax variable switches to positive again after adding the fixed effects to the equation, as was the occasion in the baseline regression. The coefficients for the tax variable, however, are considerably higher in this specification. Column 4, which corresponds with the most probable baseline outcome, indicates that a 10 percent rise in corporate tax rates will, ceteris paribus, lead to 40 percent higher debt-asset ratios on average. This effect is amplified even further when taking a first-difference equivalent of the IV-regression.

In addition to robustness checks on the sample as a whole, I have measured the responsiveness per sector using Equation 3.5. Recall from Table 4.2 that the leverage ratios do not differ much between most sectors, yet firms in the Professional Services and Medical sectors have relatively low debt levels while the opposite is true for firms in the Hotel, Restaurant and Catering industry. Table 5.3 shows the regression coefficient for the tax variables, which indicates the level of responsiveness for each sector. The fact that most coefficients take on very similar values implies that there is relatively little distortion between sectors. Not taking the non- or less significant results into account, the only sector that really stands out is the Medical and Healthcare industries: these companies seem much less responsive to taxation incentives than other firms. The fact that this sector is, at least historically, less privatized, may be a possible explanation for this outcome.

Table 5.3: Differences in responsiveness for different sectors

Industry	**Coefficient $pMTR$**
Agriculture, Forestry and Fishing	0.185 (0.061) ***
Industry (Food, Clothing etc.)	0.148 (0.051) ***
Construction	0.158 (0.054) ***
Retail and Wholesale	0.085 (0.048) **
Transport	0.185 (0.060) ***
Hotels, Restaurants and Catering	0.071 (0.074)
Communication	0.178 (0.056) ***
Professional Services	0.224 (0.050) ***
Leasing and Rental of movable property	0.091 (0.054) **
Medical Industry and Healthcare	0.035 (0.070) ***
Other	0.060 (0.058)

Finally, the regression in Equation 5.1 can be used to measure the impact of the thin-capitalisation rules. By performing this regression, using $pMTR$ rather than MTR, separately on firms to which these rules apply and on firms to which they don't, the responsiveness can be measured for both groups. These regressions lead to a regression coefficient of 0.831 for the group of firms that are not restricted by the thin-capitalisation rules, while the equivalent coefficient for the thin-cap-restricted group is negative: -1.035.

This implies that non-restricted firms respond more heavily to tax incentives than the sample as a whole (which has a coefficient of 0.230 for the equivalent specification). Restricted firms, on the other hand, do no longer benefit from accumulating additional debt and should therefore be irresponsive to a change in tax rate. Nonetheless, the regression coefficient of -1.035 indicates that these firms react even stronger, albeit in the opposite direction. However, the interpretation of this result is unclear, as the thin-capitalisation rules are by definition only applicable to firms with a very high debt-equity (and thus, debt-asset) ratio.

5.3 Results for regression discontinuity design

As pointed out in Section 3.3 and Appendix B, the corporate tax rates in The Netherlands declined step-by-step throughout the 2004-2009 time span. More importantly, the tax bracket boundaries that determine which firms are eligible for a lower tax rate were changed: the lowest tariff was only applicable to firms with an annual profit below €22.689 from 2004 to 2006[23], but applied to firms with an annual profit up to €200.000 from 2009 onwards. Once again, this shift was carried out in multiple steps, allowing for comparison between firms around four different profit levels: the old and new thresholds of €25.000 and €200.000 respectively, and the temporary sub-bracket limits of €40.000 and €60.000 in 2007 and 2008, respectively.

Table 5.4 provides an illustration of the analysis carried out along the €25.000 threshold. I have selected firms that generate a profit that is either just below or just above this threshold in both years. As a result of a change in legislation, the applicable tax rate drops from 23.5% to 20% for firms that earn a profit slightly higher than the threshold. Recall from Section 3.3 that the assumption that firms on either side of the threshold are comparable (apart from the assignment of the treatment) allows for a distinction between a common trend and the treatment effect. Using the numbers in Table 5.4, the common trend for firms in both profit range is a slight increase in DAR: 0.482 - 0.475 = 0.007. However, the average DAR for firms in the treatment group decreased by 0.003 (from 0.428 to 0.425), indicating that the 3.5% drop in tax rate had an effect of -0.01 on the leverage ratio.

Table 5.4: Analysis of treatment effect between 2007 and 2008 around €25.000 threshold

Year	Profit Bandwidth	Tax Rate	Group	Observations	Mean DAR
2007	23.000 – 25.000	20%	Control	119	0.475
2007	25.000 – 27.000	23.5%	Treatment	100	0.428
2008	23.000 – 25.000	20%	Control	119	0.482
2008	25.000 – 27.000	20%	Treatment	100	0.425

Another way to estimate the treatment effect is by running the regression in Equation 3.6: $\beta_{treatment}$ indicates the size of this effect. For this particular subsample, the value for this regression coefficient is -0.009, while the 'treatment' is a change in tax rate from 23.5% to 20%. The ratio of these two indicates the change in the debt-asset ratio as a result of a 1-percent change in the statutory tax rate: $\frac{\beta_{treatment}}{\Delta\tau_c} = \frac{-0.009}{-3.5} = 0.003$. A 1-percent decrease in the applicable tax rate therefor leads to a reduction of the DAR of 0.003, or 0,3%. Note, however, that the value for $\beta_{treatment}$ is not significant: the corresponding P-value is 0.473.

