HOW MUCH DO THE TAX BENEFITS OF DEBT ADD TO FIRM VALUE?:
EVIDENCE FROM SPANISH LISTED FIRMS

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Abstract

It is generally recognized that taxation has potentially important impact on corporate financing decisions. Nevertheless, the empirical evidence is far from conclusive. In this study, we assess the debt tax benefits of Spanish listed firms throughout the period 2007-2013. Specifically, we found the capitalized value of gross interest deductions mounts to approximately 6.4% of market value, while the debt net (of personal taxes) benefit estimated is 2.1%, in contrast to the traditional 11.4% (marginal tax rate times debt). As a different approach, we also use panel data linear and nonlinear regressions to estimate the value of the debt tax benefit. Our evidences support the view that taxes are important for corporate decision-making and that debt contributes to firm value.

¿CUÁNTO APORTAN / CONTRIBUYEN LOS BENEFICIOS FISCALES DE LA DEUDA AL VALOR EMPRESARIAL? EVIDENCIA DE EMPRESAS COTIZADAS ESPAÑOLAS

Resumen

Existe un vasto reconocimiento acerca de que los impuestos tienen un impacto potencial importante en las decisiones financieras empresariales. Sin embargo, la evidencia empírica está lejos de ser concluyente. En este estudio, valoramos los beneficios fiscales de la deuda para empresas cotizadas españolas durante el período 2007-2013. Concretamente, encontramos que el valor actualizado de la deducción bruta de los intereses de la deuda supone aproximadamente el 6.4% del valor de mercado de la empresa, mientras que el beneficio de la deuda neto (de impuestos personales) estimado es del 2.1%, en comparación con el valor más tradicional del 11.4% (resultado de multiplicar el tipo impositivo marginal por el nivel de deuda). Como enfoque diferente, también usamos regresiones lineales y no lineales de datos panel para estimar el valor de los beneficios fiscales de la deuda. Nuestra evidencia apoya la idea de que los impuestos son importantes para la adopción de decisiones en las empresas y que la deuda contribuye al valor empresarial.
1. Introduction

The tax benefits of debt are the tax savings that result from deducting interest from taxable earnings. By deducting one euro of interest, a firm reduces its tax liability by the marginal corporate tax rate. Since Modigliani and Miller (1963) hypothesized that the tax benefits of debt increase firm’s value, the implications of debt tax shield on firm valuation and capital structure has attracted attention as well as debate among the financial community. Nevertheless, how much is that increase in firm value?

Different approaches have generated controversial on the implicit benefits of debt. For instance, Miller (1977) pointed out that personal taxes might compensate the tax benefit of debt. Besides, Fama and French (1998) maintained that it remains unclear as to whether debt tax shields improve firm’s value, and found a significant negative relationship between debt and firm’s value, contrary to expectations. They attributed the findings of positive relationships in previous research, to potential failure to control for profitability. In an effort to avoid this problem, Kemsley and Nissim (2002) ran reverse regressions of profitability on firm’s value and debt, and found significant tax benefits of debt. Furthermore, Graham (2000) used firm-level financial statement data and proved that firms derive substantial tax benefits from debt. More recently, Blouin, Core and Guay (2010), have stated that the tax benefits of debt might be smaller than previously suggested, due to a biased estimation of marginal tax rates.

Nowadays, the assessment of debt tax shield has raised in importance, due to circumstances such as the large increase in the corporate borrowing, the generalized trend in changes in tax codes throughout the world, and finally the growing importance of valuation in corporate transactions such as M&As, Venture Capital, etc. (Cooper and Nyborg, 2007). Notwithstanding its implications, there is still not unanimous consensus about which the relevance of debt tax shield concerns. As Graham (2008) states, the evidence consistent with tax benefits adding to firm value is ambiguous because non-tax explanations or econometric issues might cloud interpretation. In this sense, additional cross-sectional and/or panel data regression research, that investigates the market value of the tax benefits of debt, would be helpful in terms of clarifying or confirming the interpretation of existing cross-sectional regression analysis.

Accordingly, the main purpose of this study is to estimate the value of the debt tax shield of Spanish listed companies for the period 2007-2013. Specifically, we calculate
corporate marginal tax rates to simulate the interest deduction benefit functions for individual firms, and use them to estimate the tax-reducing value of each incremental euro of interest expense as in Graham (2000). Besides, we also estimate reverse regressions in which we regress future profitability on debt following Kemsley and Nissim (2002) approach. This estimation procedure allows coping with the potential correlation between debt and the value of operations along nontax dimensions such as growth, financial distress and size.

Our findings clearly show that there is a clear fiscal advantage of using debt financing. In our sample, we find the tax benefit of debt equals 6.4 per cent of firm value, meaning that the median firm at its leverage ratio is worth in this percentage more than the same firm with no debt in its capital structure. After accounting for reductions for personal taxes, we find that the tax benefit of debt under the marginal benefit curve is 2.1 per cent of firm value. Under a regression approach, the net debt tax shield mounts up to 11.2 per cent of firm value.

Debt tax shield valuation attempts to capture the value of the tax savings from interest. There has been relatively limited empirical research into the value of debt tax shield, despite its clear significance, and most empirical studies on the value of debt tax shield have focused on firms in the U.S.A. The three main approaches to assess the impact of this tax shield are based on panel / cross-section regression, event studies and simulation. A summary of key references in this issue is shown in table 1.

