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Debt and taxes for private firms ☆

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ABSTRACT

This paper analyzes the impact of marginal tax rates on the capital structure decision of private bank-financed firms. These firms are rarely studied in capital structure contexts and differ from large listed firms in terms of agency and asymmetric information problems and funding sources. It is argued that the solution to agency and asymmetric information problems for large firms shows up as restrictions on debt in the balance sheet, whereas for small firms these problems are solved by financial institutions and are therefore less apparent in the balance sheet. This makes it easier for small firms to exploit tax advantages of debt. Using a rich and unique data set of Portuguese firms, the empirical analysis finds that the marginal tax rate has an important impact on the capital structure of smaller private firms. It is also found that the balance sheet variables used for large listed firms in different countries to model agency costs and asymmetric information do not work well for smaller private firms. The only significant variables (besides tax variables) for small firms are bankruptcy (collateral) variables.

1. Introduction

Modigliani & Miller (1958, 1963) demonstrate that the capital structure is irrelevant to the value of the firm in a perfect, frictionless world without taxes. The introduction of deductibility of interest payments entails benefits to debt financing over equity financing in the form of a tax shield and therefore the capital structure becomes important for the value of the firm. Nevertheless, increasing debt is not "a free lunch". Expected bankruptcy costs and agency costs increase, which reduces the value of the firm. The objective of the firm is then to find the optimal capital structure where the marginal benefits from debt are equal to its marginal costs. Given the sizeable tax rates facing many corporations in various countries, the role of taxes for the capital structure is potentially important. However, in his presidential address to the American Finance Association, Myers (1984, p. 588) states that, "I know of no study clearly demonstrating that a firm's tax status has predictable, material effects on its debt policy. I think the wait for such a study will be protracted". Gordon & Lee (1999, p. 1) state that, "Surprisingly, economists have had great difficulty providing evidence that taxes in fact lead to higher debt-equity ratios". Although there is increasing evidence that taxes do matter (Graham, 1996a,b) for the capital structure, the primary source of the evidence is obtained using public US firms from the Compustat tapes.[1] In general, these firms are relatively large, public on a stock exchange, financially sophisticated and have access to debt markets. What remains to be established is whether the impact of taxes has general applicability to other countries and smaller nonpublic firms with different financing sources. Smaller firms are often not as profitable as large firms, reducing the benefits from the deductibility of interest payments. On the other hand, smaller firms have less access to other types of tax shields, increasing the benefits from the deductibility of interest payments. Also, smaller firms have a higher probability of financial distress, reducing the amount of debt that they can carry. Finally, the agency and asymmetric information problems are solved differently for smaller firms. Whereas large firms may use financial markets, small firms are financed by banks. Bank

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[1] See Graham (2003) for an excellent survey of the implications of taxes on corporate finance in general and for the capital structure of corporations in particular.

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Table 1
The structure of panel data.

Number of observations by year and industry type							
Years	Observations						
	Industry 1	Industry 2	Industry 3	Industry 4	Industry 5	Industry 6	Total
1990	83	168	44	97	35	96	523
1991	94	216	51	105	40	111	617
1992	104	243	58	115	44	121	685
1993	111	276	65	125	49	135	761
1994	111	281	65	125	55	141	778
1995	113	284	71	132	55	137	792
1996	113	275	72	134	56	138	788
1997	116	282	67	132	63	133	793
1998	112	262	64	124	59	128	749
1999	99	235	61	114	57	116	682
2000	83	199	51	102	56	106	597
Total	1139	2721	669	1305	569	1362	7765

The panel data set is unbalanced as there are more observations for some firms than for others.
The table shows the number of observations by year and by industry type. The industry type classes are: class 1: food and drinks; class 2: textiles and clothing; class 3: wood and paper paste; class 4: chemical products; class 5: heavy industry and class 6: machinery production and equipment.

financing may be more flexible, enhancing the benefits to smaller firms from the deductibility of interest payments. Sogorb-Mira (2005) tests for, among other things, tax effects on Spanish SME's using the average tax rate (tax paid divided by earnings after interest and before tax) but finds that an increase in the average tax rate will decrease the amount of debt. The aim of this paper is therefore to analyze the impact of corporate taxes on the capital structure of small private firms using a more appropriate measure of taxes namely the marginal tax rate as developed by Graham (1996a,b). To secure an independent sample of companies that is as different as possible from large US firms, a sample of smaller private Portuguese firms is obtained from the Central Bank of Portugal. The advantage of using Portuguese firms is that Portugal relies on bank financing and has relatively small financial markets, thus avoiding a different institutional setting to the existing literature on the impact of taxes on capital structure. Also, the time period chosen is before the introduction of the Euro to reduce the impact of financial integration and related financial developments in Europe. As the main result of the paper, we show that there is a positive significant tax effect on the capital structure. Additionally, some of the traditional variables used for modeling agency costs and asymmetric information in large public firms, by e.g. Rajan & Zingales (1995), do not work well for private firms. Besides taxes, the main determining factor for the level of debt is the availability of collateral.

The remainder of the paper proceeds as follows. Section 2 contains a discussion of the capital structure issues for private firms and Section 3 discusses the data and variables used in the empirical analysis. Section 4 presents the empirical analysis and Section 5 concludes.

2. Capital structure issues for private firms

From a theoretical point of view, the main determinants for the capital structure are asymmetric information, agency costs, bankruptcy costs and tax benefits from debt. The existing empirical literature on capital structure is primarily centered on large public firms with access to financial markets.[2] However, smaller private firms and large public firms differ with respect to agency and asymmetric information problems and these may give rise to different financing sources for small and large firms and from an empirical point the use of different variables in regressions analyzing capital structure. At least for the US, both the capital structure and the type of financing differ between large public and small firms. Large public firms have around 34% equity to total assets (Rajan & Zingales, 1995, Table 2) whereas for small firms it is closer to 50% (Berger & Udell, 2005, Table 1). The financing sources also differ: large firms usually finance their operations with commercial paper, syndicated banks loans or loans from several banks and with public bond issues, whereas small firms use non-traded debt such as bank loans, leasing and trade credit.

Public firms are required to submit information to the stock exchange and the newspapers monitor these firms on regular basis, whereas private firms are only required to produce a straightforward annual report once a year and rarely appear in the press. The exposure of public firms reduces the information opacity of these firms compared to private firms. The availability of public information, together with credit ratings, makes it possible to finance large firms with various forms of traded debt but at a cost. The costs of obtaining a credit rating and providing the required information to financial markets are to a large extent fixed, that is, the costs of obtaining a credit rating for a small firm are nearly the same as for a large firm. On the benefit side, the rated debt is traded in competitive markets ensuring competitive cost (interest rates) of debt to the firm. An alternative to obtaining financing in financial markets is to use financial institutions. These institutions are particularly good at gathering information about firms for which they are the sole banker. Through the payment system, financial institutions have proprietary information about a firm's cash flow which is not available to financial markets. Thus, financial institutions may have advantages over financial markets and rating agencies in solving the asymmetric information problem. However, these advantages are smaller for large firms because, as argued by Mester, Nakamura, & Renault (2004), large firms often have several banking relationships, reducing the advantages derived from financial intermediaries' knowledge of the firm's transactions accounts. The main problem from the borrowers' point of view is that the bank has a monopoly since it is difficult to change bank and this leads to higher interest rates on the loans. The availability of a large amount of credible information in the public domain and economies of scale due to the high fixed costs of being public, preparing information for rating agencies etc. reduce the costs of traded debt for large public firms compared to smaller private firms. Financial institutions charge a higher interest rate from their customers than financial markets as compensation for monitoring, whereas financial markets charge a lower rate on loans but a high fixed cost for credit ratings. Overall, due to asymmetric information, it is cheaper for small private firms to borrow from banks than financial

[2] For examples of capital structure studies of private firms, also referred to as SMEs, see Cassar & Holmes (2003) for Australia, Michaelas & Chittenden (1999) for the United Kingdom and Daskalakis & Psillaki (2008) or Psillaki & Daskalakis (2009) for France and Greece. Gaud, Hoesli & Bender (2007) and Hall, Hutchinson & Michaelas (2004) use a sample of SMEs from the European countries.

markets and for large firms to access financial markets.[3] The cost of solving the asymmetric information problem is the key argument in the Pecking Order Theory of financing; firms choose the cheapest source first. For small firms, owners are often also the managers; thus, there are no costs associated with asymmetric information and equity is therefore the cheapest source. When this source is exhausted, debt is used resulting in lower costs of solving the asymmetric information problems than for external equity which is used last.[4]

Financial institutions and financial markets also solve agency and governance problems associated with debt financing differently. In the case of a bond issue, the conditions for negation of the contract are specified up front. Once the bond is sold, it is very difficult to change the terms (which may include covenants, maturity date and the amount of the loan or interest) since all lenders have to agree. For firms with higher agency costs, financial markets will charge higher interest rates and reduce the size of the issue as well as demand the inclusion of strict covenants in the debt contract. Thus, the presence of agency problems in large public firms increases interest rates, reducing the amount of debt on the balance sheet and, to the extent that the amount of debt is restricted, firms may be prevented from pursuing the optimal amount of debt for the purpose of maximizing the value of the tax shield (Graham (2000)). Financial institutions, on the other hand, solve these problems by continuous monitoring. They may for example use the payment system and "continuous" renegotiation of the debt contract (covenants). In particular, the bank manager has the authority to withhold new credit and to change the conditions of the loan as well as cancel old credit. The right of the manager to do this is a credible threat, reducing the incentive of managers/owners to exploit moral hazard problems. Thus, under bank financing the *amount* of debt is not the primary tool to control agency problems. The bank uses monitoring and the *threat* of withdrawing future debt or increasing the price of future debt to control agency problems.

