The effect of taxes on the debt policy of spanish listed companies

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Abstract This study explores the role of taxes in explaining companies' financing decisions. We test whether the corporate tax shields explanation of capital structure is applicable to firms listed on the Spanish stock exchange over the period 2007–2013. Taxes are found to be economically and statistically significant determinants of capital structure. Our results suggest that marginal tax rates affect the debt policies of Spanish listed companies, and the existence of non-debt tax shields constitutes an alternative to the use of debt as a tax shelter. Consistent with theoretical expectations, there is a stronger relation between debt and taxation in less levered firms. Finally, we empirically estimate the impact of the new thin-capitalization rule put forth by the Spanish government in 2012 on the financing behaviour of Spanish listed companies.

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Our empirical evidence supports the existence of a tax reform effect, where companies affected by interest deductibility limitations reduce their leverage more than companies that are not affected.

Keywords Capital structure · Corporate taxes · Debt · Marginal tax rate · Thin-capitalization rule

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1 Introduction

A large body of research has examined the effects of corporate taxation. Although the results of empirical models vary significantly, the majority of this research does find that, to some degree, taxes influence a broad range of corporate financial decisions such as financing policy, investment policy or corporate reorganization and hedging.[1] The magnitude of these effects and their overall impact on the economy are still under debate. Notwithstanding, the most significant obstacle a policy maker confronts in deciding on the tax treatment of corporate debt and equity financing is that the impact of taxation on corporate financial policy is not entirely understood. In addition, Graham (2013) reviews a number of studies that suggest that taxes influence financing decisions; however, this effect is not always strong. Likewise, he concludes that more research is needed for a better understanding of the influence of taxes on capital structure, particularly related to time-series effects. Therefore, whether and to what extent taxation affects the choice of capital structure is still an unsettled topic, deserving further study.

The meta-study of the existing empirical studies conducted by Feld et al. (2013) concludes that capital structure choices are indeed positively affected by taxes, an effect which is also quantitatively relevant. Tax rates are shown to be correlated with corporate capital structure choices, which suggests that firms may increase value through optimal debt choice. The trade-off theory of capital structure offers a theoretical explanation to the relationship between corporate debt policy and taxes. Specifically, this theory argues that firms determine their optimal debt ratio by comparing the present value of additional tax savings and of the additional expected cost of financial distress caused by a marginal increase in debt. There has been relatively limited empirical research into the effects of marginal corporate tax on debt policy, despite its clear significance. In this regard, Graham (1996a), as well as the subsequent studies, found that marginal corporate tax rate does influence the debt policies of US firms.[2] In countries other than the US, Alworth and Arachi (2001) conducted a similar analysis using a data panel on Italian firms and found a positive relationship between firm-specific marginal tax rates and Italian firms' debt policy. In addition, Kunieda et al. (2011), Hartmann-Wendels et al. (2012) and Sinha and Bansal (2013) obtained analogous

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[1] A detailed review of the literature on the role of taxes in corporate finance is provided by Graham (2008, 2013).

[2] A comprehensive survey of related literature can be found in Graham (2003, 2008, 2013).

results for Japanese, German and Indian firms, respectively. To the best of our knowledge, there have been no empirical studies to date on the effects of simulated marginal tax rates on debt policy in Spain.

In the area of public finance, recent debate about corporate tax reform has focused on the consequences of asymmetric tax treatment of equity and debt financing. US and European fiscal authorities have considered limiting the ability of companies to deduct interest payments from taxable income, as well as calling for equal treatment of equity and debt. Some examples are the Comprehensive Business Income Tax (CBIT) proposal by the US Treasury, the Mirrlees Review proposals for the UK tax system or the Resolution of the ECOFIN Council Meeting of June 8, 2010, which recommended to European Union member States the adoption of thin-capitalization rules.[3] The reason for this is that the tax-favoured status of debt has reduced tax revenue collection and supposedly encouraged a "debt bias" whereby tax incentives encourage companies to use extra debt. In this regard, it is believed that excessive use of debt financing increases firms' probability of becoming financially distressed and thereby exacerbates or perhaps even causes economic downturns. According to Mooij (2011), although the existence of debt in the capital structure did not cause the financial crisis, excessive leverage makes firms more vulnerable to economic shocks and therefore debt bias might have contributed to the extent of the crisis.

The main objective of this study is to analyse the relationship between taxes and debt financing using panel data on Spanish listed companies. More specifically, we focus on how the deductibility of debt interest affects the capital structure of firms. Our empirical analysis is based on a sample of Spanish listed firms for the period 2007–2013. We test the hypothesis that companies have a tax incentive to use debt financing rather than equity financing because interest paid is tax-deductible while dividends paid to shareholders are not. Besides, we use the Shevlin (1990) and Graham (1996a) expected marginal tax rate approach to examine the effects of tax on the debt policies of Spanish firms. In addition, we test the non-debt tax shields hypothesis which considers other tax shelters different from the interest allowances. In the time period analysed, the Corporate Tax Income Law was reformed and this fact might have influenced the debt policy of Spanish listed companies. For that reason, we test for a tax reform effect and consider this shock as a quasi natural experiment for our research.

This paper contributes to the existing literature on the impact of corporate taxation on firms' capital structure, further developing the contributions of previous literature in different ways. Firstly, we provide additional empirical evidence on the relationship between taxes and debt financing. In contrast with other papers, our measure of leverage includes only financial debt and directly excludes other liabilities such as trade payables, which mainly depend on business transactions and not on the effect of corporate taxation. Secondly, our findings shed some light on this issue in the European Union, which has received little attention to date in the literature. Moreover, International Financial Reporting Standards were adopted in Spain on January

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[3] Thin-capitalization refers to when a company is financed with a high level of debt relative to equity. In turn, thin-capitalization rules imply that a company that has too much debt compared to equity will be denied fiscal deductions for part of its interest payments, or that part of interest payments will be reclassified as dividends and will not obviously be considered as fiscal deductions.

1st 2007, which allows meaningful comparison between our results and those from other economies that have also implemented these international standards. Thirdly, we take into account the Spanish corporate tax reform in 2012, as an exogenous shock, which enacted a new thin-capitalization rule limiting the tax deductibility of financing expenses. Besides, and as similar tax reforms have been conducted in many OECD countries, we believe that our conclusions might be portable to other settings. Applying a difference in differences approach, we analyse the potential impact of the abovementioned reform. Finally, we study a special period partially characterized by a severe economic and financial crisis that has dramatically affected European Mediterranean countries such as Spain.

Our findings show that marginal tax rates significantly affect the debt policy of Spanish listed firms. The results are consistent with the significance of corporate taxes in company financing decisions considering the uniqueness of the Spanish tax provisions. As expected, there is a stronger relationship between taxes and debt policy in less levered companies. Furthermore, the existence of non-debt tax shields constitutes an alternative to the use of debt as a tax shelter. Regarding the corporate tax income reform approved by the Spanish Government in 2012, we found that the new thin-capitalization rule potentially affected 28 % of the companies in our sample. On average, these companies had higher debt ratios than their non-affected counterparts, and after the reform, the former group on average displayed stronger declining debt ratios as compared to the latter one. Our analysis provides empirical evidence consistent with a tax reform effect.

The remainder of the paper is structured as follows. The next section analyses the theoretical framework of the study and presents the hypotheses to be tested. Subsequently, the Spanish corporate tax legislation is described in Sect. 3, including the new thin-capitalization rule. In Sect. 4, we discuss the variables definitions, and explain the estimation of companies' marginal corporate tax rates. Thereafter, Sect. 5 provides a description of our sample and analyses descriptively the tax data. The empirical model specification, econometric methodology and the results are discussed in Sect. 6. Several robustness checks are presented in Sect. 7, and the final section draws some concluding remarks.

2 Theoretical foundation and hypotheses development

Modigliani and Miller (1963) were the first to introduce the idea that corporate taxation affects the capital structure of firms. In particular, they showed that when corporate income is taxed and debt interest is a deductible expense, firm value can be increased by using debt financing rather than funding entirely with equity. In this context, the increase in a firm's value is due to the debt tax shield. The question of why debt financing has traditionally received favourable tax treatment whereas equity financing has not, seems likely to be the result of historical forces at the time the tax rules were being developed, rather than any weighty economic reasoning pertaining to contemporary economic or business circumstances (Strebulaev and Whited 2012).

Earlier empirical articles did not find convincing evidence that taxation affected firms' financial policy (see for example, Bradley et al. 1984; Titman and Wessels 1988).

These discouraging results led Myers (1984) to state in his renowned *Presidential Address* to the American Finance Association that "we don't know how firms choose their capital structures as there is no study clearly demonstrating that a firm's tax status has predictable, material effects on its debt policy". The meta-analysis by Feld et al. (2013) suggests that very small or even negative tax estimates found in the studies do not accurately reflect debt response to taxes. It seems difficult to conduct an effective analysis of a direct relationship between tax rates and debt policy, as most large corporations have the same statutory tax rate.[4] In most developed countries, the statutory tax laws do not demonstrate any substantial variation in corporate statutory tax rates over the years and across firms. In the absence of variation in tax rates through time and across companies, we can only presume a similar debt policy for each company, which is not the case, or we may end up with contradictory results.

