FIRM SIZE AND CAPITAL STRUCTURE: EVIDENCE USING DYNAMIC PANEL DATA

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Firm size and capital structure: Evidence using dynamic panel data

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Abstract

This paper suggests that the validity of the trade-off (TOT) and pecking-order (POT) theories in explaining financing decisions varies among small, medium and large firms. Using dynamic panel data tests in a sample of 3,439 Spanish firms over the period 1995-2003, results are partially consistent with both explanations but suggest a greater validity of pecking-order predictions for small firms. In small firms, the negative influence of profitability and the positive influence of investment opportunities and of intangible assets on firm debt predicted by the POT are heightened. However, no differences are observed between small and large firms in their speed of adjustment to the target leverage as suggested by the TOT.

JEL classification: G32. Keywords: capital structure, small firms, panel data, trade-off theory, pecking-order theory.

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1. Introduction

The finance literature offers two competing but not mutually exclusive models of financing decisions: the trade-off theory (TOT) and the pecking-order theory (POT). This paper analyzes whether the validity of both theories to explain capital structure varies among small, medium and large firms. The empirical analysis is carried out on a sample of Spanish firms using dynamic panel data over the period 1995-2003.

The TOT posits that firms maximize their value when the benefits that stem from debt (the tax shield, the disciplinary role of debt or the reduction of free cash-flow problems, and the fact that debt suffers less from informational costs than outside equity) equal the marginal cost of debt (bankruptcy costs, and agency costs between shareholders and bondholders). Additionally, as adjustment costs may exist that are an impediment to achieving the optimal capital structure, the existence of a partial adjustment to optimal leverage is suggested within the TOT.¹ Results consistent with a partial adjustment to the target leverage are obtained for US firms (Marcus, 1983; Jalilvand and Harris, 1984; Auerbach, 1985; Fischer *et al.*, 1989; Shyam-Sunder and Myers, 1999; Fama and French, 2002; Flannery and Rangan, 2006), for French and German firms (Kremp *et al.*, 1999), for Spanish firms (Miguel and Pindado, 2001), for Swiss firms (Gaud *et al.*, 2005), and for UK firms (Ozkan, 2001).

The POT, developed by Myers and Majluf (1984) and Myers (1984), focuses on the information asymmetries existing between firm insiders and outsiders. In these models, managers use private information to issue risky securities when they are overpriced. Investors are aware of this asymmetric information problem, and they discount the firm's new and existing risky securities when new issues are announced. Managers anticipate these price discounts, and may forego profitable investments if these must be financed with new risky securities. To avoid this distortion of investments decisions, managers prefer to finance projects with retained earnings, which involve no asymmetric information problem as with risky debt. Accordingly, the firm will fund all projects using retained earnings if possible. If there is an inadequate amount of retained

earnings, then debt financing will be used. As a result, variation in a firm's leverage is driven not by the trade-off model's costs and benefits of debt, but rather by the firm's net cash flows (cash earnings minus investment outlays), and the POT predicts that debt typically grows when investment exceeds retained earnings and falls when investment is less than retained earnings. Thus, if profitability and investment outlays are persistent, the POT predicts that, when investment is maintained fixed, leverage is lower for more profitable firms, and given profitability, leverage is higher for firms with more investments. Unlike the TOT, in the POT there is no leverage target that firms seek to achieve in each period; the optimum debt varies from one period to another with profitability and the investment opportunities in the firm.

Both theories of capital structure are not mutually exclusive because the POT may be considered as nested in the TOT. The POT is built on the assumption that asymmetric information problems, which are only one of the costs considered in the TOT, overwhelm the remaining forces that determine optimal leverage in the trade-off model. However, if asymmetric information problems do not fully overpower other factors, the TOT partially survives. Thus, the partial survivorship of the TOT, even when the asymmetric information problems indicated by the POT are important drivers of the firm's financing decisions, may explain the attaining of results that are partially consistent with both hypotheses. The evidence provided by recent empirical research coincides in underscoring the partial validity of both explanations, but differ when indicating which one is predominant. Whereas Shyam-Sunder and Myers (1999) and Fama and French (2002) obtain results that are consistent with the predominance of the POT, Flannery and Rangan (2006) suggest a greater validity of the TOT. However, Frank and Goyal (2003) and Leary and Roberts (2005) obtain evidence that is favourable to both theories without highlighting the predominance of either.