Financial markets can also increase interest rates on future debt to reflect a new situation when debt is renegotiated, but the original lenders in financial markets cannot recover their losses since the firm can sell new (and dearer) debt in a competitive market to new lenders, which just reflects the current conditions. The situation is different for financial institutions; they can charge a higher rate than is warranted, i.e. impose a penalty and recover the original losses, because it is costly for a firm to change its banker. Thus, a financial institution can more easily recover its losses. Financial markets therefore have to protect themselves ex-ante, whereas financial institutions have a credible threat that they can exercise ex-post. This scenario has two consequences for borrowers from financial institutions. First, both the borrower and the financial institution are interested in maximizing the value of the firm and with a credible threat in hand the financial institution is likely to allow the firm to exploit potential tax benefits of debt. Second, since the solution to the agency problem does not involve the actual amount of debt supplied by a financial institution, we are less likely to find a relationship between proxies (derived from the balance sheet) for agency problems and small firm capital structure. On the other hand, we are more likely to find a tax effect for small firms compared to large firms, as discussed above. Thus, the factors determining the capital structure of private firms financed by financial institutions and of large public firms may be different.

The last component in determining capital structure is the expected bankruptcy costs. Due to e.g. more diversification, large firms generally have lower probability of bankruptcy than smaller firms; thus, larger firms can carry more debt. The other component is the existence of collateral. If the firm has "good" collateral, then they can carry more debt. Often SMEs are small firms consisting primarily of growth options with few assets that can be used as collateral. Thus, smaller firms can carry less debt compared to larger and more established firms.

Since small firms use bank financing that solves asymmetric information and agency problems differently to large firms, we expect them to be able to carry more debt and also that taxes have a greater impact on capital structure than for large firms. On the other hand, SMEs face a significantly larger probability of default and have less collateral available, reducing the amount of debt that they can carry compared to large firms.

A unique data set from Portugal is used in the empirical analysis. The advantage of using this data is that Portugal is one of the least developed countries in the OECD and so its banks and financial markets are less likely to mimic those of the large and more developed countries (G7), thereby providing a quite different institutional setting to that existing in the G7 countries. Compared with market based economies like the United States, United Kingdom and Canada, the ratio of stock market capitalization to GDP (which is a good approximation of the equity market importance) is 51.75% in Portugal, which is substantially less than in those other three countries with 180, 203 and 126%, respectively.[5] As regards, domestic bank credit to the private sector as a fraction of GDP, Portugal is in line with the above countries, with 121% comparable with 145, 123 and 83%, respectively. The Portuguese financial system is universal. It was privatized at the end of 1985 and comprises the central bank and 90 commercial banks (62 domestic and 28 foreign, including Madeira's off-shore banks). The first Portuguese private bank founded after the 1974 political revolution is now the biggest financial group in Portugal with several investments abroad. The proportion of domestic bank to total bank assets was 93% in 1999. Over the last 10 years, there has been a string of mergers and acquisitions in the banking industry in Portugal, which restricts the competition and makes credit rationing more of a potential problem. The bank system is strongly concentrated in five financial groups which have more than 75% of all bank assets. These banks operate with widespread branches and accept all types of deposits and offer many kinds of loans. They have established subsidiaries for leasing, insurance, factoring, underwriting, corporate services etc.

3. The data sample

The primary data source is the Bank of Portugal Statistical Department's database. This database contains balance sheet and income statement data for 3083 private firms with 17,737 non-continuous firm-year observations. Several selection criteria are imposed for inclusion in the sample. To ensure a relatively homogeneous sample of firms that may be concerned about corporate tax implications, only manufacturing firms for the period 1990–2000 with more than 100 employees in all years are included. The limit of 100 employees is imposed to ensure that we only have firms with limited liability and independent tax status in the sample (i.e. firms paying corporate tax, as opposed to the income of the firm and its owner being taxed together). Also, by imposing this limit, we leave out firms where the owner's personal wealth may be used as collateral for the loans in the corporation. Firms with negative net worth, negative taxes, equity less than 2000 Euros (the minimum amount allowed by law) and less than 4 years of continuous data (required for estimation purposes) are not included in the sample. The final sample consists of 998 firms and 7765 firm-year observations. Only 270 of 998 firms have available

[3] See Faulkender & Petersen (2006) for a further discussion.

[4] Shyam-Sunder & Myers (1999) find support for the Pecking Order Theory using large US listed firms. Contrary to expectations, Frank & Goyal (2003) find that the Pecking Order Theory only holds for large firms and not for smaller firms — a result confirmed by Leary & Roberts (2010). In contrast, Bharath, Pasquariello & Guojun (2009) support the original proposition that smaller firms are more likely to follow Pecking Order Financing. Serrasqueiro & Rogao (2009) find some support for the Pecking Order Theory for listed Portuguese firms whereas Hol & Van der Wijst (2008) reject the Pecking Order Theory for private Norwegian firms.

[5] Merrill Lynch, "Size & Structure of the World Bond Market: 2002"; International Financial Statistics and World Bank Group, "World Development Indicators Database".

Table 2
Balance sheets: average balance sheet items as a fraction of total assets.

Number of observations	1990	1992	1994	1996	1998	2000
	523	685	778	788	749	597
Assets						
Fixed assets	0.52	0.53	0.54	0.50	0.51	0.47
Intangible assets	0.01	0.01	0.04	0.04	0.03	0.02
Tangible assets	0.43	0.42	0.40	0.37	0.39	0.34
Investments	0.08	0.10	0.10	0.09	0.09	0.11
Current assets	0.48	0.47	0.46	0.50	0.49	0.52
Stocks (liquidity)	0.02	0.01	0.01	0.02	0.01	0.01
Debtors	0.24	0.24	0.26	0.29	0.26	0.30
Inventories	0.19	0.17	0.15	0.14	0.15	0.16
Cash and cash equivalents	0.02	0.03	0.03	0.04	0.06	0.04
Prepaid expenses	0.01	0.02	0.01	0.01	0.01	0.01
Shareholders' funds and liabilities						
Shareholders' funds	0.49	0.47	0.46	0.48	0.49	0.46
Capital	0.22	0.21	0.25	0.25	0.24	0.20
Reserves	0.23	0.25	0.19	0.21	0.22	0.21
Net income of the year	0.04	0.01	0.02	0.02	0.03	0.05
Provisions	0.02	0.01	0.01	0.01	0.01	0.01
Liabilities	0.49	0.52	0.53	0.51	0.50	0.53
Non-current liabilities	0.16	0.15	0.14	0.15	0.13	0.13
Long-term debt	0.13	0.12	0.09	0.11	0.09	0.10
Bank loans	0.10	0.10	0.07	0.09	0.08	0.09
Other	0.03	0.02	0.02	0.02	0.01	0.01
Other Non-current liabilities	0.03	0.03	0.05	0.04	0.04	0.03
Current liabilities	0.33	0.37	0.39	0.36	0.37	0.40
Loans	0.10	0.13	0.12	0.08	0.08	0.09
Bank loans	0.10	0.13	0.12	0.08	0.08	0.09
Others	<0.01	<0.01	<0.01	<0.01	<0.01	0.00
Creditors	0.10	0.10	0.12	0.12	0.12	0.14
Other current liabilities (incl. shareholders')	0.09	0.09	0.09	0.09	0.10	0.10

information for all the 11 years, but more than one third of the firms in the sample have 10 years or more of continuous data, 25% have between 7 and 9 years of continuous data and 38% have between 4 and 6 years of continuous data. On average, the number of continuous observations for a firm is between 7 and 8 years. The lowest number of firms appears in 1990 and 2000 with 523 and 597 observations, respectively.

Table 1 shows the distribution of observations across industries. Industry class 2, textiles and clothing, has the most observations over the sample period and the smallest number of observations is for class 5, heavy industry. The distribution across industries in the sample corresponds to the initial sample of 17,737 firm years and reflects the Portuguese economy in general over the sample period.

Table 2 reports the "average balance sheet" for the entire sample for selected years of the sample period. For each firm, each item on the balance sheet is divided by total assets and then the average across firms is calculated for each ratio. The amount of tangible assets as a percentage of total assets is between 34% (2000) and 43% (1990).[6] This is a slightly higher proportion compared to other European SMEs reported in Hall, Hutchinson, & Michaelas (2004) but significantly lower than what they report for Portugal.[7] Cash and cash equivalents are significantly lower for Portugal at between 2% and 6% compared to the G7 countries. Thus, compared to G7 countries, Portuguese firms have fewer reserves available for meeting interest payments and for replacing short-term debt in case of a liquidity squeeze. Financing through financial institutions is often undertaken by establishing a credit line and as long as this line is not fully utilized, there is less demand for holding cash compared to firms without credit lines or with relatively smaller credit lines. Since small firms rely more on financial institutions and credit lines, they are likely to have less demand for holding cash compared to larger firms. On the other hand, large firms are more diversified and therefore have a smaller demand for precautionary balances.