Due to asymmetric tax treatment of corporate profits and losses, the (expected) marginal tax rate may not be equal to the statutory tax rate. Specifically, although the statutory tax rate is applied when the taxable income of a company is positive, no corporate tax is imposed when the taxable income is negative. Even in cases where a company actually pays zero tax in a year due to incurred losses, its marginal tax rate may be non-zero. In such a case the marginal tax rate is 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 positive taxable income. Likewise, losses can typically be carried forward and carried backward in the corporate tax system, which leads to differences in the marginal tax rates. This dynamic dimension of taxes makes it necessary to forecast future taxable income in order to estimate current-period tax rates and tax incentives.

Recognizing the existence of loss carried forward and carried backward in the US corporate tax system, Mackie–Mason (1990) analysed the effects of the marginal tax rate on debt policy. He found that when a company has loss carried forward and investment tax credit (i.e., another tax shield), it is less likely to raise capital by new debt issue. Since both existing loss carried forward and investment tax credit are substitutes for new debt issue in terms of tax savings, this result is consistent with the trade-off theory.

Shevlin (1990) implemented the Monte Carlo method using a simple linear projection of taxable income based on actual past data to simulate future taxable income. Then, using simulated taxable income series and applying US corporate tax law, he estimated the (expected) marginal tax rates of individual firms. Also using this approach, Graham (1996a) analysed the effects of marginal tax rate on US firms' debt policy. He found a positive relationship between the firm-specific marginal tax rate and the change in debt ratio.

Conversely, there are other empirical studies using statutory tax rates or average/effective tax rates as proxies for marginal tax rates (see *inter alia* Bradley et al. 1984; Trezevant 1992; Shum 1996; Sogorb-Mira 2005; De Jong et al. 2008). These substitutes for tax rates, however, are problematic in that they introduce a significant

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[4] Statutory tax rates are those percentage rates established by the tax law. Conversely, marginal tax rates relate to the tax rate attributable to the specific company's activity and to explicit decisions that may involve taxes paid (or saved) and income received (or expenses paid) over several years; they can be defined as the present value of current and expected future taxes paid on an additional unit of income earned today.

downward bias in estimates if potential endogeneity bias is not dealt with. Accordingly, Feld et al. (2013) state that the simulated marginal tax rates suggested by Graham (1996a) offer the advantage of avoiding a significant downward bias in estimation. Furthermore, Graham (1996b) and Plesko (2003) show that the simulation approach is the best available proxy of the "true" marginal tax rate. In particular, it is preferable to simply using variables that are assumed to be highly correlated with marginal tax rates, such as statutory tax rates, dummies which indicate whether a firm is reporting losses or trichotomous variables, such as those used in Byoun (2008) or Gropp (2002).

Our first and main hypothesis follows directly from the theoretical rationale and empirical evidence discussed previously, and is formulated as: *"Since higher marginal tax rates raise the value of tax savings, marginal tax rates should be positively related to firms' debt policy"* (Hypothesis 1).

DeAngelo and Masulis (1980) introduced the idea of tax shield substitution, which contends that holding investment (and hence expected income) constant, debt interest competes with other allowable deductions as tax shelter. For example, if a more generous tax rule increases the firm's depreciation allowance, then the firm's optimal level of debt should decrease due to its lower value as a tax shield. Therefore, firms can substitute non-debt tax shields for debt tax shields. Following this rationale, firms with a large amount of non-debt tax shields will have lower levels of debt than firms with a small amount of non-debt tax shields. According to the debt substitution hypothesis, there should be a negative relationship between non-debt tax shields and debt usage.

In this context, Mackie–Mason (1990) highlights the fact that the tax shield substitute hypothesis of DeAngelo and Masulis (1980) is more applicable to firms that are close to being tax exhausted (i.e., firms that have a high probability of losing the deductibility of their tax shields). Trezevant (1992) refers to this as the tax exhaustion hypothesis. Moreover, Mackie–Mason (1990) takes issue with DeAngelo and Masulis (1980) by pointing out that firms with more profitable projects tend to have larger amounts of both depreciation and borrowing, and therefore non-debt tax shields may have a positive rather than a negative association with leverage. In order to identify the effect of debt substitution on tax exhaustion and profitability, Mackie–Mason (1990) proposes considering not only non-debt tax shields but also the probability of bankruptcy. It is likely that non-debt tax shields are a debt substitute for companies near bankruptcy and therefore near to tax exhaustion. Conversely, financially healthy companies that are far from tax exhaustion may jointly exploit both debt and non-debt tax shields.

Hence our second hypothesis can be formulated as: *"Non–debt tax shields on a stand-alone basis, should be positively related to firms' debt policy and non-debt tax shields, weighted by the probability of bankruptcy, should be negatively related to firms' debt policy"* (Hypothesis 2).

A stream of empirical research have examined the impact of taxes on the financing decisions of firms using tax reforms as natural experiments. In this sense, changes in the tax system are used as exogenous shocks to analyse whether companies respond as predicted by theory. Representative work in this field includes, but is not limited to, Alworth and Arachi (2001), An (2012), Panier et al. (2013), Doidge and Dyck (2015), Faccio and Xu (2015), and Heider and Ljungqvist (2015). A particular area within this research deals with the relationship between thin-capitalization rules or other

interest deduction restrictions and company capital structure decisions. Alberternst and Sureth (2015), and Dreßler and Scheuering (2015) investigate empirically the impact of introducing a limitation to the interest fiscal deductibility in the course of the German corporate tax reform of 2008. They all find evidence for the impact of such thin-capitalization rule on companies' debt ratio; specifically, companies that are affected by the interest barrier reduce their leverage typically more than companies that are not affected. Conversely, Blouin et al. (2014) examine the impact of thin-capitalization rules that limit the tax deductibility of interest on the capital structure of the foreign affiliates of US multinationals in 54 countries. In line with previous studies, they carve out a significant debt-reducing effect of different thin-capitalization rules on foreign partners' debt.

Based on the abovementioned discussion and taking the opportunity that offers the Spanish corporate tax reform in 2012, we state our third and last hypothesis: *"Companies affected by the new thin-capitalization rule reduce their leverage ratio after the reform more than those companies that are not affected"* (Hypothesis 3).

3 The Spanish corporate tax setting

The regulation of corporate tax in Spain is contained in the Consolidated Text of the Corporate Income Tax Law, approved by Legislative Royal Decree 4/2004, of March 5th, and in the Corporate Income Tax Regulation approved by Royal Decree 1777/2004, of July 30th. It is worth noting that Spain is politically organised as a State of Autonomous Regions, and two of these regions, namely the Basque Country and Navarra, have special tax regimes called Economic Accord and Economic Agreement, respectively, which differ to the other regions. Unless otherwise stated, we will focus on the corporate tax regime generally applied in most of the Autonomous Regions in Spain.

Corporate tax is determined by the statutory tax rate times taxable income. The Spanish legislator reduced the statutory tax rate from 32.5 % for fiscal year 2007 to 30 % for fiscal years 2008–2013. On the other hand, corporate taxable income is defined as the difference between period revenues and period expenses.[5] Business expenses are deductible if they are properly recorded and supported. By contrast with other countries, Spanish corporate income tax treats income resulting from the transfer of assets in the same way as other income. Accordingly, such income is generally added to (deducted from) regular business income to compute the taxable income.

Corporate taxable income is based on the income disclosed in the financial statements and accounting records, adjusted in accordance with tax principles. The 2007 Spanish General Accounting Plan approved by Royal Decree 1514/2007, of November 16th differentiates between the current income tax expense (income) and the deferred income tax expense (income). The total tax expense or income is the sum of these two items, which should nonetheless be quantified separately. On the one hand, the current income tax expense is the amount payable by the company as a result of income tax

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[5] The tax period is the company's business year. The annual tax return must be declared and the tax paid within 25 days following the 6 months after the end of the business year.

settlements for a given year. Conversely, the deferred income tax expense reflects in essence the recognition and settlement of deferred tax assets and liabilities. A deferred tax asset or liability represents the increase or decrease in taxes payable or refundable in future years as a result of temporary differences and any net operating loss or tax credit carry-forwards that exist at the reporting date. Its value is computed with reference to financial reporting standards for book income and tax rules for taxable income. For instance, deferred tax assets can be created by the tax authority recognizing revenues and/or expenses outside of the times set out in the accounting standards. In Spain "tax effect accounting", which includes the concept of net tax deferred assets, was first introduced in fiscal year 2007.

As in the majority of developed economies, the Spanish corporate tax system treats profits and losses asymmetrically and allows carryover of corporate losses. The Spanish tax code allows companies to carry forward losses to offset taxable income in future years, but unlike in other countries such as the US, Spanish firms cannot "carry back" current losses to receive a tax refund for taxes paid in recent years.

Conventionally, financial expenses have been largely considered as deductible from a fiscal point of view in Spain. The only restriction to this rule was those situations with excess debt with related entities not resident in the European Union, with the exception for those stablished in a territory classified as tax haven. The excess debt was computed as the difference between the actual company's indebtedness and the result of applying a coefficient of three to equity, excluding income or loss of the year. The interest generated by the excess debt was not considered as fiscally deductible; rather, it was treated exactly the same as a dividend. In spite of the preceding rule, corporate taxpayers could always submit to the Spanish fiscal authorities a proposal for applying a higher ratio; if it was accepted, a different leverage threshold would be applied.[6] On March 30th, 2012, the Spanish Government approved several tax measures with effect from fiscal years beginning from January 1st, 2012.[7] Among such measures, the tax reform introduced new rules affecting the deductibility of financial expenses. In particular, it derogated the former Spanish thin-capitalization regime and replaced it by a broader rule that stablishes limitations to the deductibility of financial expenses incurred in excess of a given percentage of a Spanish borrower's adjusted operating profits regardless of whether or not the debt is with related parties.