[23] Note that the difference between the low and high rates remained constant in these years. As the difference-in-difference design focuses on a change in relative tax rates, I have not carried out an analysis for these years.

For every concurrent shift in tax brackets and drop in tax rates, a table similar to Table 5.4 is listed in Appendix F. Considering all 'treatments' are (additional) drops in tax rates, the treatment group should have a larger decrease in DAR than the control groups. As the tables in Appendix F show, this is the case for all analyses except one.

The main results of these analyses are listed in Table 5.5. First and foremost, one should note that none of the estimated values for $\beta_{treatment}$ is significant, even at a 10-percent significance benchmark. The effects are slightly smaller than the main panel regression result: based on these five analyses, the average effect of a 1% drop in tax rate is a 0.14% drop in the debt-asset ratio. The low significance levels, however, make it hard to interpret the importance of these results.

Table 5.5: Main results of regression discontinuity analyses

Years	Threshold	Bandwidth	Obs. (C/T)	$\beta_{treatment}$	P-value	$\Delta\tau_c$	$\frac{\beta_{treatment}}{\Delta\tau_c}$
2007-2008	25.000[24]	2.000	100/119	-0.009	0.473	-3.5%	0.003
2007-2008	60.000	6.000	248/209	0.002	0.871	-2.0%	-0.001
2007-2008	200.000	20.000	188/212	-0.009	0.399	-2.5%	0.004
2008-2009	40.000[25]	4.000	1.212/1.325	-0.001	0.632	-3.0%	0.000
2008-2009	200.000	20.000	1.242/1.065	-0.002	0.188	-3.0%	0.001

As suggested by Imbens and Lemieux (2007), the bandwidth choice can have a significant effect on the results. I have carried out robustness checks using both a narrower bandwidth and one that leaves a gap between the cut-off value and the selected group. The results are listed in Tables F.5 and F.6, respectively. While other bandwidth choices do slightly increase the significance in most cases, the final outcomes are comparable.

[24] As shown in Appendix B, the lowest threshold was raised from €22.689 to €25.000 in 2007. As the NFO-database lists all variables (including annual profit) as multiples of €1.000, it is not possible to accurately distinguish between firms near this threshold in the years before 2007. Hence, no analyses were carried out on the lower threshold in these years.

[25] Note that in the analyses around the €40.000 and €60.000 mark, the firms above the threshold benefit from an (additional) drop in tax rate and are therefore the treatment group.

6 Summary and conclusion

Corporate income taxation regimes typically allow for a deduction of interest payments, while dividend payments do not affect the amount of income that is taxed. Theory and previous empirical literature suggest that this discrepancy creates an incentive for firms to finance their assets with debt rather than equity. This thesis offers a first estimation of the magnitude of this incentive for firms in The Netherlands.

Using tax return data from the NFO-database on all firms that are subject to the Dutch Corporate Income Tax Act, I have analysed the effect of the recent decrease in corporate income tax rates in The Netherlands on the debt-asset ratio of these firms. As the corporate income tax rate gradually dropped from 34,5% to 25,5% between 2004 and 2009, the average leverage ratio decreased from 66.2% to 53.0%. More importantly, the data shows that firms facing the lower statutory tax rate typically have higher debt ratios. This indicates that financial policy varies with firm size and that there may be a reverse causality problem.

Using a constructed instrument to circumvent endogeneity and a control variable for firm size, the regression results indicate that a 10%-rise of the corporate tax rate will cause firms to finance their assets with 2.3% more debt. This outcome fits nicely within the bandwidth of results from previous empirical studies: a meta-regression by De Mooij (2011b) using data from 19 different studies indicates that a 10%-rise in tax rate leads, on average, to a 1.7% to 2.8% change in the debt-asset ratio. Adding control variables gives additional information about the financial policy of firms. Corporations that own more tangible assets, which typically serve as good collateral for loans, have higher debt levels. On the other hand, if a firm’s assets mainly consist of intangible assets or cash, there is less leverage.

Although the sign and magnitude of the main result is in line with theoretical predictions, it should be taken with caution. Various robustness checks indicate that the results fluctuate quite heavily when certain groups of observations are discarded. The removal of firms with negative amounts of equity or debt-asset ratios which are abnormally low or high affects the coefficient greatly (although, in the latter case, not significantly). This may be an indication that the main result is, to a large extent, driven by these observations.

Alongside the general decrease in Dutch corporate tax rates between 2004 and 2009, the progressivity structure changed. The boundary to be eligible for the lower rate for small firms gradually shifted upward from €22.689 in 2004 to €200.000 in 2009. This change allows for a comparison between firms on either side of these thresholds through regression discontinuity designs. As a general rule, the effects have the expected positive coefficients as well as a magnitude that is comparable to the main regression results. The outcomes for none of these analyses are, however, significant.