On the liability side of the balance sheet, Portuguese firms have on average nearly 50% equity, which is a higher percentage than reported by Hall et al. (2004) for European SMEs but in line with the findings of Berger & Udell (1998) for US SMEs. This figure is also a bit higher than for Spanish SMEs with a ratio of about 40% (Sogorb-Mira (2005)). The amount of current liabilities for Portugal ranges from 33% to 40% reflecting the use of trade credit as a financing source. The ratio of trade credits to total assets ranges from 16% to 23%, which is in line with US SMEs (Berger & Udell (1998)) but slightly higher than the UK figure at 11%, as reported by Poutziouris, Michaelas, & Soufani (2005).

Dividing the sample by size quintiles shows some differences between large and small firms.[8] Small firms have a larger percentage of current assets, in particular a larger value of debtors and cash and cash equivalents. This is not a surprise given that small firms use more trade credit as a source of financing. They also give more credit to their customers. In terms of cash and cash equivalents, small firms need more liquidity because they do not have the same access to credit as their larger firm counterparts. On the liabilities side of the balance sheet, small firms have on average 5% less equity than larger firms, greater amounts of current liabilities, creditors and other current liabilities, including shareholders' loans. Therefore, small firms rely more on creditors and on shareholders' loans to finance their operations.

Although the Portuguese financial system differs from the US financial system, the financing of smaller firms seems to be similar, whereas there are significant differences between the financing of large public and smaller private firms. Thus, it appears that being large and public is a significant factor for determining the capital structure and it is therefore not clear whether results derived from a sample of these firms carry over to smaller private firms.

3.1. Measuring debt

The three main financing sources for Portuguese firms are bank loans, trade credit and internally generated equity. In general, trade credit is viewed as part of the working capital and therefore the focus of this paper is on bank loans. Data is available for both long-term debt, defined as debt with a maturity longer than one year, and short-term debt with maturity less than one year. Three different debt measures are utilized in the empirical analysis:

a) *TOTALLOANS* equal long-term bank loans plus short-term bank loans plus creditors minus debtors plus other current liabilities over the book value of total assets;
b) *LONGBANKLOANS* equal the book value of total long-term bank loans over the book value of total assets;
c) *SHORTBANKLOANS* equal the book value of total short-term bank loans over the book value of total assets.

In the sample 54.26% of firm-year observations report long-term bank loans, 76.32% have short-term bank loans and 81.88% report short and/or long-term bank loans. Indeed, the number of firms that report non-zero levels of long-term bank loans plus short-term bank loans is similar to those of previous studies (Graham, Lemmon, & Schalheim (1998)). Dividing the sample into 5 size groups based on the number of loans (??) shows that the percentage of firm-year observations with strictly positive levels of debt is higher for large firms than for small firms. Around 83% of large firms have some kind of debt, with 58% reporting long-term bank loans and 80% reporting

[6] Leased assets are included in Tangible Assets and under Other Non-Current Liabilities on the liability side of the accounts.

[7] The sample in Hall, Hutchinson & Michaelas (2004) consists of 500 companies from each country drawn from Dun and Bradstreet for 1995, whereas the present sample includes 998 companies over 10 years. It is not clear, whether the definitions of the items are different between the two samples and whether these differences are due to the different nature of the samples.

[8] The relevant table is not shown but available upon request. For the purpose of refereeing, "Available upon request" tables are included in a separate file.

short-term bank loans. For small firms, 80% report the use of debt, but only 49% report long-term bank loans. This is in spite of the fact that the percentage of some kind of debt is quite similar across both small and large firms. Large firms use long-term debt more often and so there is a distinct difference in the use of bank debt between small and large firms. A relatively large number of small firms rely solely on short-term debt (32%) and in general fewer small firms report the use of long-term debt only (7%).

3.2. Tax variables

For smaller firms with few owners, it may be that it is advantageous to borrow on personal account instead of on the corporation's behalf. However, this is not the case in the Portuguese system. The tax advantage of debt is given by (Miller (1977)):

$$\left[1-\frac{(1-\tau_c)(1-\tau_e)}{1-\tau_{pi}}\right]$$

where τ_c is the corporate tax rate ranging from 36% to 32% over the sample period, τ_e is the highest personal tax rate on capital gains income (50%) and τ_{pi} is the personal tax rate (20%) on interest income. The highest dividend tax is 40%. The tax advantage of corporate debt is around 50%, slightly above those of the G7 countries reported in Rajan & Zingales (1995).

In order to test for tax effects, a measure of the corporate marginal tax rate is required. In the existing literature, several different proxies are used; these include statutory tax rates, non-debt tax shields, tax loss carry-forwards, dummy variables and taxes paid (Bradley, Jarrell, & Han Kim (1984), Titman & Wessels (1988), Bartholdy, Fisher, & Mintz (1989), MacKie-Mason (1990), Scholes, Wilson, & Wolfson (1990) and Sogorb-Mira (2005)).[9] Graham (1996a,b) and Graham et al. (1998) have developed a method for estimating the firm specific marginal tax rate. Graham's estimation includes and tries to mimic the tax code's treatment of net operating losses, investment tax credits and the alternative minimum tax. He finds that corporate marginal tax rates relate positively to capital structure, that is, the tax shield of debt matters in determining the capital structure. Alworth & Arachi (2001) also use this approach on a panel data set of Italian firms for the years 1982–1994. Below, three measures of the marginal tax rates developed by WHO (??) are utilized:

a) MTREBIT: *Before-financing marginal tax rate,* a simulated marginal tax rate based on income after depreciation but before interest expenses are deducted;
b) KINK: Calculated as earnings before interest and taxes over interest[10];
c) STAND: Standardized kink is defined as kink time interest over the standard deviation of earnings before interest.

3.2.1. MTREBIT — before-financing marginal tax rate

The marginal tax rate is defined as the present value of current and expected future taxes paid on an additional unit of income earned today. The estimation involves three sets of inputs: the current tax rules, in particular how losses are treated, the statutory tax rate and expected future earnings.[11] In order to avoid endogeneity problems between the marginal tax rate and the capital structure decision, Graham et al. (1998) suggest using income before interest and Graham (2003) suggests lagging the estimated marginal tax rate one period.

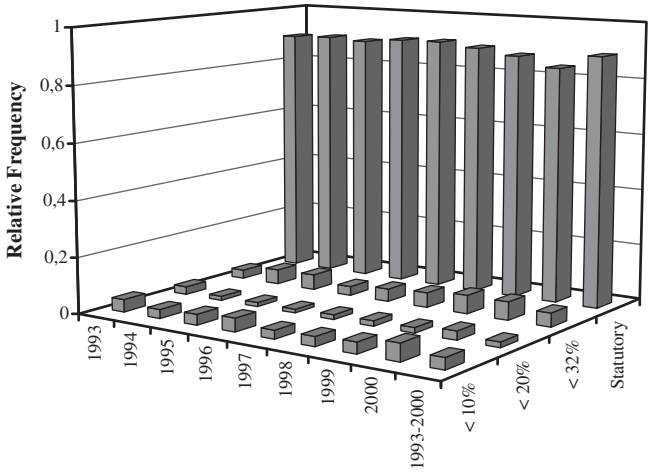

Fig. 1. Before-financing marginal tax rates (*MTREBIT*).

Fig. 1 shows the distribution of the "before-financing" marginal tax rate for 5828 firm-year observations.[12] For about 89% of the observations (firm years) of *MTREBIT,* the income before interest and taxes is positive and the before-financing marginal tax rate is therefore equal to the statutory tax rate. The remaining 11% have negative earnings before interest and taxes and from this group 22% have a marginal tax rate of zero (the losses against the profits could not be offset in the 5 or 6 following years). The years 1993 and 1996 are the ones in which the percentage of the marginal tax rate of zero is higher compared with the number of observations with negative earnings before interest and taxes (around 28%), while 1998 is the year with the lowest value (14%). The remaining 78% of firms have a marginal tax rate ranging between zero and the statutory tax rate. The annual average marginal tax rates from 1993 to 2000 are 33.7%, 34.2%, 34.08%, 33.88%, 32.48%, 32.3%, 32.00% and 29.2%, respectively. Part of this variation is generated by the change in the statutory tax rate over the years. To the extent that the earnings forecasts are biased upwards, as suggested in Appendix A and Table A1, too many firms may have been assigned the statutory tax rate as their marginal tax rate.

A higher marginal tax rate implies that an increase in debt will decrease taxes more for a firm with high marginal tax rates than for firms with low marginal tax rates. Thus, the marginal tax rate should have a positive correlation with the level of debt.