Under the new tax regime, all net financial expenses (i.e. excess of financial expenses in respect of financial income) incurred by a Spanish corporate taxpayer in a given year that exceed 30 % of such company's annual operating profits[8] will be non-deductible for corporate tax purposes. Notwithstanding, there is a floor level to the previous limitation, and it is fixed at 1 million euros of net financial expenses. Hence, net financial expenses less or equal to 1 million euros shall be tax-deductible regardless of the level of a company's operating profits in a given year.

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[6] This possibility was not applicable to transactions made with or by persons or entities resident in countries or territories legally defined as tax havens.

[7] These measures were included in Royal Decree Law 12/2012.

[8] They basically correspond to earnings before interest, taxes, depreciation and amortization (EBITDA) with certain adjustments. For more information on this issue, refer to Royal Decree Law 12/2012.

The limitation on the deductibility of financial expenses has not been defined as a permanent difference. Instead, net financial expenses that are not tax-deductible in a given year, may be carried over and deducted in the 18 subsequent years of the fiscal year in which such non-deductible amounts were generated, subject to the overall limit of 30 % of the company's operating profits.

Finally, the new thin-capitalization rule is not applicable to those corporate taxpayers that do not belong to a Group of companies (i.e. independent companies), unless more than 10 % of such company's total net financial expenses derive from either: (1) leverage that such company has with people or entities that hold an interest, directly or indirectly, of at least 20 % in such company; or (2) leverage that such company has with creditors in which such company holds an interest, directly or indirectly, of at least 20 %.

4 Leverage, tax and control variables

Our baseline model establishes debt policy as a function of several tax variables and control variables. Each variable, both dependent and independent, is discussed in detail below. Specifically, we examine and propose some proxies for debt, taxes and non-debt tax shields, since taxation and debt are the focus of our research. This is a key issue since the specific explanatory variables used in any study significantly influence tax effects; omitted variable biases are indeed quantitatively important (Feld et al. 2013).

4.1 Debt policy measures

A common issue in capital structure studies is identifying the appropriate measure of leverage. Two approaches have been developed in the study of the effects of the marginal tax rate on firms' debt policy:

- On the one hand, according to the *incremental approach*, the debt ratio is not an efficient measure of leverage as the dependent variable, since it is the cumulative result of decisions taken over many years and thus may not fully reflect changes in economic conditions. Therefore, when studying the effects of the marginal tax rate on firms' debt policy, it is more instructive to examine incremental financing decisions rather than simply widely-used debt ratios. The fact that important debt policy decisions in corporations may take a long time to be implemented supports this line of research. Studies that take this approach include Graham (1996a, 1996b), Shum (1996), Gropp (1997), Alworth and Arachi (2001), Kunieda et al. (2011), Hartmann-Wendels et al. (2012) and Sinha and Bansal (2013).
- On the other hand, the *cumulative approach* proposes the use of debt level ratio as the dependent variable. In this case, tax proxies are adjusted in some way in order not to produce a spurious relationship with debt policy. As will be discussed later on in Section 6, the potential endogeneity problem of the marginal tax rate is avoided by using before-financing tax proxies. Studies that support this approach include Graham et al. (1998), Graham (2000), Bartholdy and Mateus (2011) and Hartmann-Wendels et al. (2012).

In turn, Welch (2011) argues that debt-to-asset ratio is an inappropriate measure for capturing changes in leverage, especially when the ratio is to be used for capital

structure studies, because total assets include non-financial liabilities, meaning that non-financial liabilities are thus treated the same as equity. In its place, Welch (2011) proposes the use of debt-to-capital employed ratio in such studies and therefore ignores non-financial liabilities such as trade payables, which mainly depend on business transactions and not on the effect of corporate income taxation.

In line with the previous rationale, this study employs two measures of leverage by considering incremental debt level in the numerator and capital employed in the denominator, thus:

- LEV_1 is the first difference in long-term book debt divided by the sum of long-term book debt and market value of equity.
- LEV_2 is the same as LEV_1 but using the lagged value of the denominator.[9]

4.2 Tax variables

Testing the impact of taxes on company financing decisions is arduous and open to criticism. The main difficulty lies in finding an appropriate proxy for the company-specific marginal tax rate, as its "true" value is not observable. The computation of the marginal tax rate requires two sets of information: (1) the tax code treatment of net operating losses, and (2) the managers' expectations as to future income flows. We estimate the marginal tax rates of Spanish firms by the Monte Carlo method using Sinha and Bansal (2012) algorithm, which follows several stages. Firstly, we need a forecast of future income flows based on managers' expectations. The model proposed by Shevlin (1990) can be used to generate the proxy for managers' expectations, and is based on the assumption that pre-tax income follows a random walk with drift.[10] That is,

$$\Delta TI_{it} = \mu_{it} + \varepsilon_{it} \tag{1}$$

ΔTI_{it} being the first difference in pre-tax income (i.e. taxable income) of company i in year t, μ_{it} is the sample mean of ΔTI_{it} and ε_{it} is a normally distributed random variable with zero mean and variance equal to that of ΔTI_{it} over the sample period. Although Shevlin 1990 uses historical mean and variance of taxable income, we follow Graham (1996b) and Alworth and Arachi (2001) for estimating the drifts and white noises of equation (1) in order to avoid a reduction in the number of years available for estimation. We use taxable income series calculated from the actual financial data for individual firms in our sample, and consider the entire horizon of the carry-forward sample. As Spanish tax code allows 15 years of loss carry-forward, we simulate future income for 15 years.

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[9] We have also considered alternative leverage measures, including only debt financing. Unreported results remain qualitatively and quantitatively the same as those obtained in Sect. 6.

[10] Blouin et al. (2010) also simulate marginal tax rates but with a different assumption of future taxable income. While Shevlin (1990) adopts a random walk assumption, Blouin et al. (2010) use a mean-reverting process (namely, non-parametric procedure) to simulate future taxable income. Previous empirical evidence has proved insignificant differences between the final MTR estimates under both procedures (see, for instance, Ko and Yoon 2011).

Most tax and capital structure research uses data drawn from financial statements rather than data from actual tax returns (Gordon and Lee 2001; Contos 2005). In absence of access to corporate tax returns, reported accounting figures must be used to infer taxable income. Graham and Mills (2008) found that simulated tax rates based on financial statement data are very highly correlated with tax variables based on tax return data. Due to the fact that accounting income does not necessarily equals taxable income, the former should be adjusted to take into account timing or temporary differences. These differences are categorized as taxable temporary differences (i.e. deferred tax liabilities) and deductible temporary differences (i.e. deferred tax assets). The former will result in higher tax payments or lower recoverable tax in future reporting periods, while the latter will result in lower tax payments or higher recoverable tax in future reporting periods. As a result, we calculate taxable income as follows,

$$\text{TI}_{it} = \text{EBT}_{it} - \frac{\Delta \text{Net tax deferred assets}_{it}}{\text{Statutory tax rate}_t}, \tag{2}$$

where *EBT* is earnings before taxes, and net tax deferred assets is the difference between deferred tax assets and deferred tax liabilities coming from the balance sheet.[11] We divide the subtrahend term by the corporate statutory tax rate in order to come up with a gross measure of tax base.

Secondly, using the simulated taxable income, we calculate the corporate tax bill (T_{it}) with the statutory tax rates and the loss carry-forward rules of the Spanish corporate tax system.

Thirdly, we obtain the present value of the corporate tax bill:

$$\text{PV}(T_i) = \sum_{t=2007}^{2013+\text{Carryforward}} \frac{T_{it}}{(1+R)^{t-2007}}, \tag{3}$$

where T_{it} is the corporate tax bill and R is the discount rate.[12]

After adding one euro to the taxable income values used above, we recalculate the annual corporate tax bills. We consider increase in taxable income for the initial period of the simulation time horizon as in Shevlin (1990) and Graham (1996a). We then compute once more the present value of the new corporate tax bills:

$$\text{PV}(T_i') = \sum_{t=2007}^{2013+\text{Carryforward}} \frac{T_{it}'}{(1+R)^{t-2007}} \tag{4}$$

Fourthly, we take the difference between the present values of Eqs. (3) and (4) in order to obtain a single value of the marginal tax rate.

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[11] See Sect. 3 for more information.

[12] Although Shevlin (1990) and Graham (1996a) use the corporate bond rates of individual firms, we use the internal rate of return of 10-year government bonds for all firms (http://www.afi.es/infoanalistas/indicesAfi/mostrarIndicesAfi.asp) as not all Spanish listed firms issue long-term bonds.

Fifthly, we repeat the process 10,000 times and the average of these simulated marginal tax rates is the (expected) marginal corporate tax rate (*MTR*) of firm i.[13] Averaging these marginal tax rates should represent managers' expectation of the marginal tax rate. This simulation process is carried out for all companies in the sample.

As will be discussed in Sect. 5, we also calculate another series of (expected) marginal corporate tax rates based on an alternative measure of income: earnings before interest and taxes. We thus obtain two series of marginal tax rates: the after-interest *MTR*, simply denoted *MTR*, and the pre-interest *MTR*, which we designate *MTREBIT*.