### TABLE 1: Empirical evidence on the value of debt tax shield

<table>
<thead>
<tr>
<th>Authors</th>
<th>Gross Benefit</th>
<th>Net Benefit</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masulis (1983) (a)</td>
<td>40% of debt value</td>
<td></td>
<td>U.S.A.</td>
</tr>
<tr>
<td>Kaplan (1989) (b)</td>
<td></td>
<td>5.4% – 53.1% of equity value</td>
<td>U.S.A.</td>
</tr>
<tr>
<td>Engel, Erikson and Maydew (1999) (c)</td>
<td>28% of issue size</td>
<td></td>
<td>U.S.A.</td>
</tr>
<tr>
<td>Graham (2000)</td>
<td>9.7% of firm value</td>
<td>4.3% of firm value</td>
<td>U.S.A.</td>
</tr>
<tr>
<td>Kemsley and Nissim</td>
<td></td>
<td>10% (40%) of firm</td>
<td></td>
</tr>
</tbody>
</table>
The literature of the debt tax shield has produced a wide range of estimates, some of which are subject to non-tax explanations or identification challenges. For example, Graham (2000) found that the gross tax benefit of debt is worth 9.7% for firm value, whereas Korteweg (2010) and Van Binsbergen, Graham and Yang (2010) obtained 5.5% and 3.5%, respectively. On the other hand, Kemsley and Nissim (2002) estimated a net benefit to debt of 10% (40%) of firm (debt) value; though consistent with Masulis (1983), such large coefficients imply near-zero average debt costs and a near-zero effect of personal taxes (Graham, 2008 and 2013). In countries other than the U.S., Ko and Yon (2011) conducted an analysis using a data panel on Korean firms and found a gross debt benefit of 5.2% of firm value. In addition, Doidge and Dyck (2015) obtained a 4.6% of firm value for Canadian firms. To the best of our knowledge, no empirical study has been carried out on this matter so far, specifically in Spain or generally in Europe.

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1 A comprehensive survey of related literature can be found in Graham (2003), Graham (2008), Graham (2013) and Hanlon and Heitzman (2010).
Our study contributes to the literature in several respects. First, we find new results on the estimation of the value of tax shields comparing two approaches, namely simulation and regression approaches. Furthermore, we provide empirical evidence within a European context for the first time, and specifically for Spanish firms. Second, we use panel data econometrics for our regression approach combining linear and non-linear estimations, and thus exploiting the most of our data. Third, the findings of the present study demonstrate that though the fiscal benefits of debt are relevant, they are also sensitive to the valuation approach chosen.

The remainder of the paper is organized as follows. In the next section, we discuss the simulation approach based on Graham (2000) simulation procedure, while Section 3 deals with the regression approach which grounds upon Kemsley and Nissim (2002) proposals. Section 4 presents the data for the study and the descriptive analysis regarding the key variables. The empirical results are discussed in Section 5. Several robustness tests are presented in Section 6 and the final section provides some concluding remarks.

2. Simulation approach

2.1. The value of the debt tax benefit

The value of the debt tax shield is the present value of the tax savings from interest expense (Cooper and Nyborg, 2006). In a Modigliani and Miller (1963) context, that is with perpetual debt and if interest tax shields are completely utilized, the capitalized tax benefit of debt can be simplified to the marginal corporate tax rate times the amount of debt. That is,

\[
\frac{t_c \cdot r_d \cdot D}{r_d} [1]
\]

Where \( t_c \) is the marginal corporate tax rate, \( r_d \) is the interest rate on debt and \( D \) is the amount of debt.

An important question with this approach is that it does not consider personal income taxes, as pointed out by Miller (1977). With personal taxes, the capitalized tax benefit of debt can be computed as follows,
Where $t_p$ and $t_e$ are both marginal personal tax rates that are applied to interest`s and equity`s incomes, respectively. Note that if both $t_p$ and $t_e$ are zero (or they are equal), then Equation [2] is simplified to the Modigliani and Miller (1963) set up (i.e. Equation [1]).

Equity income includes both dividends and capital gains. The personal marginal tax rates on these income streams may differ, and capital gains tax could be deferred by investors not realizing the gains. Therefore, the marginal personal equity tax rate should be a mixture of dividends and capital gains tax rates. Following Gordon and Mackie-Mason (1990), the personal equity tax rate might be calculated as:

$$t_e = d \cdot t_p + (1-d) \cdot t_p \cdot \gamma$$  \[3\]

Where $d$ is the dividend pay-out ratio and $\gamma$ is an adjustment factor that takes into account the possible deferral of taxes on capital gains and the time value of money of the capitalized taxes$^2$.

Graham (2000, 2001) simulates interest deduction benefit functions and uses them to estimate the tax-reducing value of each incremental euro of interest expense. The estimation of the tax benefits of debt is carried out by integrating the area under the tax benefit function, which relates marginal tax rates to interest deductions. The process of making up the tax benefit function follows different stages. Firstly, $\text{MTR}_{it}^{0\%}$ is estimated for firm i in year $t$$. This is the marginal tax rate based on taxable income assuming the firm has zero debt and therefore no interest deductions. Secondly, new marginal tax rates are estimated with different percentages ($p\%$) of the actual interests paid: $\text{MTR}_{it}^{p\%}$, where $p\%$ ranges from 20% to 800%$. Thirdly, the firm`s tax benefit function is derived by connecting the previous estimated marginal tax rates with each level of interest.

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$^2$ This adjustment factor is established at 0.25 following Gordon and Mackie-Mason (1990), Graham (1999), Graham (2000), and Green and Hollifield (2003).

$^3$ As in Graham, Lemmon and Schallheim (1998), we estimate marginal tax rates with pre-financing earnings and assuming that EBIT follows a pseudo-random walk process with a drift (see Clemente-Almendros and Sogorb-Mira, 2015, for details).

$^4$ The exact numbers are 20%, 40%, 60%, 80%, 100%, 120%, 160%, 200%, 300%, 400%, 500%, 600%, 700% and 800%.
Marginal tax benefits of debt decline as more debt is added because the probability increases with each incremental euro of interest that it will not be fully valued in every state of the world. Figure 1 depicts an example of the tax benefit function throughout different years for a representative firm of our sample, namely, Meliá Hotel International, S.A. (MEL).

**Figure 1: Tax benefit function for Meliá Hotels International, S.A. (MEL)**

The integration of the area under the tax benefit curve up to the level of actual interest expense leads to the debt tax benefit. For each year and for each firm, we measure the area under the firm’s tax benefit function up to 100% of annual interest multiplied by actual interest payments to determine firm’s annual debt tax shield. Then, we estimate the capitalized tax benefits of debt under the assumption that the debt tax shield computed at the end of year t will be maintained over the following years. The interest rate on debt for each firm, computed as the quotient between interest expenses and debt, is used as the discount rate. Finally, we evaluate firm value as the sum of market value of equity and book value of financial debt.