3.2.2. Kink

This variable is adapted from Graham (2000) and measures whether firms use debt conservatively or aggressively, i.e. whether debt is used to minimize taxes. An aggressive firm with positive earnings before interest and taxes will issue just enough debt to ensure that earnings after interest but before tax are zero, whereas a conservative firm will issue less debt and therefore faces positive taxes. Firms with positive earnings after interest payments can increase their level of debt and interest payments and achieve marginal tax benefits equal to the statutory tax rate. For firms with negative earnings after interest payments, the marginal benefits of increasing debt are smaller than the statutory tax rate. To measure these effects, a variable labeled kink is defined as the ratio between earnings before interest and taxes (i.e. the amount of interest required to make earnings equal to zero) and the actual interest paid. If kink is less than one, then earnings before tax are less than the actual interest paid and earnings after interest are therefore negative. This represents an aggressive debt policy, whereas if kink is above one, then earnings after interest are positive and the firm uses debt more conservatively.

[9] The results from these variables are consistent with the analysis presented below, and they are available upon request.
[10] An alternative measure based on bank interest paid was also used with similar results.
[11] For details of the calculations, see Appendix A.
[12] Years 1990, 1991 and 1992 are excluded due to the marginal tax rate calculation.

Thus, conservatism and kink are positively related, and kink and debt levels are negatively related. In addition, kink and the marginal tax rate have a positive correlation. Fig. 2 shows the relation between the marginal tax benefit of debt and the kink variable.

3.2.3. Standardized kink

As referred by Graham (2000), firms with large values of kink use debt conservatively. However, the degree of conservatism is also a function of the degree of volatility of the earnings. If two firms have the same value for the kink variable, but one has more volatile earnings than the other, then the firm with more volatile earnings has a less conservative approach. The reason for this is that the probability of being on the downward sloping part of the benefit curve (aggressive debt policy) in the future is higher for a firm than for the firm with lower volatility. To capture this, a standardized kink variable should be constructed as interest multiplied by kink divided by the standard deviation of earnings before interest and taxes. This is a measure of the flat part of the benefit curve in Fig. 2 per unit of earnings volatility. If the probability of the firm staying in the "flat" part is lower (low standardized kink values), then there is less advantage to using debt as a tax shield. Thus, a positive relation between this variable and debt levels is expected.

3.3. Control variables: agency, asymmetric information and bankruptcy variables

Next, we need to control for asymmetric information, agency costs and expected bankruptcy. Previous empirical work on capital structure suggests that the collateral value of, among others, assets, profitability and size, volatility of earnings, growth, bankruptcy probability, nominal interest rates, inflation rates, interest rate spreads, unemployment rates, years of incorporation and financial distress may have an influence on the capital structure.

A firm with a high percentage of tangible assets in relation to total assets can support a higher debt level because it can use these assets as collateral for loans and thus reduce the expected bankruptcy costs. On the other hand, a high percentage of fixed assets also implies a higher operating risk, which increases the probability of bankruptcy, suggesting a negative relation between fixed assets and debt. Therefore, considering the bankruptcy theory, the parameter can be either positive or negative.

High levels of fixed assets can reduce agency costs associated with risk shifting if the assets are used as collateral and appropriate covenants are written into the debt contracts. Finally, the problem of underinvestment (Myers (1977)) is reduced if a large proportion of the firm's assets are fixed. Thus, agency theory suggests a positive correlation between debt and fixed assets. Both Rajan & Zingales (1995) for G7 countries and Hall et al. (2004) for European SME's found that this factor is positive and significant for long term debt.

In general, profitable firms generate more cash than less profitable firms do for a given level of debt. Therefore, profitable firms have a smaller probability of default and lower expected bankruptcy costs. As Jensen (1986) describes, the generation of cash may entice managers to build empires and undertake projects with negative NPV. Increasing the level of debt for profitable firms serves as a bonding mechanism to reduce the tendency of managers to waste funds on negative NPV projects. These two arguments suggest a positive relation between debt and profitability. However, Myers & Majluf (1984) argue that informational asymmetries cause firms to prefer internally generated funds to debt; this is referred to as the pecking order theory. As profitable firms generate more cash than less profitable firms do, the expectation under the pecking order theory is that profitable firms have less debt in their capital structure. Titman & Wessels (1988) find a negative relation between profitability and leverage, whereas Rajan & Zingales (1995) find mixed evidence for different countries — the same as in Hall et al. (2004) for European SMEs. Given that this sample consists of primarily bank-financed firms where banks are capable of solving the ex-ante asymmetric information problem through continuous monitoring and renegotiation of debt contracts, it is expected that asymmetric information is not a major problem when a firm wants to add additional debt from the same bank to its balance sheet. Therefore, we anticipate a positive relation between profitability and debt levels and define this variable in the same way as in Titman & Wessels (1988) and Rajan & Zingales (1995), as earnings before interest and taxes divided by book value of assets. An alternative measure is defined as return on assets (ROA) calculated as earnings after taxes and interest over total asset.

In general, intangible assets have poor values as collateral for loans, which leads to a negative correlation between debt and the amount of intangible assets. Intangible assets may also be a measure of asymmetric information, since these assets are very opaque to external creditors, and thus negatively correlated with debt. Finally, these assets may represent future growth opportunities or real options and, in line with Myers (1977), the increased debt may lead to underinvestment. Therefore, a negative correlation is expected.

Given that there are fixed costs associated with bankruptcy and that large firms in general have lower probability of bankruptcy compared to small firms, we expect that large firms have more debt in their capital structure than smaller firms. Rajan & Zingales (1995) and Hall et al. (2004) find a significant positive effect of the size variable across their respective samples of G7 and European SMEs. This variable is calculated as the natural logarithm of the book value of total assets.

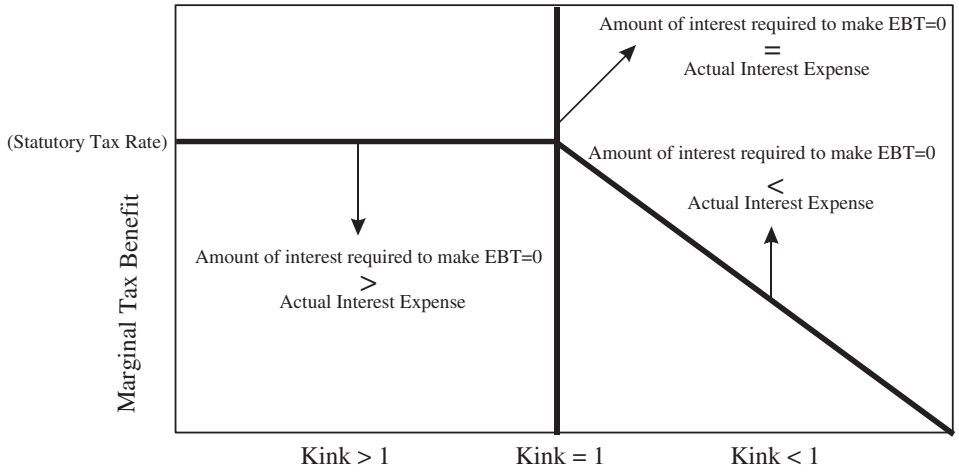

Fig. 2. Marginal tax benefit and kink.

As increases in business risk augment the probability of bankruptcy, it is expected that the level of business risk is negatively correlated with the amount of debt. As a business risk proxy, the standard deviation of return on assets is used below.

A fast growing firm is often viewed by the banking sector as a healthy firm with smaller probability of bankruptcy and therefore growth is expected to be positively correlated with debt levels. An alternative interpretation is that high growth firms have more real options for future investments than low growth firms do. If high growth firms decide to issue debt, then this may lead to underinvestment, as discussed by Myers (1977). In addition, the potential for risk shifting and other agency problems between shareholders and creditors increases with high growth. Thus, agency theory suggests a negative relationship between debt and growth. Asymmetric information theory also predicts a negative relationship between debt and growth since asymmetric information is more of a problem for high growth firms. This variable is defined as the percentage change in total assets. In their sample, Hall et al. (2004) find mixed evidence of growth being positive for some countries and negative for other countries.

If bankruptcy is costly, then the amount of debt should be a decreasing function of the probability of bankruptcy. This paper uses a modified version of the discriminant function for bankruptcy prediction found in Altman (1968). We expect a negative correlation between the modified version of Altman's Z-Score and debt levels.[13]

An increase in the nominal interest rates augments the cost of borrowing and it is expected that firms will borrow less. Since nominal interest rates and inflation rates are highly correlated, these two variables may capture the same effects and therefore only one of the two is used.

The difference between short and long-term interest rates can have a positive or negative impact on debt levels. We calculate this variable as the difference between short-term and long-term interest rates (given by the three-month risk-free rate and the ten-year Treasury bond rate, respectively). A decrease in the spread makes long-term financing relatively more expensive and so it is expected that firms will make more use of short-term financing and roll it over as required. Thus, we anticipate that the spread variable is positively related to long-term debt and negatively related to short-term debt.

We can use the age of the firm as a proxy for available information about the firm. For young firms there is very little information available. In general, it is difficult to obtain bank loans of any kind if the firm does not have a financial history, and so a positive relation between this variable and debt levels is expected. As in Giannetti (2003), we calculate this variable in terms of the natural logarithm of the number of years since the date of incorporation of the firm. Again, Hall et al. (2004) find mixed evidence across their sample of European SMEs.