We have also computed a non-debt tax shield variable (*NDTS*), which is the first difference in book depreciation[14] divided by the sum of lagged book total debt plus lagged market equity value. In addition, we have calculated an interaction variable (*NDTS*RISK*) which is *NDTS* multiplied by a bankruptcy probability index.[15]

4.3 Control variables

The different theories of capital structure suggest that, besides taxes, there are several other determinants of debt policy (Frank and Goyal 2009). We use the following variables, described below, as control variables in our regression analysis.

- Probability of bankruptcy (*RISK*): we use a bankruptcy probability index based on accounting ratios, which is a variant of Altman (1968) *Z-Score*. In line with Mackie–Mason (1990) and Graham (1996a) we calculate this variable as total assets divided by the sum of 3.3 times *EBIT*, 1.0 times *sales*, 1.4 times *retained earnings* and 1.2 times *working capital*. The trade-off theory of capital structure predicts that if the bankruptcy probability of a firm is higher, then the expected cost of financial distress is also higher, and the firm tends to reduce its debt ratio accordingly.
- Tangibility (*TANG*): we compute the percentage of tangible assets over total assets. If a higher tangibility ratio implies a lower probability of bankruptcy, the trade-off theory predicts that firms with higher tangibility ratios will tend to have higher debt ratios. This is in line with an emphasis on the agency cost of debt, as tangible assets can easily be used as collateral for debt.
- Size (*SIZE*): we use the natural logarithm of total assets. Since the bankruptcy probability of larger firms is lower due to their more widely-diversified business, the trade-off theory predicts that larger firms will have higher debt ratios.
- Profitability (*PROF*): we calculate the ratio of earnings before interest, taxes, depreciation and amortization (i.e. EBITDA) to total assets. Profitable companies

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[13] While Shevlin (1990) and Graham (1996a) only repeat this procedure 50 times for each firm, we repeat this simulation 10,000 times for each firm to obtain more stable results.

[14] Although NDTS has often included both depreciation and investment tax credit in previous US studies (see Bradley et al. 1984; Mackie–Mason 1990), we include only depreciation, as investment tax credit is less important in the Spanish corporate tax system than in the US corporate tax system.

[15] See the next subsection relating to control variables for a description of this bankruptcy probability index.

generate more cash than less profitable firms do for a given leverage level, and they face lower probability of default and lower expected costs of financial distress. Moreover, profitable firms find interest tax shields more valuable. Consequently, the trade-off theory expects that more profitable firms will be more financially indebted. Furthermore, the use of more debt in more profitable firms will help generating less agency costs coming from managers in their discretionary use of internal funds.

- Growth opportunities (*TOBIN'S Q*): we use the market to book total assets ratio. The increase in leverage to finance future growth opportunities might lead to underinvestment. Growth increases costs of financial distress, reduces free cash problems and exacerbates debt-related agency problems. Therefore, the theory of capital structure expects a negative relation between debt level and growth opportunities.

Table 7 in the Appendix provides a summary of the definitions of the dependent and explanatory variables.

5 Data and descriptive analysis

The data used in this paper come from three sources. The *Sistema de Análisis de Balances Ibéricos* (SABI), a database managed by Bureau Van Dijk and Informa D&B, S.A., and the Spanish Securities and Exchange Commission (CNMV), provide the accounting information from annual accounts[16], while financial market information comes from the quotation bulletins of the Spanish Stock Exchange.

Our sample comprises Spanish listed companies with information for the 7-year period spanning 2007 to 2013. We focus on listed companies due to the fact that we need information on market data to calculate dependent and explanatory variables. On the other hand, we concentrate on this particular period because the necessary data for estimating firm-specific marginal tax rates using the method of Shevlin (1990) and Graham (1996a) have only been available since fiscal year 2007 in Spain.[17] Furthermore, International Financial Reporting Standards (IFRSs) were implemented in Spain on January 1st 2008. The adoption of these IFRSs allows comparing our results from the capital structure of Spanish listed companies with those from other markets that have also adopted IFRSs.

As per standard practice in the empirical literature, we disregard financial institutions, utilities and governmental enterprises since these types of companies are intrinsically different in terms of the nature of their operations and financial accounting information. We also exclude companies with negative equity, i.e. near-bankrupt firms. Overall, we have a balanced data panel containing 88 companies with a total of 616 observations.

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[16] Detailed information for tax purposes is gathered only on the annual report, and this accounting statement is not available on SABI database; instead, it is actually accessible at CNMV registries for listed companies.

[17] As in many other countries, data based on financial statements do not reflect tax accounting conventions and companies' actual tax incentives. See Sect. 3 for more information.

Table 1 Descriptive statistics

Category	Variables	Mean	Median	Standard Deviation	Min.	Max.
Leverage Variables	LEV_1	−0.014	0.000	0.243	−1.958	0.620
	LEV_2	0.024	0.000	0.210	−0.642	1.384
Tax Variables	MTR	0.179	0.189	0.077	0.000	0.300
	$MTREBIT$	0.182	0.191	0.080	0.000	0.300
	$NDTS$	0.003	0.002	0.476	−3.143	2.140
	$NDTS*RISK$	−0.458	0.005	6.178	−94.307	13.909
Control Variables	$RISK$	4.328	1.298	40.816	−110.459	428.616
	$TANG$	0.109	0.034	0.163	0.000	0.845
	$SIZE$	20.502	20.460	1.940	16.025	25.634
	$PROF$	0.055	0.047	0.098	−0.426	0.471
	$TOBIN'S\ Q$	1.610	1.261	1.297	0.299	8.885

NDTS and *NDTS*RISK* have been rescaled by a factor of 100. Table 7 in the Appendix provides definitions of all the variables

Table 8 in the Appendix includes several key figures describing our firm's sample and compares them with those of the population of large corporate taxpayers (LCTP) in Spain with a total income higher than 180 million euros.[18] As reported, the relevance and representativeness of our sample is noteworthy. For instance, both total assets and total debt comprise approximately one fifth of the population data, with a similar coverage for financial expense. In the case of tax expense, our sample represents a maximum of almost 90 % of the population data in 2012 and a minimum of 11 % a year before. As far as earnings is concerned, around half of the earnings before interest and taxes (EBIT) of the population is covered by our sample data, approximately one third in the case of earnings before taxes (EBT), and nearly one fifth in the case of net income.

In order to reduce the effect of outliers, all variables are winsorized at 0.5 % in each tail of the distribution. Table 1 presents summary statistics of the dependent and explanatory variables.

The average annual growth in company debt was equal to −1.41 % of capital employed and 2.44 % of lagged capital employed.[19] The average of the estimated marginal tax rates of all firms is 17.93 % (18.18 % for *MTREBIT*), which is much lower than the statutory tax rate (32.50 % for fiscal year 2007 and 30.00 % for fiscal year 2008 onwards). This gap is caused by asymmetrical tax treatment of profits and

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[18] For comparison purposes, we focus on non-financial companies and total income that exceeds 180 million euros as our sample has a mean total income of 557 million euros.

[19] The mean values of the leverage variables have opposite signs because, on average, the value of the firm increases with the average amount of debt. Remember that LEV_1 is Δ Debt / V_t, where the denominator is the sum of debt and equity, while $LEV_2 = LEV_1 (V_t/ V_{t-1})$. It follows that, on average, $V_t / V_{t-1} > 1$ ($V_t/ V_{t-1} < 1$) when $Debt_t > Debt_{t-1}$ ($Debt_t < Debt_{t-1}$). Consequently, the quotient V_t/ V_{t-1} gives a greater weight to the observations of LEV_1 that are positive, and a smaller weight to those that are negative.

Notes: Statutory Tax Rate is the corporate income tax rate established by the Spanish corporate tax code; *MTR* is the marginal tax rate estimated as per Shevlin (1990) and Graham (1996a); *MTREBIT* is the marginal tax rate estimated using earnings *before* interest and taxes as per Graham et al. (1998); *ETR* is taxes paid on profits divided by pre-tax book income, excluding extraordinary and discontinued items; *ETRb* is taxes accrued on profits divided by pre-tax book income, excluding extraordinary and discontinued items.

Fig. 1 Taxvariables, 2007–2013

losses and by the loss carry-forward provision in the Spanish corporate tax system. The standard deviation of the marginal tax rates is 7.68 % (7.98 % for *MTREBIT*), implying that there is moderate variation in the marginal tax rates of all firms. Therefore

The percentage of tangible assets over total assets averages about 11 %. The average size of the companies included in the sample is approximately €802 million in terms of market value of assets. Besides, the average profitability of our sample amounts to 5.51 %, and the market to book ratio shows a 1.61 average value.

We have calculated the correlation matrix and, additionally, we have performed a multicollinearity test using the Variance Inflation Factor (*VIF*). Results are reported in Table 9 in the Appendix, and the low *VIF* values suggest that there is no collinearity among the variables considered.

In order to compare our marginal tax rates variables (i.e. *MTR* and *MTREBIT*) with other traditional tax measures, we have calculated *ETR* which is the ratio of taxes paid on profits to pre-tax income, excluding extraordinary and discontinued items, as well as *ETRb,* whose numerator is taxes accrued on profits and has the same denominator as the preceding ratio. Figure 1 shows the time evolution of the statutory tax rate, *MTR, MTREBIT, ETR* and *ETRb*.