Referring back to the research question posed in the introduction, I conclude that the decrease in corporate tax rates have led to a reduced use of debt-financing. After overcoming methodological problems caused by the reverse causality problem, the results show a consistent pattern with a positive coefficient for the tax variable. Higher tax rates lead to higher debt levels and vice versa (ceteris paribus). Further research using more sophisticated ways to circumvent endogeneity could affirm this conclusion.

One way or another, the outcomes show that the taxation of corporate income has a considerable effect on a company's financing decision. This substantiates the current political debate in The Netherlands on the fiscal facilitation of debt-financing. While the announced fiscal plans for 2012 propose to limit the deduction of interest payments for certain groups of taxpayers[26], the question arises whether such a specific change is sufficient. The results show that financial decisions of a broad range of firms are affected by the discrepancy in fiscal treatment of financing costs. A more fundamental reform, along the lines proposed in the Mirrlees Review, may be necessary.

How such a reform should be constructed is, naturally, a very delicate question. As discussed in Chapter 2, the ACE and CBIT alternatives proposed in the Mirrlees Review each have their own implications for corporate decisions. The NFO-database used in this thesis offers a unique opportunity to examine the various effects of taxation on corporate behaviour. As the database comprises figures of every firm that is subject to the Dutch Corporate Income Tax Act, the possibilities for further research are endless.

[26] http://www.rijksoverheid.nl/bestanden/documenten-en-publicaties/kamerstukken/2011/09/20/belastingplan-2012/nader-rapport-advies-bp2012.pdf.

Appendix A: Corporate tax rates in OECD countries[27]

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Australia	34.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Austria	34.0	34.0	34.0	34.0	34.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Belgium	40.2	40.2	40.2	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0
Canada	42.4	40.5	38.0	35.9	34.4	34.2	33.9	34.0	31.4	31.0	29.4	27.6
Chile	15.0	15.0	15.0	16.0	16.5	17.0	17.0	17.0	17.0	17.0	17.0	20.0
Czech Republic	31.0	31.0	31.0	31.0	28.0	26.0	24.0	24.0	21.0	20.0	19.0	19.0
Denmark	32.0	30.0	30.0	30.0	30.0	28.0	28.0	25.0	25.0	25.0	25.0	25.0
Estonia	26.0	26.0	26.0	26.0	26.0	24.0	23.0	22.0	21.0	21.0	21.0	21.0
Finland	29.0	29.0	29.0	29.0	29.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
France	37.8	36.4	35.4	35.4	35.4	35.0	34.4	34.4	34.4	34.4	34.4	34.4
Germany	52.0	38.9	38.9	40.2	38.9	38.9	38.9	38.9	30.2	30.2	30.2	30.2
Greece	40.0	37.5	35.0	35.0	35.0	32.0	29.0	25.0	25.0	25.0	24.0	20.0
Hungary	18.0	18.0	18.0	18.0	16.0	16.0	17.3	20.0	20.0	20.0	19.0	19.0
Iceland	30.0	30.0	18.0	18.0	18.0	18.0	18.0	18.0	15.0	15.0	18.0	20.0
Ireland	24.0	20.0	16.0	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Israel	36.0	36.0	36.0	36.0	35.0	34.0	31.0	29.0	27.0	26.0	25.0	24.0
Italy*	37.0	36.0	36.0	34.0	33.0	33.0	33.0	33.0	27.5	27.5	27.5	27.5
Japan	40.9	40.9	40.9	40.9	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5
Korea	30.8	30.8	29.7	29.7	29.7	27.5	27.5	27.5	27.5	24.2	24.2	24.2
Luxembourg	37.5	37.5	30.4	30.4	30.4	30.4	29.6	29.6	29.6	28.6	28.6	28.8
Mexico	35.0	35.0	35.0	34.0	33.0	30.0	29.0	28.0	28.0	28.0	30.0	30.0
Netherlands	35.0	35.0	34.5	34.5	34.5	31.5	29.6	25.5	25.5	25.5	25.5	25.0
New Zealand	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	30.0	30.0	30.0	28.0
Norway	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0
Poland*	30.0	28.0	28.0	27.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Portugal	35.2	35.2	33.0	33.0	27.5	27.5	27.5	26.5	26.5	26.5	26.5	26.5
Slovak Republic	29.0	29.0	25.0	25.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Slovenia	25.0	25.0	25.0	25.0	25.0	25.0	25.0	23.0	22.0	21.0	20.0	20.0
Spain	35.0	35.0	35.0	35.0	35.0	35.0	35.0	32.5	30.0	30.0	30.0	30.0
Sweden	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	26.3	26.3	26.3
Switzerland	24.9	24.7	24.4	24.1	24.1	21.3	21.3	21.3	21.2	21.2	21.2	21.2
Turkey	33.0	33.0	33.0	30.0	33.0	30.0	20.0	20.0	20.0	20.0	20.0	20.0
United Kingdom	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	28.0	28.0	28.0	26.0
United States	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.1	39.2	39.2
OECD Average	**32.6**	**31.6**	**30.5**	**30.1**	**29.2**	**28.2**	**27.5**	**27.0**	**26.0**	**25.7**	**25.6**	**25.5**

[27] These figures were retrieved from the OECD Tax Database: http://www.oecd.org/dataoecd/26/56/33717459.xls