3.4. Descriptive statistics

Panel A of Table 3 reports summary statistics for the levels of the different debt measures. On average, long-term bank loans account for 7.04% of total liabilities, short-term bank loans 10.23% and both short and long-term bank loans 17.27%. On average, the debt measure *TOTALLOANS* calculated as long-term bank loans plus short-term bank loans plus creditors minus debtors plus other current liabilities accounts for 14.40% of total assets, which indicates that the amount of debtors is higher than creditors plus current liabilities for this sample. If firm-year observations with no debt are excluded, then the average long-term bank loans account for 12.85% of total assets, short-term bank loans for 13.38% and short and long-term bank loans for 20.99% (not reported).

Table 3
Summary statistics.

Variable	Mean	Median	Std deviation	Min	Max
Panel A: debt levels					
LONGBANKLOANS	0.0704	0.0148	0.1009	0.0000	0.8160
SHORTBANKLOANS	0.1023	0.0667	0.1121	0.0000	0.6891
BANKLOANS	0.1727	0.1522	0.1515	0.0000	0.9305
TOTALLOANS	0.1440	0.1420	0.2191	−0.8867	0.9459
Panel B: tax variables					
MTREBIT	0.3383	0.3600	0.0618	0.0000	0.3600
KINK	3.3290	1.7689	3.0636	0.0000	8.0000
STAND	1.5550	0.9650	2.0154	0.0000	30.289
Panel C: agency, asymmetric information and bankruptcy variables					
INTANGIBLE	0.0113	0.0017	0.0361	0.0000	0.6266
TANGIBLE	0.3918	0.3826	0.1754	0.0023	0.9699
PROFITABILITY	0.3490	0.2978	0.2658	−0.5224	4.6165
SIZE	6.3052	6.2649	0.5529	4.5547	8.5109
BUSINESS RISK	0.0436	0.0349	0.0375	0.0003	0.4890
GROWTH	0.1081	0.0552	0.5639	−0.9911	2.2482
ZSCORE	1.5826	1.4617	0.9751	−1.7582	1.2537
INTEREST	0.0848	0.0726	0.0425	0.0304	0.1634
DIFFINTEREST	−0.0029	−0.0070	0.0171	−0.0174	0.0374
INFLATION	0.0540	0.0410	0.0348	0.0220	0.1340
UNEMPLOYMENT	0.0622	0.0650	0.0143	0.0380	0.0830
AGE	1.3439	1.3802	0.3614	0.0000	2.3856
ROA	0.0197	0.0125	0.0738	−1.1367	1.3484

The sample consists of 7765 observations for firms from the Bank of Portugal Statistical Department's database with CAE codes between 15,000 and 36,000 over the period 1990 through 2000. Total Assets is the book value of total assets. *LONGBANKLOANS* is the book value of total long-term bank loans over book value of total assets. *SHORTBANKLOANS* is the book value of total short-term bank loans over book value of total assets. *BANKLOANS* is the book value of both total short and long-term bank debt over total assets. *TOTALLOANS* is defined as long-term bank loans plus short-term bank loans plus creditors minus debtors plus other current liabilities over the book value of assets. *MTREBIT* is the before-financing marginal tax rates simulated on the basis of income after depreciation but before deduction of interest expenses. *KINK* is defined as the ratio of the amount of total interests required to make the tax function slope downward and the actual interest expenses. *STAND* is calculated as total interest times kink divided by the standard deviation of earnings before interest and taxes. *INTANGIBLE* is the book value of intangible assets divided by total assets. *TANGIBLE* is the book value of tangible assets divided by total assets. *PROFITABILITY* is the earnings before interest and taxes divided by the total assets. *SIZE* is the natural logarithm of total assets. *BUSINESS RISK* is the standard deviation of return on assets by firm. *GROWTH* is calculated as the percentage change in total assets. *ZSCORE* is a modified version of Altman's (1968) Z-Score. *INTEREST* is the three-month risk-free interest rate. *DIFFINTEREST* is the difference between long-term and short-term interest rates. *INFLATION* is the annual inflation rate. *UNEMPLOYMENT* is the annual unemployment rate. *AGE* is the natural logarithm of the number of years from the date of incorporation of the firm. *ROA* (return on assets) is defined as earnings after taxes and interests over total assets.

In Panel B, the summary statistics for the tax variables are presented. The value of the *before-financing* marginal tax rate ($MTREBIT_t$) is 33.56, with a maximum value of 36% (maximum value for the statutory tax rate) and a standard deviation of 6.40. The mean value of kink indicates that the average firm can increase total interest deductions 2.32 times before the marginal benefit begins to decline.[14] The average firm has a standardized kink of 1.56. Firms with standardized kink values between 1.5 and 7.0 have benefit functions which are more than 2 standard deviations in length[15] (table not reported). This means that firms with high kink values can stay in the flat part of their benefit function in most of the scenarios and therefore use the full benefits of debt.

[13] This variable is defined as:

$$3.3\frac{\text{EBIT}}{\text{Total Assets}} + 1.0\frac{\text{Sales}}{\text{Total Assets}} + 1.4\frac{\text{Retained Earnings}}{\text{Total Assets}} + 1.2\frac{\text{Working Capital}}{\text{Total Assets}}$$

[14] The maximum kink value was limited to 8. The benefit function for a firm in kink equal to 1.5 is downward sloping for interest deductions greater than 1.5 times those actually taken. Firms with negative EBIT have a benefit curve which is downward sloping for the first Euro of interest expenses.

[15] These results are in line with Graham (2000).

Table 4
Instrumental Variables (IV) Regressions.

Panel A. Dependent Variable: TOTALLOANS

Tax Variable	MTREBIT $_{t-1}$	KINK	STAND
	0.8623*	−0.0232*	0.0154*
	(3.5942)	(−3.7024)	(2.7653)
Other Variables			
TOTALLOANS $_{(t-1)}$	0.8512*	0.8270*	0.8402*
	(72.824)	(63.411)	(69.531)
INTANGIBLE	0.2064	0.0100	0.0254
	(0.5843)	(0.0339)	(0.0788)
TANGIBLE	0.3078*	0.2356*	0.2523*
	(3.8626)	(3.5335)	(3.4592)
PROFITABILITY	0.0906	0.1132**	0.1035***
	(1.5200)	(2.2256)	(1.8681)
SIZE	−0.0366	−0.0224	−0.0318
	(−1.5667)	(−1.1499)	(−1.4884)
BUSINESS RISK	−0.6504	-0.3649	−0.3353
	(−1.2678)	(−0.9100)	(−0.7038)
GROWTH	0.6036*	0.5327*	0.5708*
	(5.1897)	(5.3235)	(5.2898)
ZSCORE	−0.1030*	−0.0768*	−0.0911*
	(−4.5256)	(−4.3059)	(−4.5159)
INTEREST	−1.0785*	−1.0682*	−0.9077*
	(−4.4023)	(−5.0416)	(−4.1502)
AGE	0.0372	0.0371	0.0393
	(1.0202)	(1.2238)	(1.1919)
ROA	−1.5931*	−1.2956*	−1.7630*
	(−3.3919)	(−3.1027)	(−4.1280)
DISTRESS	0.2124*	0.0689***	0.1393*
	(3.8350)	(1.6692)	(2.6918)
Constant	0.1331	0.3956**	0.3519**
	(0.6410)	(2.5343)	(2.0208)
Target Adjustment Coefficient	0.1488	0.1730	0.1598
Adjusted R-Squared	0.7493	0.7484	0.7465