2.2. The kink
Graham (2000) offers an empirical measure of the underutilization of debt by companies and calls this measure the kink. It is defined as the maximum amount of interest deductions a firm could charge, before any decline in the marginal tax benefit of debt relative to the actual interest charge the firm incurred given its current debt. In short, it is the point at which the tax benefit curve starts to slope downwards. We fix the magnitude of the decline in the tax benefit curve at 25 basis points\(^5\). The use of debt to minimize tax paying leads to classify firms` debt policy as aggressive or conservative. Accordingly, an aggressive firm with positive earnings before interest and taxes would issue just enough debt to ensure that earnings after interest but before taxes are zero, whereas a conservative firm would issue less debt and therefore face positive taxes. As a result, a firm`s debt financing policy could be considered as aggressive (conservative) when its kink is smaller (larger) than one\(^6\).

The kink could be computed as a ratio where the numerator is the maximum interest that could be deducted for tax purposes before expected marginal benefits begin to declines, and the denominator is actual interest incurred (Caskey, Hughes and Liu, 2012):

\[
\text{Kink} = \frac{\text{Target Interest}}{\text{Actual Interest}} \quad [4]
\]

Where Target Interest is the point at which the firm`s tax benefit function starts to slope down as the firm uses more debt.

Figure 2 shows the tax benefit functions of two example firms, namely, Telefónica, S.A. (TEF) and Actividades de Construcción y Servicios, S.A. (ACS).

**Figure 2: The kink for Telefónica, S.A. (TEF) and Actividades de Construcción y Servicios, S.A. (ACS)**

\(^5\) Graham (2000), Blouin et al. (2010) and Van Binsbergen et al. (2010) define the kink as the first interest increment at which the firm has a decline in its marginal tax rate of at least 50 basis points. We decided to lessen this requirement in order to capture more variability in our data.

\(^6\) This characterization is based on the tax benefit of debt without considering its cost. Therefore, an aggressive-conservative debt policy in this context does not necessarily imply sub-optimality.
For example, in year 2013, although the tax benefit curve of TEF declines from 80% of the actual interest (i.e. kink of 0.8), that of ACS kinks at 160% (i.e. kink of 1.6). In this case, the kink of TEF denotes that the firm’s incremental interest generates marginal tax benefits smaller than what the firm has received from its current interest. On the other hand, for ACS, even when interest payments multiply by 1.6 times, the firm could still enjoy tax benefits at the marginal tax rate. ACS will remain at the flat part of its tax benefit curve even if it increases debt to 160% of the current level.

Underleveraged firms lose significant tax savings, that otherwise would have been available if they had increased their debt levels to their kink. Nevertheless, Graham (2000) maintains that firms with large kinks should remain on the flat part of their tax benefit functions, even when their income declines, in order to be called “conservative” in terms of their debt usage. Besides, if two “conservative” firms have the same kink but one has more volatile earnings than the other, then the former firm has a less conservative policy since the probability of being in the downward sloping part of the tax benefit function (aggressive debt policy) in the future is higher for this firm than for the firm with lower volatility. Accordingly, it is necessary to calculate a new measure of the kink to account for this fact. Following Graham (2000), this complementary kink measure called standardized kink, will reflect the length of the flat part of the tax benefit
function per unit of income volatility. Specifically, we compute this standardized measure of the kink as,

\[
\text{Standardized Kink} = \frac{\text{Interest Expense at the Kink}}{\text{Standard Deviation of EBIT}} \quad [5]
\]

2.3. Zero tax benefit of debt

We identify the level of interest expense at which the tax benefit of debt becomes zero, and called it ZeroBen.

Figure 3 displays the tax benefit functions of two example firms, namely, Fomento de Construcciones y Contratas, S.A. (FCC) and Fluidra, S.A. (FDR).

**Figure 3: ZeroBen for Fomento de Construcciones y Contratas, S.A. (FCC) and Fluidra, S.A. (FDR)**

For year 2013, ZeroBen are 700% and 400% for FCC and FDR, respectively. The economic interpretation of these figures is that FCC and FDR could use seven and four times, respectively, their actual interest before the marginal benefit reaches zero level.
3. Regression approach

3.1. Forward specification

Considering corporate taxes, Modigliani and Miller (1963) established the valuation of a leveraged firm as follows,

\[ V_L = V_U + t_c \cdot D \]  \[6\]

Where \( V_L \) is the market value of the leveraged firm, \( V_U \) is the market value of the unleveraged firm, \( t_c \) is the corporate marginal tax rate and \( D \) is the debt level. If we also take into account personal taxes, Equation [6] will still be valid; although corporate marginal tax rate shall we substituted by a mixture of corporate and personal tax rates as explained in Miller (1977). That is,

\[ V_L = V_U + \left[ 1 - \frac{(1-t_c) \cdot (1-t_p)}{(1-t_p)} \right] \cdot D \]  \[6 \text{ bis}\]

Where \( t_c \) and \( t_p \) are both marginal personal tax rates that are applied to equity’s and interest’s incomes, respectively.

Fama and French (1998) suggested estimating Equation [6] by regressing \( V_L \) on debt interest, dividends, and a proxy of \( V_U \). Specifically, they measured \( V_L \) as the excess of market value over book assets, and proxied \( V_U \) with several control variables such as current earnings, assets and R&D expenses, as well as future changes in these same variables\(^7\). A positive coefficient on the interest explanatory variable shall be evidence of positive tax benefits of debt. Contrary to expectations, Fama and French (1998) found in their regressions either non-significant or negative estimated coefficients on interest. As a result, they interpreted this evidence as being inconsistent with debt tax benefits having a first-order effect on firm value. They justified this antagonic evidence with a mismeasurement of \( V_U \), and the interest variable including information about earnings not captured by control variables.

\(^7\) All the regression variables were deflated by total assets.
Kemsley and Nissim (2002) endeavoured to bypass the $V_U$ measurement problem with two alternative proposals. In the first one, they proxied $V_U$ with the present value of the expected operating income,

$$V_U = \frac{E(\text{FOI})}{\rho} = \frac{E(\text{EBIT} \cdot (1-t_c))}{\rho} \quad [7]$$

Where $E()$ is the expected operator, FOI is future operating income, EBIT is earnings before interest and taxes\(^8\), and $\rho$ is the capitalization rate.