Appendix B: Corporate income tax rates in The Netherlands

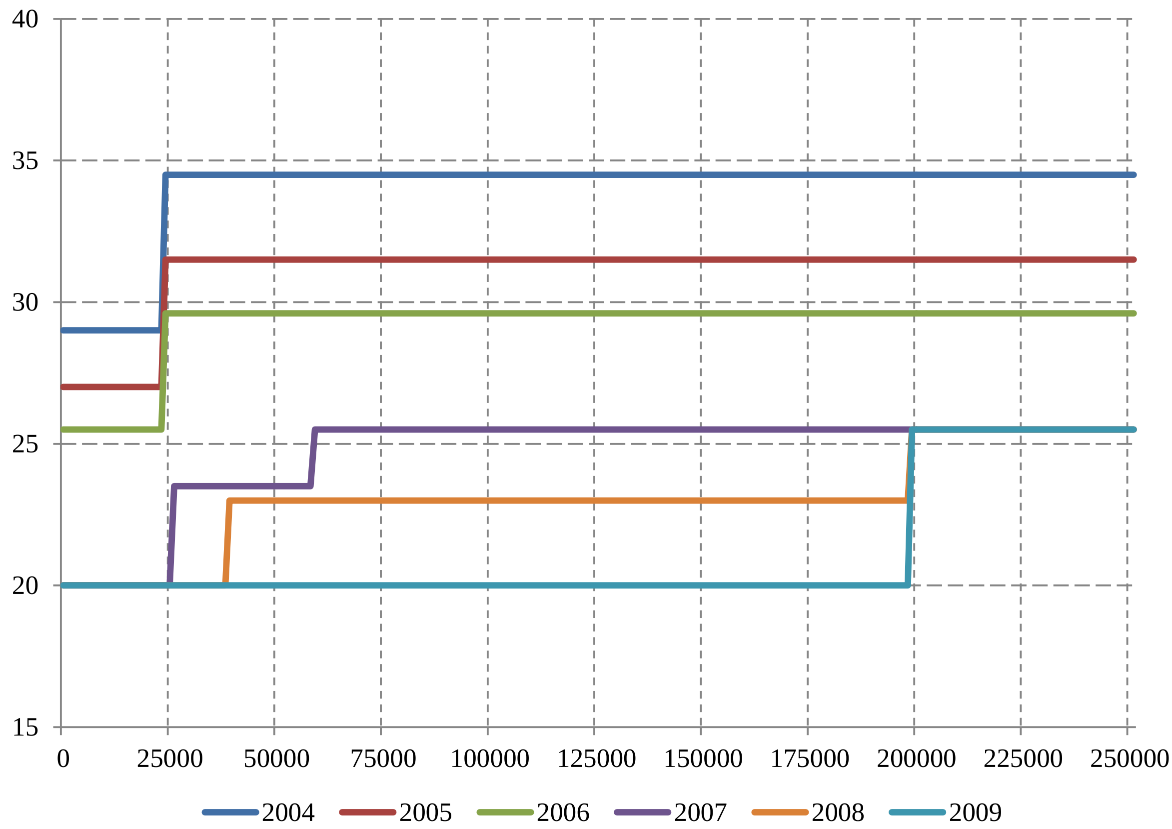
Table B.1: Corporate Income Tax rates in The Netherlands between 2004 and 2009

Year	Taxable Income	Tax rate	Taxable income	Tax rate	Taxable income	Tax rate
2004	0 – 22.689	29%			> 22.689	34.5%
2005	0 – 22.689	27%			> 22.689	31.5%
2006	0 – 22.689	25.5%			> 22.689	29.6%
2007	0 – 25.000	20%	25.000 – 60.000	23.5%	> 60.000	25.5%
2008	0 – 40.000	20%	40.000 – 200.000	23%	> 200.000	25.5%
2009	0 – 200.000	20%			> 200.000	25.5%
2008*	0 – 275.000	20%			> 275.000	25.5%

On 18 September 2008, the Dutch government announced that the corporate income tax rates over 2008 would be lowered even further with retroactive effect (see the final row in the table). This tax rate cut was finalized on the 18th of December 2008. However, as most of the year had already passed (and thus most financial decisions by firms had already been made) before the cut was announced, let alone legally in place, the original 2008 tax rates were used in this research.

Graphically, these tax rates can be depicted as follows:

Figure A.1: Graphical illustration of Corporate Income Tax rates between 2004 and 2009