Panel B. Dependent Variable: Long and Short-Term Bank Loans

	Long-Term Bank Loans			Short-Term bank Loans		
Tax Variable	MTREBIT $_{t-1}$	KINK	STAND	MTREBIT $_{t-1}$	KINK	STAND
	−0.1079	−0.0104*	0.0096*	0.4193*	−0.0150*	0.0120*
	(−1.1481)	(−5.4443)	(3.4306)	(3.8527)	(−6.2030)	(2.8075)
Control Variables						
Lag Dep Var	0.8086*	0.7897*	0.8022*	0.8316*	0.7997*	0.8160*
	(50.082)	(46.726)	(49.516)	(45.439)	(40.369)	(41.859)
INTANGIBLE	0.1513	0.0769	0.0892	−0.3245***	−0.3437**	−0.3425*
	(0.7469)	(0.4262)	(0.4625)	(−1.8730)	(−2.4691)	(−2.240)
TANGIBLE	0.0592***	0.0584**	0.0647**	−0.1327*	−0.1389*	−0.1320*
	(1.7962)	(2.0018)	(2.0773)	(−3.3263)	(−4.2678)	(−3.7044)
PROFITABILITY	0.0086	0.0047	−0.0022	−0.0400	−0.0224	−0.0335
	(0.4360)	(0.2661)	(−0.1168)	(−1.4281)	(−0.9998)	(−1.3410)
SIZE	0.0117	0.0188**	0.0161***	0.0033	0.0073	0.0002
	(1.2407)	(2.1914)	(1.7677)	(0.2728)	(0.7207)	(0.2126)
BUSINESS RISK	−0.4508*	−0.2587**	−0.1914	−0.1895	−0.1778	−0.1194
	(−3.4452)	(−2.4004)	(−1.5613)	(−0.8489)	(−1.1313)	(−0.6039)
GROWTH	0.1824*	0.1569*	0.1651*	0.1883*	0.1598*	0.1717*
	(3.7294)	(3.6982)	(3.6661)	(3.9030)	(4.0840)	(4.0427)
ZSCORE	−0.0260*	−0.0209*	−0.0259*	0.0009	0.0088	0.0035
	(−4.2695)	(−3.7697)	(−4.4465)	(0.0783)	(1.0509)	(0.3632)
INTEREST	−0.2419**	−0.3895*	−0.3057*	−0.3974*	−0.3866*	−0.2643**
	(−2.0509)	(−3.7023)	(−2.8316)	(−2.5948)	(−3.0902)	(−1.9717)
AGE	−0.0067	0.0000	−0.0010	0.0126	0.0157	0.0160
	(−0.4133)	(0.0018)	(−0.0693)	(0.6355)	(0.9885)	(0.9141)
ROA	−0.1880**	−0.0050	−0.1701**	−0.8743*	−0.5211*	−0.7999*
	(−2.0817)	(−0.0621)	(−1.9607)	(−4.6914)	(−3.8783)	(−5.0516)
DISTRESS	−0.0152	−0.0321***	−0.0030	0.0489***	−0.0047	0.0393***
	(−0.7559)	(−1.7913)	(−0.1641)	(1.7871)	(−0.2230)	(1.6620)
Constant	0.0983	0.0401	0.0062	0.0780	0.2188*	0.1773**
	(1.2219)	(0.6100)	(0.0880)	(0.7247)	(2.6921)	(1.9848)
Target Adjustment Coefficient	0.1914	0.2103	0.1978	0.1684	0.2003	0.1840
Adjusted R-Squared	0.5692	0.5772	0.5743	0.5826	0.5825	0.5776

The sample consists of 7765 firm-year observations over the period 1990 through 2000. The following regression is estimated: $D_{i,t} = \gamma\alpha + \gamma\beta_{TAX} TAX + \gamma\beta_Z Z_{i,t} + (1-\gamma) D_{i,t-1} + e_{i,t}$. $D_{i,t}$ is the debt level of firm "i" in year "t". α is the constant term. γ is the target adjustment coefficient. TAX is the taxation proxy accounting for the effect of corporate taxes on capital structure (previously defined) and the model is estimated once for each variable Z_{it} is a vector of variables representing agency, asymmetric information and bankruptcy effects. e_{it} is the error term. White heteroskedasticity-consistent t-statistics in parenthesis. Superscript * indicates statistical significance at the 0.01(*), 0.05 (**) and 0.10 (***) percent levels. A two-stage least square estimation procedure is used. Industry dummy variables are included in the regressions, but the coefficients are not reported.

Panel C provides the sample statistics for the control variables. The average intangible and tangible assets are 1.13 and 39.18% of total assets. Earnings before interest and taxes are 34.90% of the total assets on average. Firms have an average growth measured as the percentage change in total assets of 10.81%. The measure of financial distress, Z-Score, averages about 1.58 for all firm-year observations, but there is wide dispersion on this number (standard deviation of 0.97). The macroeconomic variables, short-term interest rate, interest rate spread, inflation and unemployment rate, are on average 8.48, −0.29, 5.40 and 6.22%, respectively. Regarding the number of years from the incorporation of the firm, the average value is 22 years with a standard deviation of 2.3 years and a maximum of 243 years.

4. Results

4.1. Testing for a tax effect on leverage

The model used to test for tax effects is given by:

$$D_{it} = \gamma\alpha + \gamma\beta_{TAX}TAX + \gamma\beta_{Z}Z_{it} + (1-\gamma)D_{it-1} + e_{it} \quad (1)$$

TAX is one of the tax variables and Z contains the variables representing the agency, asymmetric information and bankruptcy effects discussed above. The initial model is a fixed effects model with firm specific effects.[16] Looking at Fig. 1, it is clear that the marginal tax rate is constant at the statutory rate for most of the firms over most of the years and there is little variation in the statutory tax rate. Having a firm specific dummy variable and the marginal tax rate in the same regression is likely to result in an insignificant tax variable; on the other hand, leaving the dummy variable out means that the tax variable will "pick up" the effects from the unobservable variables making interpretation of this variable difficult. A compromise solution is to use a set of industry dummy variables instead of firm specific dummy variables.

The next estimation problem is the lagged dependent variable on the right hand side of the equation. If there is auto-correlation in the residuals, then the lagged dependent variable and the error term are correlated, leading to biased and inconsistent estimates. A simple application of the Hausman test confirms this. In order to avoid this problem, an instrumental variables (IV) estimator is used. As an instrument for the lagged dependent variable, the dependent variable lagged for 2 periods is used. Unfortunately, with this procedure 998 firm–year observations are lost.[17]

Table 4 (Panels A and B) presents the results from the pooled time series' cross-sectional IV regressions for the 3 different measures of debt levels. The measures short-term and long-term debt have problems given that some firms may roll over short-term debt and use it for long-term financing due to lower rates or more flexibility. Also, some short-term bank debt is technically short-term debt, but gets renewed each year and is therefore for practical purposes long-term debt. This suggests using the sum of short and long-term debt as a measure, but parts of short-term debt have nothing to do with capital structure decisions since the amount is determined by working capital requirements. Thus, neither the sum of long and short-term debt nor each of them stated separately will provide a good measure of the amount of debt. The alternative measure TOTALLOANS can bypass these problems, being calculated as long-term bank loans plus short-term bank loans plus creditors minus debtors plus other current liabilities over the book value of assets. This is an attempt to remove the impact of working capital requirements from short-term debt. The results for this measure are also presented in Table 4. In terms of explanatory power, the R-squared for both short and long-term bank debt regressions is around 57% whereas for TOTALLOANS the R-squared is around 75%, thus providing a significantly better fit.

The model is estimated once for each tax variable, including the control variables, and this generates a total of three regressions for each of the three different measures of debt. The 9 regressions are reported in Table 4 (??), as are the target adjustment coefficient and the adjusted R-squared. The control variables used in each regression are: *INTANGIBLE*, *TANGIBLE*, *PROFITABILITY*, *SIZE*, *BUSINESS RISK*, *GROWTH*, *ZSCORE*, *INTEREST*, *AGE* and *ROA*. The control variables *DIFFINTEREST*, *INFLATION* and *UNEMPLOYMENT* are left out due to high correlation with *INTEREST*.[18]

4.1.1. Tax variable

For the total leverage, TOTALLOANS (Table 4, Panel A), all the tax variables are strongly significant; thus, there is evidence of a strong tax effect in the sample with a stronger effect for short-term debt than for long-term debt (Table 4, Panel B). Part of the explanation for this may be that it is easier to adjust the amount of short-term debt: if earnings are high, then the firm increases the amount of short-term debt to take advantage of the tax shield and if earnings are low, then they reduce the amount of short-term debt since the tax shield has little value.

For long-term bank loans (Table 4, Panel B) KINK and STAND are significant with the predicted signs whereas MTREBIT is not significant. As discussed in the Appendix A, the estimates of MTREBIT may be biased upwards since the estimates of future earnings used to construct MTREBIT may be too high. The high earnings estimates increase the estimates of the marginal tax rate and the statutory tax rate is assigned as the marginal tax for "too many firms". Under "normal circumstances", if an explanatory variable is scaled upwards in a regression, for example changing the measurement from cents to dollars, then the estimate of the parameter will be reduced without affecting the significance of the parameter. However, in this case, we may have too high earnings estimates, indicating that too many firms are assigned the statutory tax rate as the marginal tax but the statutory tax rate is constant across firms. This reduces the variation in this variable, both influencing the parameter estimate and reducing the significance level of the variable. As discussed in the Appendix A, it is not possible to ascertain whether the procedure produces biased estimates of earnings or whether the high earnings are due to statistical chance. However, we do know that if it is biased, then it will be towards making MTREBIT insignificant.

The results for short-term bank loans differ from the long-term bank loan case. The main difference is with *MTREBIT* which is now statistically significant at the 1% level and has the predicted sign. Therefore, it appears that an increase in the marginal tax rate will induce firms to increase short-term bank loans in order to exploit the tax benefits of debt. Compared to long-term bank debt, the coefficients on the tax variables are larger, which indicates that tax considerations are more important for short-term debt than for long-term debt. The potential importance of short-term debt in capital structure has been highlighted by Scholes et al. (1990). They argue (p. 170) that firms facing uncertainly in their tax status may prefer to use short-term debt when their tax rate is high. In this setting, short-term debt will be the least costly and easiest way to adjust debt levels temporarily to a firm's optimum, and the potential cost of retiring outstanding debt in the future is avoided. Therefore, a correct measure of debt to capture the tax effects in capital structure should include short-term debt as part of its calculation.