Combining Equations [6] and [7], we derive:

$$V_L = \frac{E(\text{FOI})}{\rho} + t_c \cdot D \quad [8]$$

And from Equation [8], the following model specification is developed:

$$V_L = \beta_0 + \beta_1 \cdot \frac{E(\text{FOI})}{\rho_{it}} + \beta_2 \cdot D_{it} + \epsilon_{it} \quad [9]$$

Where $\beta_2$ represents the estimated value for the debt tax shield.

Model coming from Equation [9] has two drawbacks. First, debt is likely to be correlated with the value of operations (i.e. $E(\text{FOI})$ and $\rho$) along several nontax dimensions, and therefore $\beta_2$ would be biased. Second, using the market value of the firm as the dependent variable instead of the market-to-book ratio might preclude considering risk issues related to $\rho$ and expectations about growth in operating income. Consequently, Kemsley and Nissim (2002) suggest a second alternative to the forward specification, called the reverse specification, in order to circumvent the measurement problems.

Empirical estimation of Equation [9] implies some kind of assumptions about expected future earnings ($E(\text{FOI})$) and the capitalization rate ($\rho$). Specifically, we proxy $E(\text{FOI})$ as EBIT times one minus marginal corporate tax rate. Conversely, we consider $\rho$ as a constant and hence we do not include any specific controls for the capitalization rate. Following Kemsley and Nissim (2002) we deflate the intercept and all explanatory

\(^8\) The use of EBIT as the basic of valuation is strictly valid only when the underlying real assets are assumed to have perpetual lives. In such a case, EBIT and cash flow are one and the same (Modigliani and Miller, 1963).
variables by total assets in order to handle heteroskedasticity\(^9\). Consequently, the empirical specification of Equation [9] now resembles the following,

\[
\frac{V_{t,u}}{\text{Total Assets}_{u,t}} = \beta_0 + \beta_1 \cdot \frac{E(\text{FOI})_{u,t}}{\text{Total Assets}_{u,t}} + \beta_2 \cdot \frac{D_{u,t}}{\text{Total Assets}_{u,t}} + \varepsilon_{u,t} \tag{10}
\]

### 3.2. Reverse specification

The reverse specification proposal consists in performing a switch of variables in Equation [6], moving \(V_U\) to the left-hand side and \(V_L\) to the right-hand side of the equation. The resulting relation is:

\[
V_{U,t} = V_{L,t} - \text{coefficient} \cdot D \tag{11}
\]

Now, adopting Equation [8] in the same spirit of Equation [11], and operating for \(E(\text{FOI})\),

\[
E(\text{FOI}) = \rho \cdot (V_{L,t} - t_c \cdot D) \tag{12}
\]

Finally, from Equation [12] we derive the following specification model:

\[
E(\text{FOI})_{u,t} = \beta_0 + \beta_1 \cdot \rho_{u,t} \cdot (V_{t,u} - \beta_2 \cdot D_{u,t}) + \varepsilon_{u,t} \tag{13}
\]

Where \(\beta_2\) represents the estimated value for the debt tax shield.

Model of Equation [13] overcomes the two limitations of the forward model. First, placing \(E(\text{FOI})\) on the left-hand side of [13] transfers the measurement error in the proxy for \(E(\text{FOI})\) to the dependent variable, and in this sense the regression residual can capture the random component of the error. Second, moving \(V_L\) to the right-hand side of Equation [13] controls for all market information concerning expected operating earnings and \(\rho\).

\(^9\) Fama and French (1998) deflated all the explanatory variables but not the intercept. This choice implies that all regression variables in Equation [10] are converted into ratios.
Equation [13] shows a non-linear relationship among the parameters, and there are basically two ways to estimate it: by using a linear transformation of the equation and by using nonlinear least squares (Hoaglin, 2003; McGuirre et al., 2014). If we consider $\rho$ as a constant and deflate the intercept and all the explanatory variables by total assets, we can set up the following linear specification of Equation [13],

$$
\frac{E(FOI)}{\text{Total Assets}} = \frac{\beta_0}{\text{Total Assets}} + \beta_1 \cdot \frac{V_{Li}}{\text{Total Assets}} + \beta_2 \cdot \frac{D_i}{\text{Total Assets}} + \varepsilon_i \tag{14}
$$

In this method the estimate for the debt tax shield is calculated as the quotient between $-\beta_2$ and $\beta_1$. Using market value as an explanatory variable allows us to control for $\rho$, but nevertheless we need to assume market efficiency (Penman, 1996). On the other hand, we need a proxy for expected future earnings and as in the forward specification, we use EBIT times one minus marginal corporate tax rate.

The second way of estimating Equation [13] is carrying it out directly by nonlinear least squares. Now, instead of considering $\rho$ as a constant, we express the capitalization rate as a linear function of several observable instruments associated with risk and growth. Specifically, we use four variables namely the industry median beta of operations ($\beta_U$) (Modigliani and Miller, 1966); the market-to-book ratio of operations or the quotient between the market value of operations ($V_L - \beta D$) and net operating assets (NOA) (Fama and French, 1992, and Penman, 1996); size measured as the natural logarithm of NOA; and the natural logarithm of operating liabilities (OL) (Hoaglin, 2003, and McGuirre et al., 2014). To control for any direct relation between $E(FOI)$ and the abovementioned variables, we also include these variables in additive form in the regression (Kemsley and Nissim, 2002). Finally, to control for industry effects, we replace the intercept in Equation [13] with industry dummies. As a result, we come up with the next empirical specification:

$$
E(FOI) = \left[ \beta_0 + \beta_1 \cdot \beta_U + \beta_2 \cdot \frac{V_{Li} - \beta \cdot D_i}{\text{NOA}} + \beta_3 \cdot \ln(\text{NOA}) + \beta_4 \cdot \ln(\text{OL}) \right] \cdot \left( V_{Li} - \beta \cdot D_i \right) + \\
+ \sum_{i=1}^{s} \gamma_{i} \cdot \text{Dummy}_i + \gamma_2 \cdot \frac{V_{Li} - \beta \cdot D_i}{\text{NOA}} + \gamma_3 \cdot \ln(\text{NOA}) + \gamma_4 \cdot \ln(\text{OL}) + \varepsilon_i \tag{15}
$$
The net tax benefit from a euro of debt, i.e. the debt tax shield, is represented by $\beta$. Equation [15] is estimated using nonlinear least-squares as it is nonlinear in the parameters. To alleviate possible effects of heteroskedasticity, we weight the observations by the reciprocal of the square of total assets, which is consistent with deflating the entire equation by total assets.