During the period 2007–2013, statutory tax rates remained mostly stable. Conversely, from 2008 onwards, there is an increasing number of companies with losses (i.e. pre-tax book income and *EBIT* < 0). Simultaneously, the number of companies with *MTR* and *MTREBIT* below 10 % increases. Overall, there is a downward trend in both *MTR* and *MTREBIT*.

Figure 2 depicts the distribution of simulated marginal tax rates, calculated using earnings before interest and taxes as the base for taxable income (*MTREBITs*) for the sampled firms from 2007 to 2013, and an aggregation across all years in the sample. The data reveal substantial variation in the marginal tax rate across firms and over
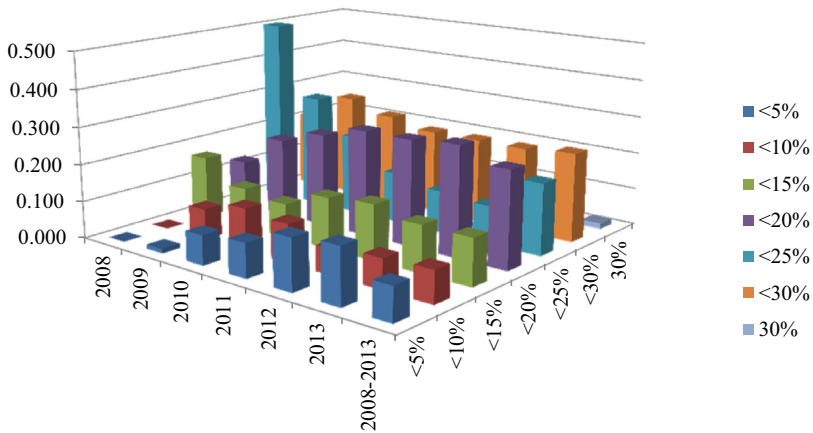
Notes: *MTREBIT* is the marginal tax rate estimated using earnings *before* interest and taxes as per Graham et al. (1998).

Fig. 2 Marginal tax rate (*mtrebit*) distribution

time.[20] In any given year, about 2 % of the firms have *MTREBITs* equal to the top statutory tax rate, roughly 10 % have *MTREBITs* below the 5 %, while the rest have *MTREBITs* ranging between 5 % and the highest rate (i.e. 30 %). The cross-sectional variation in tax rates occurs because of the carry-forward features of the tax code. The relatively large percentage of low tax rates is due to the fact that over 27 % of the observations in the sample represent firms with negative taxable income.

6 Empirical strategy and results

As Roberts and Whited (2013) state in their survey paper, the most important and pervasive issue confronting studies in empirical corporate finance is endogeneity. In the case of testing the impact of taxes on companies' financing decisions, the difficulty stems from the fact that any measure of marginal tax rates based on actual balance sheet data is not exogenous. This is due to the marginal tax rate's dependence on past financing decisions: the higher the leverage ratio, the lower the taxable income and the expected marginal tax rates because of the interest deductibility. This may result in a negative relationship between leverage ratios and estimated marginal tax rates even if high taxes encourage companies to use debt as a financing instrument. Consequently, the endogeneity of the tax status may produce a spurious correlation between the leverage ratio and the marginal tax rate, making it difficult, if not virtually impossible, to draw causal inferences.

As discussed in Sect. 2, we have formulated three empirical hypotheses for our research. The correct testing of these hypotheses requires the overcoming of the endogeneity issue, and as such we apply two different methodologies: regression based on

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[20] This figure and the one corresponding to the other marginal tax rate variable (i.e. *MTR*) turned out to be very much alike.

observables and difference in differences approach. Both of them will allow us to test Hypotheses 1 and 2, and the latter one will be used in order to test Hypothesis 3.

6.1 Regression approach

Conventionally, there have been two possible solutions to the endogeneity problem in the empirical literature (Graham et al. 1998). The first resembles a traditional way of implementing an endogenous regressor in econometrics, that is, using the lagged value of the simulated marginal tax rate as an explanatory variable. In turn, since the simulated marginal tax rate based on the pre-tax income (and after interest) already incorporates the firm's leverage choices, a second possible solution to the endogeneity problem uses income before interest to compute marginal tax rates. Therefore, this second strategy considers the contemporaneous value of the marginal tax rate as an explanatory variable but simulated on a before-financing basis, i.e. with earnings before interest. Our empirical research will use the latter solution to avoid the endogeneity of marginal tax rates. Notwithstanding, we will check as a robustness test the instrumental variable solution.

Our regression model specifies companies' capital structure as a function of tax and control variables, which were discussed in detail in Sect. 4. Specifically, we use a static model of leverage because we are not interested in an economic model of the dynamic adjustment towards an optimal level of leverage. As there is an incremental basis to our dependent variable, we use—as per Graham (1996a)—the changes in possible determinants as explanatory variables, except for the variables *MTREBIT*, *NDTS*RISK* and *RISK*. Therefore, our regression model equation is as follows:

$$
\begin{aligned}
\text{LEV}_{it} = {} & \beta_0 + \beta_1 \cdot \text{MTREBIT}_{it} + \beta_2 \cdot \text{NDTS}_{it} \\
& + \beta_3 \cdot \text{NDTS}_{it} {*} \text{RISK} + \beta_4 \cdot \text{RISK}_{it} \\
& + \beta_5 \cdot \Delta\text{TANG}_{it} + \beta_6 \cdot \Delta\text{SIZE}_{it} + \beta_7 \cdot \Delta\text{PROF}_{it} \\
& + \beta_8 \cdot \Delta\text{TOBIN'S Q}_{it} + \eta_i + \eta_t + \varepsilon_{it},
\end{aligned} \tag{5}
$$

where LEV_{it} is a measure of leverage of firm i in year t; *MTREBIT* represents the marginal tax rate estimated with earnings before interest and taxes; *NDTS* is the non-debt tax shield variable; *RISK* is the probability of bankruptcy variable; *TANG* is the tangibility variable; *SIZE* denotes the natural logarithm of total assets; *PROF* is the return on assets ratio; *TOBIN'S Q* is the market to book assets ratio; η_i represents time-invariant unobservable firm-specific effects (e.g., management performance, reputation, etc.)[21]; η_t represents time-specific effects which are common to all firms and may change over time (e.g., macroeconomic conditions); and ε_{it} is the disturbance term.

Table 2 shows the estimation results of our regression model for both leverage measures LEV_1 and LEV_2.[22]

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[21] Lemmon et al. (2008) show that corporate capital structures are characterized by an important firm specific effect.

[22] To verify the character—fixed or random—of the unobservable individual effects, we use Hausman test. This test rejects the null hypothesis regarding the absence of correlation between the unobservable effects and the explanatory variables, which leads to the selection of the fixed-effect estimator.

Table 2 Estimation results of the capital structure model from Eq. (5)

Fixed–effect regression coefficients estimated from Eq. (5) with robust standard errors in brackets. Table 7 in the Appendix provides definitions of all the variables. Superscript asterisks indicate statistical significance at 0.01(***), 0.05(**) and 0.10(*) levels

Explanatory variables	LEV_1	LEV_2
MTREBIT	2.188** (0.938)	1.078 (0.975)
NDTS	1.265 (1.601)	1.536 (1.724)
*NDTS*RISK*	−0.395*** (0.073)	−0.122 (0.091)
RISK	−0.001* (0.000)	−0.001* (0.000)
ΔTANG	0.244* (0.129)	0.239* (0.136)
ΔSIZE	0.281*** (0.077)	0.219*** (0.076)
ΔPROF	0.298* (0.1704)	0.296 (0.2475)
ΔTOBIN'SQ	−0.159*** (0.045)	−0.083*** (0.017)
Observations	434	434
R-Squared Within	0.200	0.121

In the case of the regression for LEV_1, with the exception of *NDTS* all parameter estimates have the expected signs and are statistically significant. To address the economic significance of the estimated coefficient of 2.188 on *MTREBIT* reported in Table 2, consider the impact on leverage policy resulting from a movement from average *MTREBIT* of 0.182 (see Table 1) to the maximum for the sample period (0.300). All else equal, a hypothetical firm with a marginal tax rate of 30.00 % would increase the use of net debt (i.e. the change in its debt ratio) by 25.86 % points, compared to an identical firm with a marginal tax rate of 18.20 %. If we get the standardized regression coefficients, *MTREBIT* appears to be the strongest predictor in the model and a one standard deviation increase in *MTREBIT* leads to a 0.720 standard deviation increase in predicted leverage change, with the other variables held constant.

When LEV_2 is used as dependent variable, the most important difference from the previous results is that *MTREBIT* is no longer statistically significant. Therefore, we partially confirm our Hypothesis 1 whereby debt policy and marginal tax rates are positively related. Moreover, the results in the case of dependent variable LEV_1 support our Hypothesis 2 regarding non-debt tax shields. Control variables show the typical and expected coefficient signs.

6.2 Difference in differences approach

An alternative approach to overcome the endogeneity problem of the tax status in capital structure research, is to look for exogenous changes in tax laws, and then analyse how companies react to those changes by adjusting their debt ratios. In particular, we study the impact of the 2012 reform of the Spanish corporate tax income. Accordingly, we use a difference in differences approach (DiD)[23] and divide our firms' sample into a treatment group and a control group. We design the treatment group by identifying

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[23] We refer to Roberts and Whited (2013) for an in depth review of econometric techniques aimed at addressing endogeneity problems, including techniques such as DiD that rely on a clear source of exogenous variation.

those companies that are likely to be affected by the new thin-capitalization rule. For that reason, the classification criteria relates to the following:

- A company is included in the treatment group if, in 2012, its net financial expenses exceed 30 % of EBITDA, considering net interest expense surpasses 1 million euros, it is considered as a fiscal group, and its tax residence is located in any Spanish Autonomous Region except the Basque Country or Navarra.[24]
- A company is assigned to the control group if it does not meet any of the previous criteria. For instance, a company whose tax residence is located in the Basque Country or Navarre will belong to this group albeit its financial expenses level.