In this paper, we extend the previous evidence analyzing whether the validity of both theories is related to firm size and, therefore, whether it varies among small, medium and large firms. The importance of firm size in explaining differences in the validity of the TOT and the POT would arise from the greater information asymmetries existing in small firms, which might lead to a greater weight of the pecking order explanations in this type of firm. To analyze how the validity of both theories varies with firm size, we study two aspects: 1) Since both theories propose different determinants of debt, we

shall analyze whether the determinants of firm leverage vary across firm size in a way that is consistent with the predictions of one or other of the two theories, and 2) we also analyze whether the prediction of the TOT that firms have a target leverage has a different validity among the three groups of firms. The greater (lesser) the validity of this prediction in one type of firm, the greater the empirical support this would provide for the TOT (POT) in this type of firm. Unlike previous studies, this paper considers not only quoted firms but also non-publicly traded firms, providing evidence about the speed of adjustment to the target leverage of the latter group of firms.

To account for dynamic processes in firm leverage, we use the generalized-method-ofmoments (GMM) estimators developed by Arellano and Bond (1991) for dynamic panel data. This generation of GMM models has the market advantage that it is specifically designed to handle autoregressive properties in the dependent variable (firm leverage) when lagged values are introduced as explanatory variables and endogeneity in the explanatory variables (other firm specific characteristics) must be controlled for.

The results of the paper indicate that the TOT and the POT are complimentary in explaining capital structure decisions in Spanish firms. Consistent with the TOT, firms have a target leverage and will have a higher leverage ratio, the greater the tax benefits of debt due to interest deductibility. However, consistent with the POT, leverage is positively related to growth opportunities and intangible assets in the firm, and negatively related to the firm's profitability. Moreover, our results support the hypothesis that the greater information asymmetries in small firms lead to a greater validity of the prediction of the POT in these firms, since the positive influence of investment opportunities and of intangible assets and the negative influence of profitability predicted by the POT are heightened in small firms. Moreover, the paper also shows that small firms have a similar speed of adjustment to the target leverage compared to large firms.

The rest of the paper is structured as follows. Section 2 discusses the influence of firm size in capital structure and the hypotheses tested in the paper as regards the validity of the TOT and the POT across firms of different sizes. Section 3 describes the characteristics of the database and the methodology, while Section 4 discusses the empirical results. Finally, Section 5 presents some conclusions.

2. Firm size and capital structure theories: Hypotheses

A large number of papers have suggested that firm size is positively related to leverage ratio. The rationale for this belief is the evidence provided by Warner (1977) and Ang et al. (1982) that the ratio of direct bankruptcy costs to firm value decreases as said value increases, suggesting that the impact of these costs on the borrowing decisions of large firms might be negligible. It is also argued that larger firms are more diversified (Titman and Wessels, 1988), have easier access to the capital markets, and borrow at more favorable interest rates (Ferri and Jones, 1979). Larger firms with less volatile benefits also have a greater likelihood of being able to fully use tax shields from interest payments, increasing the expected tax benefits of debt (Smith and Stulz, 1985). For small firms, the conflicts between creditors and shareholders are more severe because the managers of such firms tend to be large shareholders and are better able to switch from one investment project to another (Grinblatt and Titman, 1998). Informational asymmetries between insiders in a firm and the capital markets are higher for small firms. According to these arguments, most empirical studies in fact report a positive sign for the relationship between size and leverage (Rajan and Zingales, 1995; Booth et al., 2001; Frank and Goyal, 2003; Gaud et al., 2005).