4. Data and descriptive statistics

4.1. Sample selection

The data used in this paper come from four 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, i.e. CNMV, provide the accounting information from annual accounts, while financial market information comes from the quotation bulletins of the Spanish Stock Exchange and Bloomberg.

As it is standard in the empirical literature, financial institutions, utilities and governmental enterprises are disregarded because these types of companies are intrinsically different in the nature of their operations and financial accounting information. We also excluded companies with negative equity, i.e. near bankruptcy firms. Overall, we have a balanced data panel containing 88 companies with a total of 616 observations. In order to mitigate the effect of outliers, all variables are winsorised at 0.5% in each tail of the distribution.

4.2. Descriptive statistics

Table 2 presents summary statistics for the simulation approach tax variables (Panel A) joint with the regression approach key variables (Panel B).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Median</th>
<th>St. Dev.</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTR$^{0%}$</td>
<td>0.1784</td>
<td>0.1910</td>
<td>0.0824</td>
<td>0.0002</td>
<td>0.3000</td>
</tr>
<tr>
<td>MTR$^{100%}$</td>
<td>0.1737</td>
<td>0.1879</td>
<td>0.0840</td>
<td>0.0003</td>
<td>0.3000</td>
</tr>
<tr>
<td>Kink</td>
<td>3.0765</td>
<td>1.0000</td>
<td>3.2265</td>
<td>0.0000</td>
<td>8.0000</td>
</tr>
</tbody>
</table>

Table 2: Descriptive statistics*
From Panel A of Table 2, we observe that the mean value of the before-financing marginal tax rate is 17.37% (17.84% assuming the firm has no interest deductions), with a maximum value of 30% (maximum value for the statutory tax rate) and a standard deviation of 8.40% (8.24%). An average firm’s marginal tax benefit begins to slope downward when its interest increases to 310% of the current level.

As displayed in Panel B of Table 2, the average firm finances 35 percent of its assets with financial debt and 14 percent with operating liabilities. The market value of the firm (without considering operating liabilities) is 163 percent of the book value of total assets.

5. Empirical results

5.1. The value of the debt tax shield

It is interesting to analyse the time evolution of debt financing and interest expenses of our sample, which is displayed in table 3.

<table>
<thead>
<tr>
<th>Years</th>
<th>Debt €</th>
<th>Interest Expenses €</th>
<th>Equity €</th>
<th>Debt / Equity</th>
<th>Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZeroBen</td>
<td>7.9100</td>
<td>8.0000</td>
<td>0.5697</td>
<td>2.0000</td>
<td>8.0000</td>
</tr>
</tbody>
</table>

*Table A1 in the Appendix provides definitions of all the variables. V_L, OI, NOA, OL and D are all deflated by total assets.
In 2008, total financial debt (sum of short-term and long-term borrowings) mounts to 62 million euros. It reaches a maximum of 179 million euros in 2011 and then declines. The value of the equity, however, increases from 2008 to 2009, and then declines until 2011, starting a new upward trend. The debt-equity ratio increases steadily from 2008 to 2011, when it shows a slight fall, being more pronounced in 2013. The steady increment in the debt-equity ratio until 2011 is driven by both a decrease in the numerator and an increase in the denominator, the latter higher than the former. Interest expenses reveal an upward trend throughout the whole sample period.

Table 4 shows the aggregate tax benefit of debt.

<table>
<thead>
<tr>
<th>Years</th>
<th>Total €</th>
<th>Per Firm €</th>
<th>% of Firm Value Capitalized</th>
<th>Total €</th>
<th>Per Firm €</th>
<th>% of Firm Value Capitalized</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>12,974,181,773</td>
<td>589,735,535</td>
<td>7.45</td>
<td>7,475,643,151</td>
<td>339,801,961</td>
<td>4.27</td>
</tr>
<tr>
<td>2009</td>
<td>33,673,455,900</td>
<td>410,651,901</td>
<td>6.29</td>
<td>17,544,511,082</td>
<td>213,957,452</td>
<td>3.27</td>
</tr>
<tr>
<td>2010</td>
<td>32,344,457,358</td>
<td>380,523,028</td>
<td>6.23</td>
<td>13,056,879,356</td>
<td>153,610,345</td>
<td>2.31</td>
</tr>
<tr>
<td>2011</td>
<td>30,452,850,336</td>
<td>354,102,911</td>
<td>6.67</td>
<td>11,569,591,429</td>
<td>134,530,133</td>
<td>2.33</td>
</tr>
<tr>
<td>2012</td>
<td>28,521,178,948</td>
<td>327,829,643</td>
<td>6.78</td>
<td>6,195,241,880</td>
<td>71,209,677</td>
<td>1.29</td>
</tr>
<tr>
<td>2013</td>
<td>26,037,330,523</td>
<td>306,321,536</td>
<td>5.83</td>
<td>5,133,123,132</td>
<td>60,389,684</td>
<td>0.90</td>
</tr>
</tbody>
</table>
Total (Individual) tax benefit of debt is largest in 2009 (2008) and then gradually diminishes over time. Capitalized tax benefits are the present value of future tax benefits divided by the firm value. The capitalized gross value of interest deductions is about 6.4% of market value over the sample period; this compares to the traditional 11.4% (marginal tax rate times debt) of firm value, which assumes that full tax benefits are realized on every euro of interest deduction in every scenario. It reaches its highest value in 2008 at 7.5%, and then gradually reduces to 5.8% in 2013. Capitalized net tax benefits after the personal penalty follow a similar trend, but obviously with lesser figures.

Firms with a kink larger than 1 can increase interest, and still receive the maximum marginal tax benefit until they reach their kink. If the incremental non-tax costs of debt are smaller than the incremental tax benefits, then a firm can increase its firm value by issuing more debt. In accordance with Graham (2000, 2008, 2013), we estimate the incremental gross tax benefits from additional debt up to their kink for firms with a kink larger than 1. Figure 4 presents these incremental gross tax benefits, i.e. gross money left on the table, as a percentage of firm value joint with the capitalized gross tax benefit of debt.