According to the previous treatment and control groups definitions, 25 companies (175 observations) were classified as treated and the other 63 companies (441 observations) were included in the control group. Therefore, approximately 28 % of the companies in our sample were potentially affected by the new thin-capitalization rule. The main characteristics of the companies of both treatment and control groups are reported in Table 10 in the Appendix. As expected, the treatment group shows a 13 % points larger average debt level than the control group. It is likely that the treatment group has a higher absolute value of leverage than the control group. Treatment group companies must have correspondingly high interest expenses to ensure that the tax deductibility restriction applies, while companies in the control group will not incur in such high interest allowances. Additionally, treated companies have a lower average tangibility, a lower average profitability and a lower market-to-book ratio compared with control group firms.

Under the DiD approach, also known as "interaction among dummy variables", we construct two dummy variables: the first one is called *TREATED* which is equal to 1 if the company belongs to the treatment group and zero otherwise, and controls for permanent differences between the treatment and control groups; the second one is called *TAX_REFORM* which is equal to 1 for fiscal years 2012 and 2013 (i.e. after the implementation of the corporate tax reform) and 0 for all the preceding fiscal years, and it controls for trends common to both treatment and control groups. The resulting DiD model with the inclusion of the two new dummy variables is:

$$
\begin{aligned}
\text{LEV}_{it} = {} & \beta_0 + \beta_1 \cdot TREATED_{it} + \beta_2 \cdot TAX\_REFORM_{it} \\
& + \beta_3 \cdot TREATED_{it} \cdot TAX\_REFORM_{it} \sum_{j=1}^{m} \beta_j \\
& \cdot \text{TAX VARIABLES}_{jit} + \sum_{k=1}^{n} \beta_k \\
& \cdot \text{CONTROL VARIABLES}_{kit} + \eta_i + \varepsilon_{it}
\end{aligned} \tag{6}
$$

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[24] The special tax regimes in these Autonomous Regions do not apply the same thin-capitalization rule than in the rest of the Spanish Autonomous Regions.

Where the dependent variable, and tax and control variables have been identified before in Eq. (5); η_i is the fixed effect for company i; and ε_{it} is the residual term. We have added company-fixed effects in order to capture all time-constant effects that might be responsible for a company to be a high- or low-leveraged firm in general; therefore, the *TREATED* dummy variable is not identified in the estimation of Eq. (6) The interaction term *TREATED*TAX_REFORM* equals 1 when company i belongs to the treatment group and year t is 2012 or 2013; conversely, it is equal to zero otherwise. The observable variables in Eq. (6) will have two potential outcomes corresponding to the outcomes under the treatment and the control groups. The treatment effect is the difference between the two potential outcomes. In particular, the β_3 coefficient gives the DiD estimate of the treatment effect, namely the change in the debt ratio of the treatment group and that of the control group before and after the tax reform came into effect. We expect this coefficient to be negative, which indicates that the debt ratio of the treated companies declines compared to their counterparts in the control group after the reform.

While it is likely to see a sharp change in behavior among the treatment group following the exogenous shock that is the limitation to the tax deductibility of financial expenses, it is not expected to see such a change in the control group that is not affected by that shock. As Roberts and Whited (2013) point out, the key assumption for consistency of the DiD estimator is what is called the zero correlation assumption. In economic terms, this condition implies that, in the absence of the treatment, the evolution in the variable of interest (in our case, leverage) would have been identical for both the treatment and control groups. This assumption is often referred to as the parallel trends assumption because it requires any trends in the dependent variable for the two groups of companies prior to the treatment to be the same (Angrist and Pischke 2009). While level differences of outcomes between the treatment and control groups as well as common trends of outcomes for both treated and control companies are easily handled by the DiD estimator, differential trends among the two groups will generally lead to inconclusive or erroneous inferences.

The same as with all endogeneity problems, we cannot formally test the parallel trends assumption. Even though similar pre-treatment trends are reassuring, for example performing a mean-difference t test, they are not a sufficient condition to ensure that the endogeneity problem has been amended. Notwithstanding, and as we have more than 1-year pre-reform data, we can compare the trends in the outcome variable during the time frame prior to 2012 for both treatment group companies and their non-treated counterparts. Figure 3 illustrates the time evolution of the debt level scaled by total assets of both treatment (i.e. companies affected by the tax reform) and control (i.e. companies not affected by the tax reform) groups.

The mean debt level of the treatment group companies increases slightly throughout the whole period. Overall, an increase of approximately 2.89 % from 29.78 % in 2008 to 32.67 % in 2013 can be observed. Conversely, not affected or control group companies increase their mean debt level by a 2.84 % from 19.20 % in 2008 to 22.04 % in 2013. On a closer examination, the mean leverage reaches a maximum of 47.11 % (23.82 %) for treated (non-treated) companies in 2012. In terms of
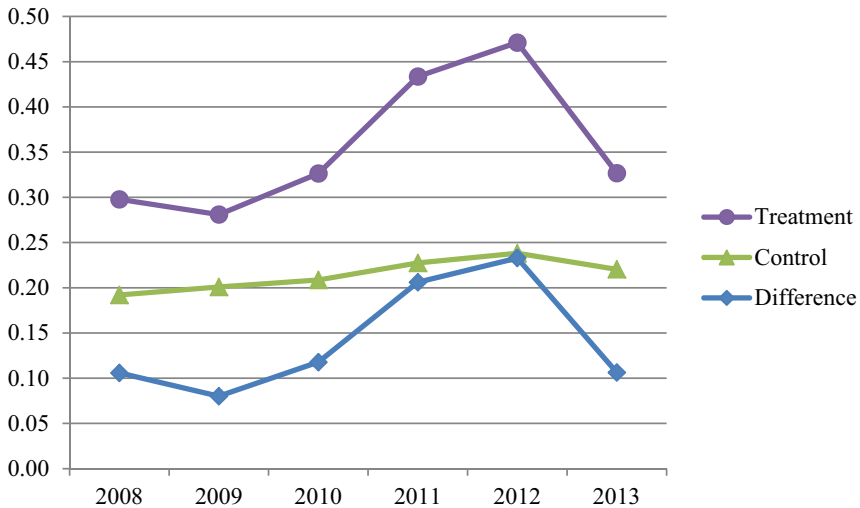
Notes: the treatment group is defined as companies affected by the tax reform, while the control group includes companies not affected by the reform. Difference is the treatment outcome minus the control outcome.

Fig. 3 Debt level time evolution of treated vs. control companies

the direction of the post-reform response, it is expected that companies in the treatment group reduce their leverage position more strongly than those counterparts in the control group. As Fig. 3 illustrates, there is a significant decrease in the mean debt level of 14.44 % for the treatment group from 2012 to 2013, while this reduction was only of 1.78 % for the control group. From a simple descriptive perspective, Fig. 3 shows that on average companies affected by the 2012 corporate tax reform reduce their debt ratio after the reform to a much larger extent than their not affected counterparts. Next, we formally test whether this difference is statistically significant.

Table 3 depicts the estimation results of our difference in difference regression model coming from Eq. 6. As An (2012), Kahle and Stulz (2013), and Dreßler and Scheuering (2015), we employ a fixed effects DiD approach as fixed effects regression controls for companies' unobserved and time-invariant characteristics that may influence the outcome variable.[25]

Columns (1) and (2) in Table 3 show the estimates from the DiD regression model without and with covariates, respectively. The interaction term, *TREATED*TAX_ REFORM*, captures to what extent companies in the treatment group adjust their leverage when they are affected by the 2012 tax reform. The coefficient of this interaction

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[25] Hausman test rejects the null hypothesis regarding the absence of correlation between the unobservable effects and the explanatory variables, which leads to the selection of the fixed-effect estimator.

Table 3 Regression estimation results under the DiD approach

Explanatory variables	(1)	(2)	(3)	(4)
TAX_REFORM	−0.008 (0.021)	0.038 (0.028)	−0.047* (0.028)	−0.008 (0.036)
*TREATED*TAX_ REFORM*	−0.178** (0.069)	−0.124** (0.054)	0.055 (0.062)	0.072 (0.069)
MTREBIT		2.216** (1.043)		1.661 (1.076)
NDTS		1.881 (1.601)		0.703 (2.640)
*NDTS*RISK*		−0.398*** (0.113)		0.225** (0.0922)
RISK		−0.001** (0.000)		−0.000** (0.000)
ΔTANG		0.231* (0.125)		0.138 (0.148)
ΔSIZE		0.268*** (0.076)		0.225*** (0.069)
ΔPROF		0.273* (0.178)		−0.098 (0.150)
ΔTOBIN'SQ		−0.153*** (0.045)		−0.076*** (0.025)
Observations	528	434	352	258
R-Squared Within	0.043	0.214	0.011	0.129

Columns (1) and (2) include fixed-effect regression coefficients estimated from Eq. (6) without and with covariates, respectively. Regressions in columns (3) and (4) restrict the sample to years 2007–2011 and use a fake tax policy in 2011 as a placebo. The dependent variable is debt level scaled by total assets in all regressions. *TAX_REFORM* is a dummy variable that takes the value of 1 for data after the tax reform, and *TREATED* is a dummy variable that takes the value of 1 if the company is affected by the 2012 corporate tax reform. Table 7 in the Appendix provides definitions of the rest of the variables. Superscript asterisks indicate statistical significance at 0.01(***), 0.05(**) and 0.10(*) levels. Robust standard errors are in brackets

term has turned out to be negative and statistically significant at the 5 % level in both regressions. This negative sign implies that those companies affected by the new thin-capitalization rule reduce their indebtedness stronger than those counterparts not affected. Specifically, and without including covariates, the change of the pre- to post-reform debt ratio is 18 percentage points lower for the treatment group compared to the control group. After controlling for other factors, the second column of Table 3 depicts that the average debt ratio in the treatment group declines more by 12 percentage points relative to the control group. Therefore, our Hypothesis 3 is confirmed which can be interpreted as there does seem to exist a tax reform effect.