Appendix C: Construction of the instrumental variable $pMTR$: results of regression 3.3

```
. xtreg MTR r01 r012 r013 r014 r015 r016 r017 r01lag r01lag2 r01lag3 r01lag4 r01lag5
>  j09, fe

Fixed-effects (within) regression               Number of obs      =   1211326
Group variable: ID                              Number of groups   =    336406

R-sq:  within  = 0.1155                         Obs per group: min =         1
       between = 0.0456                                        avg =       3.6
       overall = 0.0703                                        max =         6

                                                F(17,874903)       =   6722.94
corr(u_i, Xb)  = -0.0881                        Prob > F           =    0.0000

------------------------------------------------------------------------------
         MTR |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         r01 |   .0000263   2.58e-07   102.06   0.000     .0000258    .0000268
        r012 |  -1.45e-09   2.08e-11   -69.52   0.000    -1.49e-09   -1.41e-09
        r013 |   3.30e-14   6.19e-16    53.29   0.000     3.18e-14    3.42e-14
        r014 |  -3.64e-19   8.25e-21   -44.13   0.000    -3.80e-19   -3.48e-19
        r015 |   2.05e-24   5.36e-26    38.31   0.000     1.95e-24    2.16e-24
        r016 |  -5.68e-30   1.66e-31   -34.24   0.000    -6.01e-30   -5.36e-30
        r017 |   6.11e-36   1.96e-37    31.17   0.000     5.73e-36    6.50e-36
      r01lag |  -8.22e-06   1.28e-07   -64.46   0.000    -8.47e-06   -7.97e-06
     r01lag2 |   4.16e-10   8.75e-12    47.56   0.000     3.99e-10    4.33e-10
     r01lag3 |  -6.93e-15   1.81e-16   -38.38   0.000    -7.28e-15   -6.58e-15
     r01lag4 |   4.82e-20   1.47e-21    32.84   0.000     4.53e-20    5.10e-20
     r01lag5 |  -1.45e-25   5.00e-27   -29.03   0.000    -1.55e-25   -1.35e-25
     r01lag6 |   1.57e-31   6.00e-33    26.11   0.000     1.45e-31    1.68e-31
         j06 |  -.0207287   .0002818   -73.57   0.000    -.0212809   -.0201764
         j07 |  -.0470593   .0002848  -165.26   0.000    -.0476175   -.0465012
         j08 |  -.0634428   .0002891  -219.44   0.000    -.0640095   -.0628762
         j09 |  -.0777807   .0002997  -259.51   0.000    -.0783682   -.0771933
       _cons |   .1850062   .0002673   692.24   0.000     .1844824      .18553
-------------+----------------------------------------------------------------
     sigma_u |  .10573356
     sigma_e |  .09068406
         rho |  .57617275   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(336405, 874903) =     4.26      Prob > F = 0.0000
```

Appendix D: Additional descriptive statistics

Table D.1: Descriptive statistics for all variables

Variable	Obs.	Mean	Median	Std. Dev.
Balance Sheet, Total (BST)	1211336	1119.06	402	2202.61
Intangible Assets	1211336	15.06	0	180.05
Fixed Assets	1211336	285.58	27	898.30
Subsidiaries	1211336	63.78	0	439.28
Accounts Receivable	1211336	295.78	76	783.30
Accounts Receivable (Long Term)	1211336	84.70	0	393.42
Accounts Receivable (Short Term)	1211336	211.08	53	613.80
Trade Account Debtors	1035208	179.22	17	571.48
Stock	1211336	127.71	0	546.21
Liquid Assets	1211336	177.99	31	544.88
Equity	1211336	365.29	81	1265.72
Provisions	1211336	102.99	0	245.62
Total Debt	1211336	546.14	119	1488.65
Debt (Long Term)	1211336	261.63	0	951.83
Debt (Short Term)	1211336	284.51	67	933.98
Trade Account Creditors	1035208	122.44	7	437.33
Turnover	1211336	1607.79	312	5137.90
Costs of Turnover	1211336	-1140.79	-134	4517.71
Salary costs	1211336	-337.21	-99	898.57
Depreciations	1211336	-42.01	-8	161.73
Operating Income	1211336	87.78	18	416.94
Result from Subsidiaries	1211336	20.02	0	560.96
Net Interest Income	1211336	-15.34	-2	64.22
Interest Income	1211336	4.15	0	21.20
Interest Costs	1211336	-19.49	-3	64.68
Other Financial Results	1211336	1.78	0	139.30
Net Accidental Results	1211336	2.71	0	210.26
Positive Incidental Results	1211336	6.31	0	160.30
Negative Incidental Results	1211336	-3.60	0	141.41
Taxable Income	1211336	96.95	19	717.96
Taxes Paid	1211336	-23.40	-1	103.71
Net Result	1211336	73.54	16	682.36
Dividend Payments	1211336	33.98	0	714.44
MTR	1211336	0.166	0.2	0.13
Predicted MTR	1211336	0.166	0.192	0.105
Average Tax Rate	1184252	0.13	0.111	0.80
Debt-Asset Ratio	1211336	0.56	0.396	0.70
Dummy Thincap	1211336	0.09	0	0.29
Interest Costs / Total Debt	1195105	0.12	0.028	1.42
Interest Income / Total Debt	1161436	0.05	0	0.45
Dividend Dummy	1211336	0.12	0	0.33
Intangible Assets / Total	1211336	0.02	0	0.08
Fixed Assets / Total	1211336	0.19	0.081	0.24
Subsidiaries / Total	1211336	0.05	0	0.16
Accounts Receivable / Total	1211336	0.33	0.23	0.30
Trade Acc. Debt. / Total	1035208	0.16	0.064	0.21
Stock / Total	1211336	0.08	0	0.18
Liq. Assets / Total	1211336	0.20	0.103	0.25