**Figure 4: Debt tax benefits**

For the entire sample period, the incremental gross tax benefits given up by firms are larger than the capitalized gross tax benefits taken. In particular, the foregone incremental tax benefits are 28.19% of firm value in 2008, and then decline gradually to
23.64% in 2013. These results suggest that the gross money left on the table from conservative debt policy is material, though weakening in time. The total tax benefits of debt can be computed by adding the incremental tax benefits from additional debt to the capitalized tax benefits from the current debt. As a result, an average firm achieves 7.45% of firm value from its current debt level in 2008, and will add 28.19% if leveraging up to its kink. Therefore, in 2008 the total gross tax benefit is 35.64% of firm value. Conversely, for the rest of the years, the total gross tax benefits are 41.80% (2009), 37.05% (2010), 34.84% (2011), 34.86% (2012) and 29.46% (2013).

The estimation results of Equation [10] are shown in table 5.

| Table 5: Estimation Results of Equation [10] |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| $\beta_0$ | $\beta_1$ | $\beta_2$ | Adj. $R^2$ | $N$ | Obs. |
| Mean | 2.50 | 2.8969 | 1.2331 | 0.9734 | 87 |
| $t$-statistic | 5.01 | 2.17 | 5.80 |

Fixed effects regression coefficients estimated from Equation [10] with the intercept and all the explanatory variables scaled by total assets. The $t$-statistic is the ratio of the coefficient to its standard error.


| Table 6: Estimation Results of Equation [14] |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| $\beta_0$ | $\beta_1$ | $\beta_2$ | Debt Tax Shield | $R^2$ | $N$ | Obs. |
| Mean | 1,134,251 | 0.0147 | 0.0153 | 1.0408 | 0.7467 | 87 |
| $t$-statistic | -3.98 | 3.36 | -1.15 |

Fixed effects regression coefficients estimated from Equation [14] with the intercept and all the explanatory variables scaled by total assets. The $t$-statistic is the ratio of the coefficient to its standard error.

Table 7: Estimation results of equation [15]

<table>
<thead>
<tr>
<th></th>
<th>$\beta_0$</th>
<th>$\beta_1$</th>
<th>$\beta_2$</th>
<th>$\beta_3$</th>
<th>$\beta_4$</th>
<th>Debt</th>
<th>Tax</th>
<th>Shield</th>
<th>$Y_2$</th>
<th>$Y_3$</th>
<th>$Y_4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.8077</td>
<td>0.0080</td>
<td>0.0012</td>
<td>-</td>
<td>0.0087</td>
<td>0.2818</td>
<td>-</td>
<td>3,707,272</td>
<td>43,205</td>
<td>195,638</td>
<td></td>
</tr>
<tr>
<td>t-statistic</td>
<td>5.90</td>
<td>1.33</td>
<td>0.83</td>
<td>-5.97</td>
<td>2.59</td>
<td>1.77</td>
<td>-6.05</td>
<td>0.16</td>
<td>1.08</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Nonlinear panel data regression coefficients estimated from Equation [15].

The debt tax shield in terms of firm value can be computed as the mean leverage ratio (39.81%) multiplied by the estimated coefficient of the debt tax shield in Table 7 (0.2818) and equals to 11.22%.

5.2. Debt conservatism

The extent of conservatism in a firm’s debt financing may be assessed by the firm’s tax benefit function and kink. A large kink implies that the firm is using debt conservatively, as it can raise more debt without any decline in the tax benefit of incremental interests. Table 8 reports the distribution of kinks and standardized kinks.

Table 8: The distribution of kink and standardized kink

<table>
<thead>
<tr>
<th>Kink</th>
<th>Standardized Kink</th>
<th>Obs.</th>
<th>Percentile (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0.00</td>
<td>86</td>
<td>19.2</td>
</tr>
<tr>
<td>0.2</td>
<td>0.08</td>
<td>55</td>
<td>12.3</td>
</tr>
<tr>
<td>0.4</td>
<td>0.19</td>
<td>42</td>
<td>9.4</td>
</tr>
<tr>
<td>0.6</td>
<td>0.18</td>
<td>12</td>
<td>2.7</td>
</tr>
<tr>
<td>0.8</td>
<td>0.25</td>
<td>13</td>
<td>2.9</td>
</tr>
<tr>
<td>1.0</td>
<td>0.19</td>
<td>19</td>
<td>4.3</td>
</tr>
<tr>
<td>1.2</td>
<td>0.21</td>
<td>7</td>
<td>1.6</td>
</tr>
<tr>
<td>1.6</td>
<td>0.19</td>
<td>9</td>
<td>2.0</td>
</tr>
<tr>
<td>2.0</td>
<td>0.57</td>
<td>14</td>
<td>3.1</td>
</tr>
<tr>
<td>3.0</td>
<td>1.78</td>
<td>12</td>
<td>2.7</td>
</tr>
</tbody>
</table>
From Table 8 we derive that 49.1% of kink is larger than 1, and 42.4% of kink is larger than 2. Therefore, approximately half of sample firms can raise additional debt and still enjoy the maximum marginal tax benefit. The maximum value of kink, 8.0, corresponds with the maximum value of standardized kink, 1.98. This suggests that firms with a large kink will remain in the flat part of their tax benefit function, even after a negative shock to their income, and still use the full benefits of debt.

### Table 9: Time evolution of kink and zeroBen

<table>
<thead>
<tr>
<th>Years</th>
<th>Kink</th>
<th>ZeroBen</th>
<th>Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>3.11</td>
<td>8.00</td>
<td>22</td>
</tr>
<tr>
<td>2009</td>
<td>2.94</td>
<td>8.00</td>
<td>82</td>
</tr>
<tr>
<td>2010</td>
<td>3.06</td>
<td>7.99</td>
<td>85</td>
</tr>
<tr>
<td>2011</td>
<td>3.03</td>
<td>7.94</td>
<td>86</td>
</tr>
<tr>
<td>2012</td>
<td>3.07</td>
<td>7.86</td>
<td>87</td>
</tr>
<tr>
<td>2013</td>
<td>3.27</td>
<td>7.76</td>
<td>85</td>
</tr>
<tr>
<td>Total</td>
<td>3.08</td>
<td>7.91</td>
<td>447</td>
</tr>
</tbody>
</table>

ZeroBen steadily declines from 8.00 in 2008 to 7.76 in 2013

### 5.3. Firm-by-firm analysis

We consider four different groups of firms and analyse them.
• Group A: high profitable firms, defined as those firms whose EBIT is above the median EBIT of the firms’ sample.