As far as the rest of estimates is concerned, the signs and significance of the coefficients remain qualitative and quantitatively alike to those encountered in Table 2. Consequently, Hypotheses 1 and 2 are again confirmed.

Furthermore, we carry out a falsification test in order to validate whether there was a parallel trend of the dependent variable between treatment and control groups in the pre-reform period (i.e. before fiscal year 2012). In this way, we examine whether potential treated and untreated companies had a different development of their debt ratio in a placebo reform. Specifically, we restrict our sample time horizon to years 2007–2011, and establish as a placebo a fake tax policy in 2011. Columns (3) and (4) in Table 3 report the results of this test without and with covariates, respectively. As expected, the DiD estimate of the treatment effect is neither statistically and nor economically significant; in other words, the difference in leverage ratios between treatment and

Table 4 Estimation results of the capital structure model from Eq. (5) with lagged marginal tax rate (*mtr*)

Explanatory variables	LEV_1	LEV_2
LAGGED_MTR	1.275* (0.748)	0.299 (0.681)
NDTS	1.654 (2.015)	2.742 (2.121)
*NDTS*RISK*	−0.395*** (0.099)	−0.125 (0.089)
RISK	−0.001* (0.000)	−0.001* (0.000)
ΔTANG	0.319** (0.156)	0.351** (0.143)
ΔSIZE	0.259*** (0.080)	0.174** (0.077)
ΔPROF	0.423** (0.172)	0.430 (0.273)
ΔTOBIN′SQ	−0.155*** (0.047)	−0.076*** (0.016)
Observations	370	370
R-Squared Within	0.203	0.129

Fixed–effect regression coefficients estimated from Eq. (5) with robust standard errors in brackets. Table 7 in the Appendix provides definitions of the variables. Superscript asterisks indicate statistical significance at 0.01(***), 0.05(**) and 0.10(*) levels

control groups is insignificant for every year considered prior to the 2012 tax reform. This implies that the analysed companies do not differ in the financial behaviour and all the companies react in the same way. This finding constitutes evidence that there is a parallel trend between the two groups in the years before the tax reform.

7 Robustness of results

In order to assess the robustness of our previous empirical evidence, we perform three different tests.

Firstly, in the regression approach that we have applied in the preceding Section, a pre-interest income measure of the marginal tax rate was used in order to confront the endogeneity problem. This solution evades the effect of financing decisions, and thus alleviates the non-exogeneity tax status of companies. Nevertheless, there still could exist biases in this measure due to potential earnings manipulation from managers in order to influence the marginal tax rate and hence, the company's debt policy. Consequently, as a robustness check we have instrumented the leverage dependent variable with its lag. Table 4 presents the results of this new estimation and corroborate our previous findings.

Secondly, the relationship between marginal tax rates and debt policy could be influenced by the leverage status of the companies. Specifically, the positive effect of taxation on leverage should be stronger for less levered firms, which presumably have more incentive to increase their debt. In order to test this issue we calculate a dummy variable (*DUMMY_LEV*) that equals 1 if the debt ratio is below the median and 0 otherwise. Furthermore, we introduce in the regression *MTREBIT*DUMMY_LEV* which is an interaction term resulting from the multiplication of the dummy variable *DUMMY_LEV* and the *MTREBIT* variable. Table 5 contains the estimation results and shows that the coefficient associated with the interaction term is only statistically significant for the dependent variable LEV_1. Its positive sign indicates a more intense positive effect of taxes on debt for firms with a less levered status. In the sample of more levered firms, the effect of *MTREBIT* on debt policy is equal to 2.4, while among less levered firms the impact is 1.1 higher, although this difference is only marginally significant.

Table 5 Estimation results of the capital structure model from Eq. (5) controlling for leverage

Explanatory Variables	LEV_1	LEV_2
MTREBIT	2.383*** (0.787)	1.454 (0.964)
NDTS	1.785 (1.226)	2.103 (1.493)
*NDTS*RISK*	−0.402*** (0.067)	−0.138* (0.083)
RISK	−0.001* (0.000)	−0.001** (0.000)
ΔTANG	0.167 (0.144)	0.162 (0.147)
ΔSIZE	0.281*** (0.071)	0.221*** (0.075)
ΔPROF	0.267* (0.140)	0.270 (0.217)
ΔTOBIN′SQ	−0.133*** (0.032)	−0.066*** (0.018)
DUMMY_LEV	−0.480*** (0.162)	−0.230*** (0.081)
*MTREBIT*DUMMY_LEV*	1.103* (0.627)	0.096 (0.434)
Observations	434	434
R-Squared Within	0.307	0.187

Fixed-effect regression coefficients estimated from Eq. (5) with robust standard errors in brackets. Table 7 in the Appendix provides definitions of the variables. Superscript asterisks indicate statistical significance at 0.01(***), 0.05(**) and 0.10(*) levels

Table 6 Estimation results of the capital structure model from Eq. (5) controlling for statutory tax rate

Explanatory variables	LEV_1	LEV_2
TAX DIFFERENCE	−1.192 (0.834)	−0.096 (0.735)
NDTS	1.581 (2.037)	2.768 (2.114)
*NDTS*RISK*	−0.387** (0.096)	−0.120 (0.089)
RISK	−0.000* (0.000)	−0.001* (0.000)
ΔTANG	0.319** (0.156)	0.344** (0.141)
ΔSIZE	0.257*** (0.079)	0.175*** (0.077)
ΔPROF	0.428** (0.172)	0.434 (0.272)
ΔTOBIN′SQ	−0.158*** (0.046)	−0.078*** (0.164)
Observations	370	370
R-Squared Within	0.200	0.129

Fixed-effect regression coefficients estimated from Eq. (5) with robust standard errors in brackets. Table 7 in the Appendix provides definitions of the variables. Superscript asterisks indicate statistical significance at 0.01(***), 0.05(**) and 0.10(*) levels

Thirdly, if managers make decisions based on their firm's current statutory tax status, higher debt figures would be observed for companies with greater differences between their statutory tax rate and marginal tax rate. Therefore, we construct a *TAX DIFFERENCE* variable as per Graham (1996a) and Sinha and Bansal (2013), which is the result of the statutory tax rate minus the marginal tax rate. According to this rationale, we expect this tax difference variable to be positively related to debt usage if companies make tax-based leverage decisions based on their statutory tax rates. Conversely, the coefficient on this variable will be zero or non-significant if firms make tax-based leverage decisions based exclusively on simulated marginal tax rates. We have used the lagged values of this variable, and we have controlled for the marginal tax rate in the regression though it is dropped due to collinearity. Table 6 reports the estimation results and shows companies make debt decisions based on their marginal tax rate and not the statutory tax rate.

8 Concluding remarks

This paper provides empirical evidence on the statistical and economic impact of taxes on debt policy, using a data panel of Spanish listed companies covering the period 2007–2013. It is the first empirical analysis of the relationship between firm-specific marginal tax rates and leverage measures of individual firms in Spain. Moreover, we investigate for the first time whether the introduction of interest deductibility restrictions put forth by the Spain's 2012 corporate tax reform has an impact on the capital structure of listed companies.

We follow the Graham (1996a) and Shevlin (1990) methodology for computing company-specific marginal tax rates, relying on the non-linearity of corporate tax schedules resulting from company losses and the ensuing tax provisions (carry-forward rules). This procedure accounts for the fact that firms may report losses, and in that case, the debt tax shield cannot be used immediately but will offset future positive taxable income. Furthermore, we control for the endogeneity problem stemming from the reverse causality between debt and taxes. We circumvent this problem by basing our marginal tax rate measure on income before the relevant financing decisions. Our results suggest that there is a positive relationship between the firm-specific marginal tax rates and the leverage ratio increase of Spanish firms. As expected, we have also found that less levered firms tend to use debt tax shields more intensively as they are more likely to increase debt.

In addition, we have also tested the non-debt tax shields hypothesis. Our findings indicate that firms with greater amounts of non-debt tax shields have lower levels of debt, substituting debt tax shields for other tax allowances such as depreciation expenses.