Table D.2: Distribution of debt-asset-ratios for firms in different tax brackets

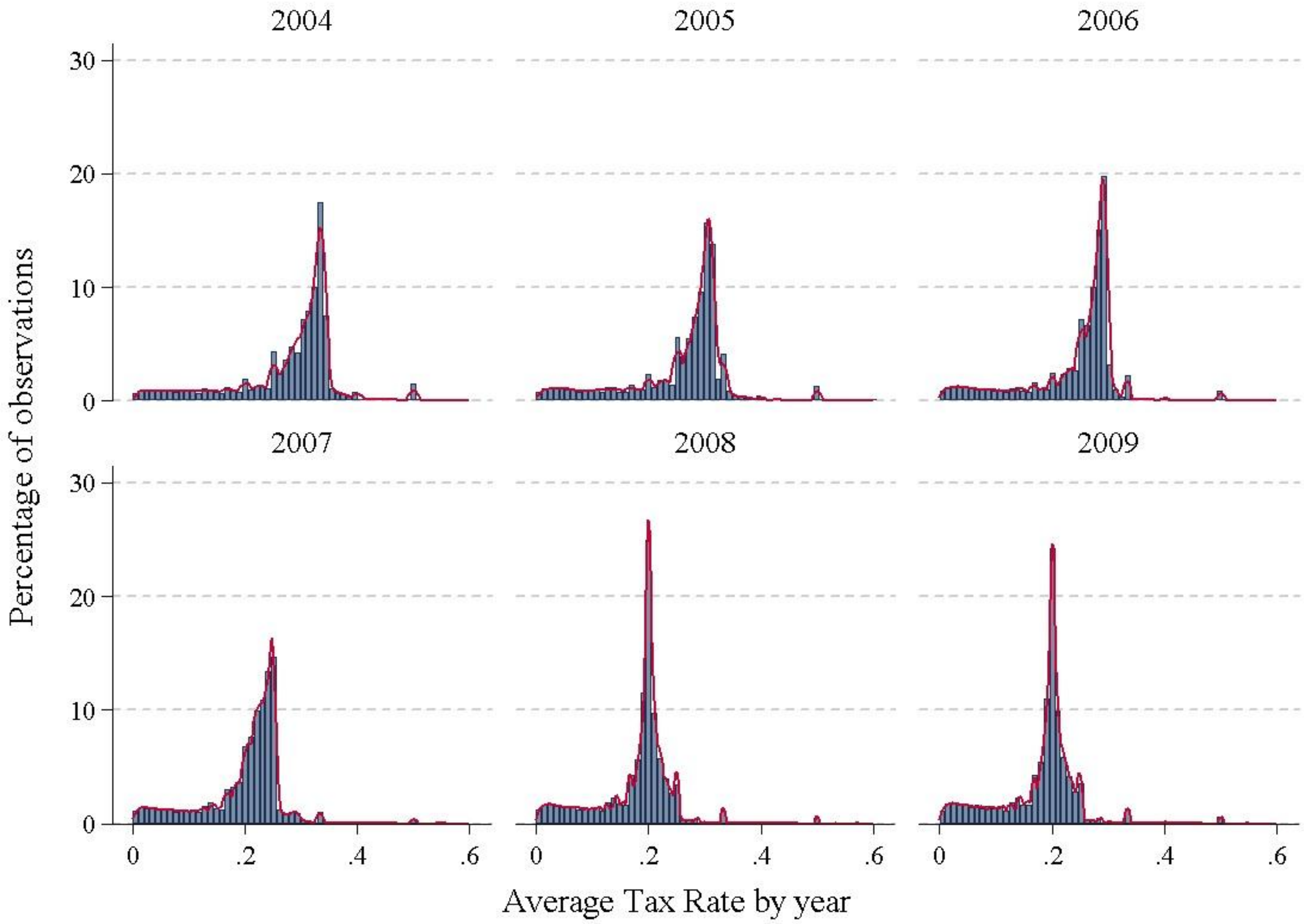
2004			2005			2006		
MTR	**Obs.**	**DAR**	**MTR**	**Obs.**	**DAR**	**MTR**	**Obs.**	**DAR**
0	61.086	0.9357	0	66.949	0.7752	0	69.069	0.8020
29%	40.222	0.5774	27%	36.010	0.4574	25.5%	36.381	0.4577
34.5%	74.820	0.4842	31.5%	73.368	0.3700	29.6%	86.091	0.3760
Total	**176.128**	**0.6621**	**Total**	**176.327**	**0.5417**	**Total**	**191.541**	**0.5451**

2007			2008			2009		
MTR	**Obs.**	**DAR**	**MTR**	**Obs.**	**DAR**	**MTR**	**Obs.**	**DAR**
0	69.845	0.8249	0	58.357	0.8031	0	85.664	0.7851
20%	39.737	0.4540	20%	57.030	0.4342	20%	111.154	0.3823
23.5%	27.412	0.4085	23%	33.422	0.3596	25.5%	28.954	0.3425
25.5%	73.623	0.3707	25.5%	85.664	0.3495			
Total	**210.617**	**0.5420**	**Total**	**234.473**	**0.4844**	**Total**	**225.772**	**0.5300**