• Group B: low profitable firms, defined as those firms whose EBIT is below the median EBIT of the firms’ sample.

• Group C: high leveraged firms, defined as those firms whose leverage ratio is above the median leverage ratio of the firms’ sample.

• Group D: low leveraged firms, defined as those firms whose leverage ratio is below the median leverage ratio of the firms’ sample.

Table 10 compares the tax benefits of debt by firms’ characteristics.

**Table 10: Comparison of the Tax Benefit of Debt by Firms’ Characteristics**

<table>
<thead>
<tr>
<th>Group of Firms</th>
<th>Characteristic</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Benefit of Debt</td>
<td>Tax Shield (%)</td>
<td>7.64</td>
<td>5.97</td>
<td>6.08</td>
<td>6.51</td>
<td>6.35</td>
<td>5.61</td>
</tr>
<tr>
<td><strong>A</strong></td>
<td>Net Benefit of Debt</td>
<td>Tax Shield (%)</td>
<td>3.99</td>
<td>3.03</td>
<td>2.46</td>
<td>2.45</td>
<td>1.79</td>
</tr>
<tr>
<td></td>
<td>Kink</td>
<td>3.36</td>
<td>2.25</td>
<td>2.60</td>
<td>2.87</td>
<td>2.65</td>
<td>2.98</td>
</tr>
<tr>
<td></td>
<td>MTR&lt;sup&gt;100%&lt;/sup&gt; (%)</td>
<td>18.78</td>
<td>19.76</td>
<td>18.54</td>
<td>17.35</td>
<td>17.35</td>
<td>17.19</td>
</tr>
<tr>
<td></td>
<td>Leverage (%)</td>
<td>40.23</td>
<td>31.07</td>
<td>33.53</td>
<td>38.44</td>
<td>36.37</td>
<td>33.42</td>
</tr>
<tr>
<td></td>
<td>EBIT (€ million)</td>
<td>8,294</td>
<td>19,988</td>
<td>15,999</td>
<td>20,437</td>
<td>14,845</td>
<td>15,115</td>
</tr>
<tr>
<td>Gross Benefit of Debt</td>
<td>Tax Shield (%)</td>
<td>7.27</td>
<td>6.61</td>
<td>6.38</td>
<td>6.84</td>
<td>7.19</td>
<td>6.04</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>Net Benefit of Debt</td>
<td>Tax Shield (%)</td>
<td>4.54</td>
<td>3.51</td>
<td>2.16</td>
<td>2.21</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>Kink</td>
<td>2.85</td>
<td>3.62</td>
<td>3.53</td>
<td>3.20</td>
<td>3.49</td>
<td>3.55</td>
</tr>
<tr>
<td></td>
<td>MTR&lt;sup&gt;100%&lt;/sup&gt; (%)</td>
<td>22.41</td>
<td>19.71</td>
<td>16.92</td>
<td>16.49</td>
<td>15.63</td>
<td>14.93</td>
</tr>
<tr>
<td></td>
<td>Leverage (%)</td>
<td>31.70</td>
<td>33.05</td>
<td>38.38</td>
<td>43.25</td>
<td>49.22</td>
<td>43.78</td>
</tr>
<tr>
<td></td>
<td>EBIT (€ million)</td>
<td>142</td>
<td>-318</td>
<td>-140</td>
<td>-294</td>
<td>-788</td>
<td>-2,114</td>
</tr>
</tbody>
</table>
### C

<table>
<thead>
<tr>
<th></th>
<th>Tax Shield (%)</th>
<th>Kink</th>
<th>MTR&lt;sup&gt;100%&lt;/sup&gt; (%)</th>
<th>Leverage (%)</th>
<th>EBIT (€ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Benefit of Debt</td>
<td>11.57</td>
<td>2.20</td>
<td>21.71</td>
<td>54.43</td>
<td>4,209</td>
</tr>
<tr>
<td>Net Benefit of Debt</td>
<td>10.12</td>
<td>2.95</td>
<td>19.84</td>
<td>51.01</td>
<td>15,083</td>
</tr>
<tr>
<td>Tax Shield (%)</td>
<td>9.75</td>
<td>2.74</td>
<td>17.24</td>
<td>56.57</td>
<td>10,592</td>
</tr>
<tr>
<td>6.78</td>
<td>3.57</td>
<td>16.45</td>
<td>63.17</td>
<td>67.11</td>
<td>15,176</td>
</tr>
<tr>
<td>5.33</td>
<td>2.43</td>
<td>15.43</td>
<td>67.11</td>
<td>60.81</td>
<td>4,325</td>
</tr>
<tr>
<td>3.56</td>
<td>2.50</td>
<td>15.17</td>
<td></td>
<td></td>
<td>4,862</td>
</tr>
<tr>
<td>1.69</td>
<td>2.41</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### D

<table>
<thead>
<tr>
<th></th>
<th>Tax Shield (%)</th>
<th>Kink</th>
<th>MTR&lt;sup&gt;100%&lt;/sup&gt; (%)</th>
<th>Leverage (%)</th>
<th>EBIT (€ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Benefit of Debt</td>
<td>3.33</td>
<td>4.02</td>
<td>19.48</td>
<td>17.50</td>
<td>4,227</td>
</tr>
<tr>
<td>Net Benefit of Debt</td>
<td>2.46</td>
<td>2.92</td>
<td>19.63</td>
<td>13.11</td>
<td>4,586</td>
</tr>
<tr>
<td>Tax Shield (%)</td>
<td>2.79</td>
<td>3.37</td>
<td>18.23</td>
<td>15.76</td>
<td>5,266</td>
</tr>
<tr>
<td>3.06</td>
<td>3.63</td>
<td>17.39</td>
<td>18.52</td>
<td>19.18</td>
<td>4,966</td>
</tr>
<tr>
<td>3.10</td>
<td>3.64</td>
<td>17.51</td>
<td>19.02</td>
<td>17.03</td>
<td>9,731</td>
</tr>
<tr>
<td>2.88</td>
<td>4.10</td>
<td>16.90</td>
<td></td>
<td></td>
<td>8,138</td>
</tr>
</tbody>
</table>

*Both gross and net benefits of debt tax shield are computed in terms of firm’s market value. Leverage is the quotient between total book debt and firm’s market value.