We have examined the impact of taxes on the financing decisions of firms using the Spanish corporate tax reform of 2012 as a "quasi-experiment". Accordingly, we identify companies that would in theory have been affected by the new thin-capitalization rule, and compare their financing behaviour to a group of companies that were not affected. Thin capitalization rules prevent firms from deducting excessive interest expenses from their tax base. Therefore, it is expected that companies that are affected by interest deductibility limitations reduce their debt ratio. Our empirical results, with a difference in differences approach, point towards differences between the debt policy of potential affected firms and their non-affected counterparts, with a negative and statistically significant treatment effect.

Our study may be subject to several potential caveats. Firstly, access to tax related data is a complex issue in most developed countries. In Spain, the taxable income of corporations and therefore deferred tax assets and liabilities has been explicitly included in financial statements from fiscal year 2007 onwards which makes the time horizon of our study relatively short. As more historical tax data become available, we expect improved results and availability of more accurate values for marginal tax rates. Moreover, the effect of taxes on companies' debt policy might be conditioned by time issues as previous research indicate that financing choices are mostly long-term decisions and companies adapt their structure only very slowly (Fama and French 2012).

Secondly, in our study we have focused on corporate income taxes generated by parent companies located in Spain. We are aware that these companies typically con-

stitute a group of companies (i.e. parent or principal and subsidiaries) with operations in different tax settings. Consequently, the impact of taxes on their debt policies might be lower than the actual obtained in the present study because these companies can shift profits into low-tax jurisdictions. One of the main implications of this is that the marginal tax rate should be estimated on a group of companies basis instead of an individual one. What is more, it would be necessary to consider the specific corporate tax schemes in each of the countries where the corporate group operates. The inclusion of international corporate taxation goes beyond the scope of our study, and this subject should be subject to future research.

Thirdly, the marginal tax rates may either overstate or understate the fiscal benefit of debt financing according to whether, at the personal level, interest income is taxed at a higher or lower rate than returns from common stocks. Therefore, an interesting future line of research would be to analyse whether not only corporate taxes but also personal taxes affect corporate financing decisions in Spain. Fourthly, another issue worth noting is the fact that the findings may be strongly influenced by the use of listed as opposed to unlisted firms, since listed firms can raise capital more easily thanks to the less severe agency problems and asymmetric information (López-Gracia and Sogorb-Mira 2014). As a result, it would also be interesting to evaluate the relation between firm leverage and taxation using a dataset of unlisted companies.

Finally, it is very important to understand whether managers consider tax related features of a particular source of finance or not. All other factors affecting capital structure are internal to a company, but taxes may be exogenously determined and used to control a company's actions to some extent. In terms of tax policy, our findings prove that asymmetric treatment of equity and debt in the Spanish corporate tax system affects the debt policies of Spanish listed companies. While considering the new thin-capitalization rule stablished by Spanish government in 2012, there appears to be a clear effect on the debt policy of Spanish listed companies due to the new limitation of financing expenses deductibility. Therefore, policy makers might be encouraged to revise and re-evaluate corporate tax reform in order to consider the inequality in tax treatment of debt and equity financing in Spain.

9 Appendix

Table 7 Definition of variables

Variables	Definition
LEV_1	First difference in long-term book debt divided by the sum of long-term book debt and market value of equity
LEV_2	The same as LEV_1 but using the lagged value of the denominator
MTR	Marginal tax rate estimated as per Shevlin (1990) and Graham (1996a) approach
MTREBIT	Marginal tax rate estimated with earnings before interest and taxes as per Graham et al. (1998) approach
NDTS	First difference in book depreciation divided by the sum of lagged book total debt plus lagged market equity value
RISK	1 / [(3.3*EBIT/Total Assets) + (1.0*Sales/Total Assets) + (1.4*Retained Earnings/Total Assets) + (1.2*Working Capital/Total Assets)]
TANG	Percentage of tangible assets over total assets
SIZE	Natural logarithm of total assets
PROF	Ratio of earnings before interest, taxes, depreciation and amortization to total assets
TOBIN'S Q	Market to book ratio of total assets

Table 8 Description and relevance of our firm's sample vs large corporate taxpayers (LCTP)

Item	2007	2008	2009	2010	2011	2012	2013
No. of firms							
Sample	88	88	88	88	88	88	88
LCTP	1235	1167	1012	1019	1036	1027	994
Total assets							
Sample (%)	17.5	18.6	20.8	21.5	21.4	21.5	21.3
LCTP (€)	1,546,448,678,140	1,608,358,176,263	1,541,479,551,651	1,565,923,557,759	1,592,298,080,322	1,559,391,980,480	1,548,200,225,350
Turnover							
Sample (%)	4.5	7.2	7.5	7.2	7.0	7.7	7.7
LCTP (€)	759,521,288,292	725,754,031,745	627,818,023,932	682,716,429,389	696,746,127,101	706,676,592,120	721,892,432,788
EBIT							
Sample (%)	n/a	46.0	50.1	34.8	47.2	61.1	29.8
LCTP (€)	n/a	34,582,592,229	40,112,302,894	45,682,304,877	42,811,119,239	23,090,271,935	43,605,838,379
Total debt							
Sample (%)	15.4	18.8	22.1	22.7	22.5	22.6	23.4
LCTP (€)	938,392,556,548	836,077,681,397	772,496,868,114	778,144,024,252	792,741,546,669	773,158,280,828	701,409,019,765
Financial expense							
Sample (%)	12.3	17.5	20.0	22.2	22.9	23.7	27.3
LCTP (€)	−56,891,769,992	−44,069,868,852	−31,037,807,355	−28,013,136,304	−30,103,560,892	−31,124,638,855	−28,435,598,825
EBT							
Sample (%)	n/a	31.8	26.3	18.7	31.5	14.8	14.2
LCTP (€)	n/a	54,027,897,630	68,144,530,196	71,655,853,214	53,318,506,735	23,422,966,570	46,205,741,840
Tax expense							
Sample (%)	13.5	51.4	16.2	15.7	11.1	89.8	48.0
LCTP (€)	−10,911,761,225	−2,147,427,517	−5,484,132,694	−5,472,108,067	−4,788,633,501	−451,531,669	−1,690,653,833

Table 8 continued

Item	2007	2008	2009	2010	2011	2012	2013
Net income							
Sample (%)	18.1	27.3	23.3	17.8	36.3	15 .6	13.6
LCTP (€)	97,566,998,396	71,602,525,210	81,801,174,784	80,656,118,976	44,697,149,429	−40,612,367,440	59,710,122,783

Data come from Agencia Estatal de la Administración Tributaria (AEAT), Estadística por partidas del impuesto sobre sociedades, Years 2007, 2008, 2009, 2010, 2011, 2012 and 2013, and own elaboration. We focus only on large corporate taxpayers whose total income surpasses 180 million euros

Table 9 Correlation matrix and variance inflation factors

	LEV_1	LEV_2	MTR	MTREBIT	NDTS	RISK	TANG	SIZE	PROF	TOBIN'S Q
LEV_1	1.000									
LEV_2	0.769	1.000								
	(0.000)									
MTR	0.078	0.026	1.000							
	(0.095)	(0.584)								
MTREBIT	0.051	0.000	0.747	1.000						
	(0.275)	(0.996)	(0.000)							
NDTS	0.107	0.130	0.036	0.004	1.000					
	(0.014)	(0.003)	(0.445)	(0.925)						
RISK	−0.004	−0.057	0.036	0.042	−0.025	1.000				
	(0.920)	(0.191)	(0.438)	(0.367)	(0.566)					
TANG	0.074	0.016	−0.029	−0.093	0.181	−0.042	1.000			
	(0.092)	(0.722)	(0.531)	(0.046)	(0.000)	(0.302)				
SIZE	0.030	−0.020	−0.015	0.105	−0.023	−0.007	−0.264	1.000		
	(0.494)	(0.651)	(0.746)	(0.024)	(0.596)	(0.880)	(0.000)			
PROF	0.146	0.020	0.053	−0.013	0.043	−0.030	0.149	0.221	1.000	
	(0.000)	(0.652)	(0.253)	(0.785)	(0.324)	(0.460)	(0.000)	(0.000)		
TOBIN'S Q	−0.041	−0.089	0.102	0.053	−0.080	−0.029	−0.154	0.292	0.478	1.000
	(0.344)	(0.040)	(0.029)	(0.259)	(0.067)	(0.510)	(0.000)	(0.000)	(0.000)	
VIF			2.38	2.39	1.04	1.00	1.15	1.21	1.33	1.36

Significance levels in brackets. Table 7 provides definitions of all the variables

Table 10 Characteristics of treatment group versus control group

Variable	Treatment group	Control group	Mean difference t test
Debt to assets market value	0.328	0.200	0.128 * **
MTREBIT	0.185	0.181	0.004
NDTS	−0.007	0.007	−0.014
NDTS*RISK	−1.429	−0.078	−1.351 **
RISK	7.556	3.062	4.494
TANG	0.064	0.126	−0.062 * **
SIZE	20.374	20.553	−0.179
PROF	0.019	0.069	−0.050 * **
TOBIN'S Q	1.298	1.734	−0.436 * **

This table compares the means of key variables between companies assigned to the treatment group and companies included in the control group. The total sample of 88 companies (616 observations) is distributed between 25 companies (175 observations) of the treatment group and 63 companies (441 observations) of the control group. *NDTS* and *NDTS*RISK* have been rescaled by a factor of 100. Table 7 provides definitions of the variables. The last column on the right hand side show the result of a t test if the mean values between the treatment group and the control group are statistically equal. Superscript asterisks indicate statistical significance at 0.01(***), 0.05(**) and 0.10(*) levels

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