Table D.3: Detailed correlation matrix

	DAR	MTR	$pMTR$	ATR	TO	EBT	BST	$Debt$	$Thincap$
DAR	1.00								
MTR	-0.2644	1.00							
$pMTR$	-0.2928	0.8052	1.00						
ATR	-0.0402	0.0981	0.0922	1.00					
TO	-0.0047	0.1036	0.1275	0.0233	1.00				
EBT	-0.0775	0.1986	0.1838	0.0194	0.2006	1.00			
BST	-0.0507	0.1379	0.1694	0.0215	0.6251	0.2554	1.00		
$Debt$	0.1599	0.0178	0.0343	0.0065	0.5105	0.0596	0.7584	1.00	
$Thincap$	0.3028	-0.1237	-0.1200	-0.0166	0.1774	-0.0483	0.2378	0.4622	1.00

Figure D.1: Average Tax Rate distribution by year



Appendix E: Additional panel regression results

Table E.1: Robustness check on Table 5.1, Column 4

Dropped observations	MTR coefficient	R^2
Equity < 0	-0.196***	0.0723
(255.777)	(0.002)	
DAR > 1 or < 0.01	-0.229***	0.0638
(141.941 / 43.189)	(0.002)	
EBT < 0	-0.582***	0.0281
(373.129)	(0.007)	
Turnover lower 25%	-0.416***	0.0410
(300.953)	(0.004)	
Turnover upper 75%	-0.396***	0.0299
(910.383)	(0.013)	
ATR > Statutory rate	-0.442***	0.0384
(86.007)	(0.005)	

Table E.2: Results of first-difference specification of Equation 5.1

	(1)	(2)	(3)	(4)
ΔMTR	-0.349***	-0.312***	-0.334***	-0.294***
	(0.003)	(0.004)	(0.004)	(0.004)
Δln(Turnover)		-0.031***	-0.029***	0.036***
		(0.000)	(0.001)	(0.001)
$\Delta\frac{\textbf{Tangible Assets}}{\textbf{Total Assets}}$				0.155**
				(0.070)
$\Delta\frac{\textbf{Intangible Assets}}{\textbf{Total Assets}}$				-0.293***
				(0.071)
$\Delta\frac{\textbf{Cash}}{\textbf{Total Assets}}$				-0.247***
				(0.070)
ΔDividends				0.040***
				(0.001)
ΔConstant	-0.024***	-0.023***	-0.120***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Year dummies?	No	No	Yes	Yes
Observations	847.027	840.609	840.609	692.664
$\mathbf{R^2}$	0.0111	0.0142	0.0281	0.0314

Table E.3: Robustness check on Table E.2, Column 3

Dropped observations	ΔMTR coefficient	R^2
Equity < 0 (255.777)	-0.264*** (0.002)	0.0511
DAR > 1 or < 0.01 (141.941 / 43.189)	-0.277*** (0.002)	0.0566
EBT < 0 (373.129)	-0.319*** (0.007)	0.0044
Turnover lower 25% (300.953)	-0.332*** (0.004)	0.0403
Turnover upper 75% (910.383)	-0.322*** (0.011)	0.0100
ATR > Statutory rate (86.007)	-0.348*** (0.004)	0.0285

Table E.4: Results of first-difference specification using $pMTR$

	(1)	(2)	(3)	(4)
ΔpMTR	-1.244*** (0.027)	-0.544*** (0.029)	0.766*** (0.033)	0.199*** (0.038)
Δln(Turnover)		-0.035*** (0.001)	-0.046*** (0.001)	-0.046*** (0.001)
$\Delta\frac{\textbf{Tangible Assets}}{\textbf{Total Assets}}$				0.183*** (0.070)
$\Delta\frac{\textbf{Intangible Assets}}{\textbf{Total Assets}}$				-0.280*** (0.071)
$\Delta\frac{\textbf{Cash}}{\textbf{Total Assets}}$				-0.256*** (0.070)
ΔDividends				0.023*** (0.001)
ΔConstant	-0.038*** (0.001)	-0.026*** (0.001)	-0.103*** (0.001)	0.008*** (0.001)
Year dummies?	No	No	Yes	Yes
Observations	847.018	840.600	840.600	692.657
R^2	0.0022	0.0057	0.0188	0.0231

Table E.5: Results of IV-regression using pMTR = MTR

	(1)	(2)	(3)	(4)	(5)
MTR (=pMTR)	-1.031***	-2.072***	-2.280***	4.055***	0.231
	(0.008)	(0.010)	(0.087)	(0.272)	(0.145)
ln(Turnover)			0.026***	-0.137***	-0.058***
			(0.000)	(0.007)	(0.004)
$\frac{\textbf{Tangible Assets}}{\textbf{Total Assets}}$					1.076***
					(0.1102)
$\frac{\textbf{Intangible Assets}}{\textbf{Total Assets}}$					0.690***
					(0.1106)
$\frac{\textbf{Cash}}{\textbf{Total Assets}}$					0.578***
					(0.110)
Dividends					0.012***
					(0.002)
Constant	0.754***	1.135***	1.037***	0.533***	0.174
	(0.001)	(0.003)	(0.003)	(0.023)	(0.110)
Year dummies?	No	Yes	Yes	Yes	Yes
Fixed effects?	No	No	No	Yes	Yes
Observations	1.211.326	1.211.326	1.201.322	1.201.322	799.561
R^2	0.0682	0.0807	0.0848	0.0708	0.0150