Consistent with the findings of Blouin et al. (2010), we observe that kink increases with profitability.

### 6. Robustness of results

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

A number of studies have attempted to analyze the tax implications of financing decisions on the firm’s value by considering the interest expense instead of the debt level as explanatory variable (see Fama and French 1998; Kemsley and Nissim, 2002; Jayaraman, 2006; Sinha and Bansal, 2014, among others). Therefore, our first robustness test will consist of including the interest expense variable in the regression analysis. Following previous research, we formulate the following empirical specification:
\[
\frac{VALUE_{it}}{\text{Total Assets}_{it}} = \beta_0 + \beta_1 \cdot \frac{\text{INT}_{it}}{\text{Total Assets}_{it}} + \beta_2 \cdot \frac{\text{OI}_{it}}{\text{Total Assets}_{it}} + \beta_3 \cdot \frac{\text{DIV}_{it}}{\text{Total Assets}_{it}} + \beta_4 \cdot \frac{\text{CAPEX}_{it}}{\text{Total Assets}_{it}} + \beta_5 \cdot \text{SIZE} + \varepsilon_{it}
\]  

[16]

Where \( VALUE \) is the difference between market and book value of the firm, \( INT \) is the interest expense and constitutes the pivotal value (i.e., its coefficient leads to the estimated value for the debt tax shield), \( OI \) is earnings before interest and taxes times one minus marginal corporate tax rate, \( DIV \) is the amount of dividends paid, \( CAPEX \) is capital expenditures, and \( SIZE \) is the natural logarithm of sales\(^{10}\).

Estimating Equation [16] requires to test for the potential endogeneity of the contemporaneous interest variable. The implementation of Hausman (1978) test of endogeneity results in the absence of endogeneity for the interest regressor\(^{11}\).

Table 11 shows the estimated coefficients of Equation [16].

<table>
<thead>
<tr>
<th>TABLE 11: ESTIMATION RESULTS OF EQUATION [16]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Explanatory Variables</strong></td>
</tr>
<tr>
<td>INT</td>
</tr>
<tr>
<td>OI</td>
</tr>
<tr>
<td>DIV</td>
</tr>
<tr>
<td>CAPEX</td>
</tr>
<tr>
<td>SIZE</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>

\(^{10}\) Fama and French (1998) argue that poor controls for future profitability could distort the relation between firm value and debt. In order to cope with this concern, we include capital expenditures to better control for the firm’s future profitability, and firm’s size to take into account other firm level factors.

\(^{11}\) \( \chi^2 = 0.81 \ (0.999) \) accepting the null of absence of endogeneity.
The interpretation of the estimated coefficient associated to the interest variable (i.e. $\beta_1$) is the following. Recall that the value of a leveraged firm is the sum of the value of the unleveraged firm and the present value of the debt tax shield. We can compute the present value of the debt tax shield as the quotient between the marginal tax rate and the capitalization rate (i.e. cost of debt) times the interest expense. Therefore, the estimated marginal tax rate may be calculated as $\hat{\gamma}_c = \hat{\beta}_1 \cdot r_d$. Specifically, 7.705 multiplied by the median interest rate (3.14%) equals 24.19%, which represents the debt tax shield in terms of debt value. If we now multiply 24.19% by the mean leverage ratio (39.81%), we obtain the debt tax shield in terms of firm value (9.63%).


<table>
<thead>
<tr>
<th>Table 12: Estimation Results of Equation [15]</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_0$</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>$t$-statistic</td>
</tr>
</tbody>
</table>
Nonlinear panel data regression coefficients estimated from Equation [15].

Multiplying the median interest rate (3.14%) by 3.4696 leads to the debt tax shield in terms of debt value (10.89%). The debt tax shield in terms of firm value results from multiplying 10.89% by the mean leverage ratio (39.81%) which mounts up to 4.34%.

7. Concluding remarks

Previous studies on debt tax shields have evaluated the determinants of debt usage or the basic relationship between marginal tax rates and firms’ debt policy. On the contrary, this study directly estimates the tax benefits of debt. It is the first empirical analysis of the assessment of the tax benefit of debt, and how much it contributes to firm value within Spanish context.

Our results prove that the tax benefits of debt for Spanish listed firms are significant. Under the simulation approach, the mean capitalized gross tax benefit of current interests is estimated to be 6.4% of firm value. For the entire sample period, the mean incremental tax benefit is found to be 28.9% of firm value. Conversely, the regression approach leads to a 11.2% (28.2%) debt tax shield in terms of firm (debt) value. Robustness tests are in line with previous results.

The results of this study should provide insight into government regulations, especially referred to tax code, on the capital structure of firms. Moreover, managers should be aware of the relative importance of the value of debt tax benefits.
References


## APPENDIX

### TABLE A1
**DEFINITION OF VARIABLES**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTR(^{0%})</td>
<td>Marginal tax rate estimated following Graham et al. (1998) approach, and assuming the firm has no interest deductions</td>
</tr>
<tr>
<td>MTR(^{100%})</td>
<td>Marginal tax rate estimated following Graham et al. (1998) approach, and using the actual firm’s interest deductions</td>
</tr>
<tr>
<td>Kink</td>
<td>Point at which the tax benefit function starts to slope downwards</td>
</tr>
<tr>
<td>ZeroBen</td>
<td>Point at which the tax benefit function equals zero</td>
</tr>
<tr>
<td>(V_L)</td>
<td>Market value of the firm calculated as market value of equity plus book value of debt</td>
</tr>
<tr>
<td>OI</td>
<td>Operating income calculated as earnings before interest and taxes times one minus marginal corporate tax rate</td>
</tr>
<tr>
<td>NOA</td>
<td>Net operating assets calculated as total assets minus operating liabilities</td>
</tr>
<tr>
<td>OL</td>
<td>Operating liabilities (i.e. all non-debt liabilities)</td>
</tr>
<tr>
<td>(\beta_U)</td>
<td>Unlevered beta</td>
</tr>
<tr>
<td>D</td>
<td>Total financial debt</td>
</tr>
</tbody>
</table>