[16] A Hausman test was performed and the the random effects model was rejected.

[17] We also removed the most extreme 0.5% values in either tail of the distribution. This procedure reduced the sample to 6730 observations and 898 firms. However, the main results did not change so they are not reported.

[18] The regressions were also run with *INFLATION*, *DIFFINTEREST* and *UNEMPLOYMENT* instead of *INTEREST*. The results do not differ from the ones with the variable *INTEREST* included and are therefore not reported here. These variables are, however, included in the robustness test at the end of the paper.

4.1.2. Bankruptcy measures

The primary measures of bankruptcy effects are TANGIBLE, SIZE, BUSINESS RISK ZSCORE and ROA. Except for SIZE, these variables are all significant for long-term bank debt with the predicted signs. However, for short-term debt only TANGIBLE and ROA are significant. Thus, it appears that bankruptcy considerations are not as important for short-term debt as for long-term debt. For TOTALLOANS (Table 4, Panel A) all the variables, except for SIZE and BUSINESS RISK, are significant but SIZE has the "wrong sign" since it is negative. The evidence points toward bankruptcy and the availability of collateral as important factors in the determination of capital structure for private firms. This is consistent with Frank & Goyal (2003) who demonstrate that collateral availability is one of the most reliable factors in capital structure decisions for US firms. Thus, firms that have more collateral tend to have more leverage.

4.1.3. Agency/asymmetric information variables

The agency variables are INTANGIBLE, PROFITABILITY, GROWTH and AGE. If the variable PROFITABILITY has a negative sign, it follows the asymmetric information (pecking order) theory which states that more profitable firms can finance more of their expenditures from internally generated funds. PROFITABLE is positive for long-term loans and negative for short-term loans. However, the coefficients are not statistically significant. For TOTALLOANS the parameter is positive and significant, rejecting the pecking order theory. In Rajan & Zingales (1995), the pecking order theory is supported by a negative significant coefficient for the USA, Japan and Canada but it is insignificant for the other countries. The rejection of the pecking order theory in this paper is surprising since the general intuition is that smaller firms (and high growth firms) operating in a less-developed financial system are more likely to suffer from adverse selection problems than larger public firms. The firms in this sample are solely financed by bank loans and trade credits whereas the large public firms used in Rajan & Zingales (1995) raise part of their funding from financial markets. The main difference between bank financing and market financing is that banks monitor the firms continuously, thus reducing the adverse selection problem, but charge a higher interest rate than financial markets. Firms can therefore obtain additional financing from banks much easier than if they have to approach the market where the lenders will first want to perform a credit evaluation (charging a fixed cost but lower interest rates). Thus, there is a higher probability that the pecking order theory applies to market-financed firms than to bank-financed firms. Since large firms are often market financed and smaller firms bank financed, these results are consistent with Frank & Goyal (2003) who find that for US firms the pecking order theory is more likely to be valid for large firms than for smaller firms — a result confirmed by Leary & Roberts (2010). However, Bharath, Pasquariello, & Guojun (2009) confirm the more common expectation that asymmetric information drives pecking order behavior and that small firms are more likely to follow the pecking order than large firms.

The finding that PROFITABILITY is positive is consistent with the view that these firms have a lower bankruptcy probability and therefore have a higher debt capacity. It is also consistent with the view that debt is used as a bonding mechanism refraining management from generating large amounts of (free) cash flows, as suggested by Jensen (1986). However, this sample deals with firms where managers and owners are often the same persons, reducing the need for a mechanism to restrain the activities of managers.

GROWTH is positive and significant for all three debt definitions, which rejects the underinvestment theory by Myers (1977). Finally, INTANGIBLE is only significant for short-term loans with a negative sign and AGE is not significant at all.

Thus, the agency-based measures from the balance sheet are not significant determinants of the capital structure of smaller private firms. But this is not the same as saying that they are not important *ex-ante*, only that we do not observe the implications of these factors *ex-post* on the balance sheet. Before the loan is issued, these smaller private firms are more prone to agency and asymmetric information problems compared to the large public firms in the G7 countries. If the solution to these problems were the same for private and public firms, then we would observe the same implications on the balance sheet, but the argument put forward here is that banks solve these problems differently to financial markets. The solution used by financial markets for large public firms is based on restricting the amount of debt and debt covenants, i.e. these solutions will appear on the balance sheet primarily in the form of a correlation between measures of agency problems and the amount of debt. Financial institutions, on the other hand, solve these problems primarily off the balance sheet by continuous monitoring and the threat of renegotiation or withdrawal of the debt contract if problems arise. Thus, the lack of significance of the agency variables does not imply that agency and asymmetric information problems are not important but merely that for smaller bank-financed private firms, it may not be possible to test for agency problems based on balance sheet data.

4.2. Robustness of tax results

By definition, debt ratios are restricted to values between zero and one. The model is therefore re-estimated using Tobit regressions with double censoring. The results are similar to the results presented in Table 4. In addition, the analysis is repeated for firms with strictly positive debt, again without qualitative differences. Finally, a dynamic model with firm specific effects is estimated using Arellano and Bond's estimation technique. The marginal tax rate is insignificant with a negative sign. However, as discussed previously, there is limited variation in the marginal tax rate (Fig. 1), which causes problems when firm specific effects are assumed.[19] The sign on the marginal tax rate is correct but insignificant if the marginal tax rate is not lagged one period.

As a final robustness check, the so-called "global sensitivity analysis" advocated by Leamer (1985) is applied. The analysis undertaken above has several problems. Firstly, it involves running a large number of regressions before settling on the one presented in Table 4 and there is always the risk that the results reported are outliers chosen because of the significance of the focus variable (here the tax variables). Secondly, the significance of the marginal tax variable may be driven by one industry or a few firms and therefore the results are not generally applicable. To analyze whether these problems have an influence on the results reported in the paper, the model is estimated dropping one of the control variables at a time as well as adding control variables not included in Table 4, making a loop of regressions. For each of these loops, first one industry at a time, then one firm at a time and in the end all observations from 1 year are dropped. Finally, the whole procedure is repeated without industry dummies and for OLS and IV estimation techniques leading to 15,225 regressions. Fig. 3 presents the resulting parameter estimates and t-statistics for the marginal tax rate for the three dependent variables.[20] As seen from Fig. 3, the average coefficients and t-statistics do confirm the ones from Table 4. In addition, the results for the other tax variables also corroborate the ones from Table 4. Thus, the results reported in the paper are not driven by any particular firm, industry, year or control variable configuration. Therefore, the conclusion is that the results reported are robust.

5. Conclusions

The purpose of this paper is twofold: first, to test for the impact of the debt tax shield on the capital structure choice of private firms and, second, to test whether the factors determining the capital structure

[19] Results from the Tobit, positive debt and Arellano and Bond procedure are available upon request.

[20] The results for the other tax variable proxies are available upon request.

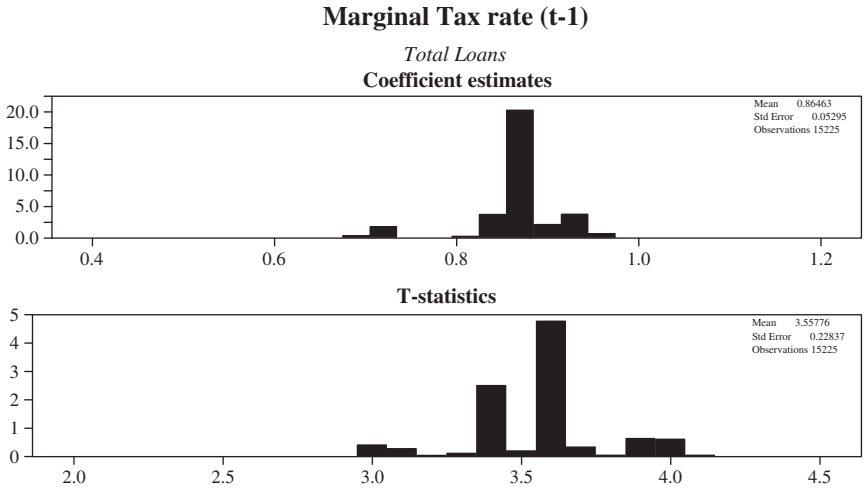

Fig. 3. Leamer histograms. The sample consists of 5769 firm-year observations over the period 1992 through 2000. The following regression is estimated: $D_{i,t} = \gamma\alpha + \gamma\beta_{TAX} TAX + \gamma\beta_Z Z_{it} + (1-\gamma) D_{i,t-1} + e_{i,t}$. $D_{i,t}$ is the debt level of firm "i" in year "t". α is the constant term. γ is the target adjustment coefficient. TAX is the marginal tax rate. $Z_{i,t}$ is a vector of variables representing agency, asymmetric information and bankruptcy effects. $e_{i,t}$ is the error term. The model is estimated dropping one of the control variables at a time, making a loop of 10 regressions For each of these loops, one industry is dropped at a time, then one firm at a time and in the end all the observations from 1 year. The procedure is repeated without industry dummies leading to 15,225 regressions.

of large public firms are also relevant for smaller private firms. The existing literature primarily focuses on testing various determinants of capital structure using public firms that are large in their respective countries. The sources of capital differ between these two types of firms. Large public firms have access to domestic as well as international financial markets whereas smaller private firms are primarily financed using owner provided equity and debt financing from financial institutions. Finally, asymmetric information and agency problems also differ between these two types of firms. Considering these differences, the question remains therefore whether the same factors are responsible for the capital structure choice in these two types of firms. First, it is found that there is a significant impact of the debt tax shield on the capital structure for smaller private firms. Second, the traditional variables used to model agency problems are generally not significant for smaller private firms, except for the variables used to model bankruptcy risk (collateral). This result is attributed to the fact that banks have an ex-post credible threat of withdrawing funds and increasing interest rates in cases where firms exploit moral hazard/agency problems whereas financial markets restrict the amount of debt and increase interest rates ex-ante to control for agency/moral hazard problems. Consequently, in studies of capital structure, one is more likely to find significant effects for the proxies for agency problems on balance sheet variables for large firms than for smaller private firms. This, of course, does not mean that agency and asymmetric information do not constitute a problem for smaller private firm, only that the solution to these problems differs between these two types of firms.