Table E.6: Results of first-difference IV-regression

	(1)	(2)	(3)	(4)
ΔMTR (ΔpMTR)	-1.750***	-4.608***	5.034***	0.727***
	(0.043)	(0.445)	(0.118)	(0.038)
Δln(Turnover)		0.0949***	-0.188***	-0.067***
		(0.013)	(0.004)	(0.005)
$\Delta\frac{\textbf{Tangible Assets}}{\textbf{Total Assets}}$				0.230***
				(0.074)
$\Delta\frac{\textbf{Intangible Assets}}{\textbf{Total Assets}}$				-0.258***
				(0.074)
$\Delta\frac{\textbf{Cash}}{\textbf{Total Assets}}$				-0.306***
				(0.073)
ΔDividends				0.030***
				(0.002)
ΔConstant	-0.054***	-0.116***	0.058***	0.016***
	(0.001)	(0.009)	(0.004)	(0.003)
Year dummies?	No	No	Yes	Yes
Observations	847.018	840.600	840.600	692.657
R^2	0.0111	0.0057	0.0075	0.0007

Appendix F: Additional regression discontinuity design results

Table F.1: Analysis of treatment effect between 2007 and 2008 around €60.000 threshold

Year	Profit Bandwidth	Tax Rate	Group	Observations	Mean DAR
2007	54.000 – 60.000	23.5%	Control	93	0.425
2007	60.000 – 66.000	25.5%	Treatment	62	0.396
2008	54.000 – 60.000	23%	Control	93	0.383
2008	60.000 – 66.000	23%	Treatment	62	0.368

Group	$\Delta\tau_c$	ΔDAR
Control	-0.5%	-0.042
Treatment	-2.5%	-0.028

Table F.2: Analysis of treatment effect between 2007 and 2008 around €200.000 threshold

Year	Profit Bandwidth	Tax Rate	Group	Observations	Mean DAR
2007	180.000 – 200.000	25.5%	Treatment	212	0.349
2007	200.000 – 220.000	25.5%	Control	188	0.331
2008	180.000 – 200.000	23%	Treatment	212	0.308
2008	200.000 – 220.000	25.5%	Control	188	0.298

Group	$\Delta\tau_c$	ΔDAR
Control	0	-0.033
Treatment	-2.5%	-0.041

Table F.3: Analysis of treatment effect between 2008 and 2009 around €40.000 threshold

Year	Profit Bandwidth	Tax Rate	Group	Observations	Mean DAR
2008	36.000 – 40.000	20%	Control	1.325	0.406
2008	40.000 – 44.000	23%	Treatment	1.212	0.366
2009	36.000 – 40.000	20%	Control	1.325	0.405
2009	40.000 – 44.000	20%	Treatment	1.212	0.364

Group	$\Delta\tau_c$	ΔDAR
Control	0	-0.001
Treatment	-3.0%	-0.002

Table F.4: Analysis of treatment effect between 2008 and 2009 around €200.000 threshold

Year	Profit Bandwidth	Tax Rate	Group	Observations	Mean DAR
2008	180.000 – 200.000	23%	Treatment	1.242	0.313
2008	200.000 – 220.000	25.5%	Control	1.065	0.326
2009	180.000 – 200.000	20%	Treatment	1.242	0.311
2009	200.000 – 220.000	25.5%	Control	1.065	0.325

Group	$\Delta\tau_c$	ΔDAR
Control	0	-0.001
Treatment	-3.0%	-0.002

Table F.5: Robustness check using smaller bandwidths

Years	Threshold	Bandwidth	Obs. (C/T)	$\beta_{treatment}$	P-value	$\Delta\tau_c$	$\frac{\beta_{treatment}}{\Delta\tau_c}$
2007-2008	60.000	3.000	80/78	-0.008	0.646	-2.0%	0.004
2007-2008	200.000	10.000	65/55	-0.019	0.293	-2.5%	0.008
2008-2009	40.000	2.000	589/625	-0.001	0.607	-3.0%	0.000
2008-2009	200.000	10.000	508/621	-0.003	0.113	-3.0%	0.001

Table F.6: Robustness check using bandwidths with gaps

Years	Threshold	Bandwidth *	Obs. (C/T)	$\beta_{treatment}$	P-value	$\Delta\tau_c$	$\frac{\beta_{treatment}}{\Delta\tau_c}$
2007-2008	25.000	2.000	190/213	-0.007	0.743	-3.5%	0.002
2007-2008	60.000	3.000	93/62	0.013	0.523	-2.0%	-0.065
2007-2008	200.000	10.000	65/62	0.008	0.681	-2.5%	-0.003
2008-2009	40.000	2.000	648/578	0.000	0.971	-3.0%	0.000
2008-2009	200.000	10.000	523/575	-0.001	0.433	-3.0%	0.000

Note that, in Table F.6, a gap equal to the size of the bandwidth is taken before selecting the respondents. For instance, respondents around the €200.000 threshold are firms that generate a profit within the range of €180.000 - €190.000 or €210.000 - €220.000.

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