Appendix A. Estimation of the marginal tax rate

Estimating marginal tax rates requires an estimate of future taxable income. First, the sample is divided into six industry sectors (defined previously). For the n_3 firms with 4 years of consecutive data in sector "i", the following pooled model is estimated for each year "t":

$$\frac{EBIT_{i,j,t}}{SALES_{i,j,t}} = \alpha_i + \beta_{i,1}\frac{EBIT_{i,j,t-1}}{SALES_{i,j,t}} + \beta_{i,2}\frac{EBIT_{i,j,t-2}}{SALES_{i,j,t}} + \beta_{i,3}\frac{EBIT_{i,j,t-3}}{SALES_{i,j,t}} + \varepsilon_{i,j,t} \qquad for\ j = 1, n_3 \tag{1a}$$

However, not all firms have 4 years of consecutive data available and in order to include these firms in the sample, the following pooled models are also estimated:

$$\frac{EBIT_{i,j,t}}{SALES_{i,j,t}} = \alpha_i + \beta_{i,1}\frac{EBIT_{i,j,t-1}}{SALES_{i,j,t}} + \beta_{i,2}\frac{EBIT_{i,j,t-2}}{SALES_{i,j,t}} + \varepsilon_{i,j,t} \quad for\ j = 1, n_2 \tag{1b}$$

$$\frac{EBIT_{i,j,t}}{SALES_{i,j,t}} = \alpha_i + \beta_{i,1}\frac{EBIT_{i,j,t-1}}{SALES_{i,j,t}} + \varepsilon_{i,j,t} \quad for\ j = 1, n_1 \tag{1c}$$[21]

The next step is to simulate a set of earnings forecasts for the next 5 or 6 years for each company. If the firm has 4 years of consecutive data available, then model 1a is used and if it has 3 years of data, then model 1b is used and so forth. The forecast for "t + 1" is generated by:

$$\frac{EBIT_{i,j,t+1}}{SALES_{i,j,t}} = \widehat{\alpha_{i,t}} + \widehat{\beta_{i,t,1}}\frac{EBIT_{i,j,t}}{SALES_{i,j,t}} + \widehat{\beta_{i,t,2}}\frac{EBIT_{i,j,t-1}}{SALES_{i,j,t}} + \widehat{\beta_{i,t,3}}\frac{EBIT_{i,j,t-2}}{SALES_{i,j,t}} + e_{i,t} \qquad for\ j = 1, n_3$$

where e is a random draw with mean 0 and uses the variance of the error term for the individual firms from the estimation of Eq. (1a–c). The forecast for "t + 1" is then used to generate a forecast for year "t + 2" and so forth.

In order to test the efficiency of the above forecast, the following model is estimated:

$$\frac{Real_{j,t,f}}{Sales_{j,t}} = \alpha_t + \beta_t\frac{Forecast_{j,t,f}}{Sales_{j,t}} + \varepsilon_{j,t},f \qquad for\ f = 1, \ldots, 5 \tag{2}$$

where $Real_{j,t,f}/Sales_{it}$ is the known EBIT at time "t + f", divided by sales for firm "j", and $Forecast_{i,f\ t}$ is the earnings forecast "f" years ahead

[21] Notice that $n_1 > n_2 > n_3$. Thus, the firms with 4 years of consecutive data are also used to estimate the models 1b and 1c.

Table A1
Earnings forecast vs. real earnings. The following model is used to test the properties of the forecasted earnings from 1 to 5 years ahead:

$$\frac{Real_{j,t,f}}{Sales_{j,t}} = \alpha_t + \beta_t \frac{Forecast_{j,t,f}}{Sales_{j,t}} + \varepsilon_{j,t}, f \quad for\ f = 1, \ldots, 5$$

where $Real_{j,t,f}/Sales_{it}$ is the known EBIT at time "t + f", divided by sales for firm "j", and $Forecast_{i,f,t}$ is the earnings forecast "f" years ahead made at time "t". The sample consists of firms with 9 years of consecutive data: 4 years for estimation and 5 years of forecasts. Three periods are used: 1990–1998, 1991–1999 and 1992–2000. The sample comprises 1072 nine-year periods. To facilitate comparison with the method used by Graham et al. (1998) and Graham (2000), future earnings are estimated using a random walk with drift assumption:

$$\Delta I_{it} = \mu_i + \varepsilon_{it}$$

where ΔI_{it} is the first difference in pre-tax income of firm "i" in year "t", μ_i is the drift estimated as the sample mean of ΔI_{it} and ε_{it} is a normally distributed random variable with mean zero and variance equal to that of ΔI_{it} over the sample years. Superscript * indicates statistical significance at the 0.01(*), 0.05 (**) and 0.10 (***) percent levels.

	Forecast method			
	Present paper		Graham et al. (1998), Graham (2000)	
	α	β	α	β
One-year forecast	0.0168***	0.7005*	0.0182**	0.6125*
	(1.7261)	(4.2996)	(2.0585)	(4.7136)
Two-year forecast	0.0154**	0.7403*	0.0141***	0.5869*
	(1.6471)	(4.4418)	(1.6104)	(4.9489)
Three-year forecast	0.0327*	0.5374*	0.0248*	0.3697*
	(6.9634)	(5.0406)	(2.6055)	(2.7823)
Four-year forecast	0.0399*	0.2844*	0.0382*	0.2029*
	(6.2000)	(2.4548)	(5.8019)	(2.4924)
Five-year forecast	0.0323*	0.3819*	0.0142**	0.4374*
	(5.9666)	(3.5447)	(2.2592)	(5.8114)
Forecasts for all 5 years	0.0280*	0.5278*	0.0243*	0.3970*
	(8.4013)	(8.2638)	(5.0373)	(5.8281)

made at time "t". All variables are scaled by total sales at time "t". An unbiased forecast requires β_1 to be one and the constant term to be zero. To undertake this test, a sample of firms with EBIT available for at least nine consecutive years is selected: 4 years to estimate the coefficients and 5 years of forecasts in the future to compare the estimated results with those that the firm actually obtained.

As seen from Table A1, β is below one in general, but the constant term is not significant. The forecasts are therefore too large compared to the actual numbers over the period. Notice that the periods are overlapping and that therefore the results should be interpreted with care, i.e. they do not constitute a statistical test of the forecast ability of the models. In particular, it is not clear whether these results indicate a systematic bias or are just specific to the present period, and the size of the data set does not allow us to analyze this question in details. However, the method used in this paper performs slightly better than the method used by Graham (2000) and Graham et al. (1998). For one, two, three and four-year forecasts, the method in this paper outperforms Graham's method since β is closer to one whereas it performs slightly worse for the five-year forecast.

Under Portuguese tax rules, with no tax loss carry-backs, a firm with positive income has a marginal tax rate equal to the statutory tax rate. For a firm with negative income, the marginal tax rate is below the statutory rate due to the availability of tax loss carry-forwards. If the firm has negative taxable income, then an additional unit of income reduces the losses that can be carried forward and used to offset taxable income in future years, thus increasing future taxes. If the losses carried forward fully offset positive income the next year, year 1, then an additional unit of income in year 0 is fully taxed in year 2 (provided that tax losses carried forward do not fully offset the positive income in year 2). Thus, the marginal tax rate in year 0 of an additional unit of income is the statutory tax rate discounted for two periods, and therefore it is smaller than the statutory tax rate at time 0. If the firm is not able to generate positive income in the subsequent 5 or 6 years to offset the losses carried forward, then it is assumed that the marginal tax rate is zero.[22] Briefly, to estimate the marginal tax rate for a given firm in a given year, the following steps should be taken. First, the expected income is estimated by simulation of Eq. (1a–c) for the next 5 or 6 years. For each simulation, taxes and tax loss carry-forwards are calculated for each year. Next, the net present value of the expected taxes over the next 5 or 6 years is calculated. Then one unit of income is added to the reference year and the present value of the tax bill is recalculated (always taking into account the loss carry-forward provisions). Taking the difference between these two present values and calculating the average over the simulations provide an estimate of the marginal tax rate.

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