Although the influence of size on firm debt has been widely analyzed, no study has been carried out to ascertain whether the validity of the TOT and the POT varies with firm size. However, arguments exist that suggest that size is related to the information asymmetry problems that the POT rests on. Larger firms usually have lower information asymmetries. Larger listed firms are required to submit information to the stock exchange and financial analysts monitor these firms on a regular basis, whereas small non-listed firms are only required to produce a straightforward annual report once a year and are rarely monitored by analysts. Credit rating agencies also monitor the solvency of large firms and reduce information asymmetries between the firm and outside investors. The exposure of large listed firms. To derive our hypotheses, we assume that with no information asymmetry the POT does not survive and only the TOT applies and that the greater the information asymmetry, the greater the validity of the propositions of the POT. Thus, if information asymmetries decrease with firm size, the

validity of the POT will be greater in small firms. This argument leads us to establish our main hypothesis in the paper as follows:

H.1. The validity of the predictions of the POT (TOT) concerning the determinants of a firm's leverage is negatively (positively) related to firm size and will thus be greater (lesser) in small firms.

In order to test this hypothesis, we first analyze how the two theories differ as regards the determinants of firm leverage, and secondly how both theories differ with respect to the existence of a leverage target in the firm.

2.1. Determinants of debt ratio under the TOT and the POT

As potential determinants of firm leverage we consider the same variables as Rajan and Zingales (1995) have shown to influence firm leverage in 7 countries: non-debt tax shield, profitability, growth opportunities and intangibility of assets.² As the TOT and the POT differ in the predicted influence of each variable on firm leverage we may discriminate between the two theories by empirically analyzing which type of prediction is consistent with the data. In fact, we focus on analyzing whether the influence of each variable on firm leverage varies across firm size according to the TOT or to the POT. Table 1 summarizes the predictions of the TOT and POT regarding the influence of each variable on firm leverage, which we shall go into below.

a) Non-debt tax shields

The TOT predicts that companies have an incentive to take debt because they can benefit from the tax shield due to interest deductibility. However, if firms have non-debt tax shields (NDTS), such as depreciation and investment tax credits, they have a lower incentive to use debt from a tax shield point of view and hence use less debt (DeAngelo and Masulis, 1980; Graham, 2000). Thus, the trade-off explanation predicts a negative coefficient for NDTS in the equation explaining firm leverage.

In our paper, NDTS have been measured as the earnings before taxes minus the ratio between the taxes paid and the tax rate, as in Titman and Wessels (1988), Miguel and Pindado (2001) and Saa-Requejo (1996). Other papers, such as Ozkan (2001), have used the ratio of annual depreciation expense to total assets as a proxy for non-debt tax

shields. However, it should be noted that this ratio could also be a proxy for the tangibility of the assets, and may thus lead to confounding effects.

b) Profitability

In the TOT, a positive relationship between a firm's profitability and debt is expected because taxes, agency costs and bankruptcy costs push more profitable firms towards higher leverage. More profitable firms should prefer debt to benefit from the tax shield. Moreover, when firms are profitable, all things being equal, they increase their free cash flow and the marginal benefit of using debt to discipline managers. Finally, an increase in profitability reduces the likelihood of firm bankruptcy and the cost of financial distress originated by the use of debt. Thus, all these reasons lead the TOT to predict a positive relationship between profitability and debt.

According to the POT, the contrary relationship is expected when firms prefer using internal sources of financing first, then debt and finally external equity obtained by stock issuing. According to this argument, firms passively accumulate retained earnings, becoming less levered when they are profitable, and accumulate debt, becoming more levered when they are unprofitable. All things being equal, the more profitable the firms are, the more internal financing they will have, and therefore we should expect a negative relationship between leverage and profitability. This negative relationship is one of the most systematic findings in the empirical literature. Harris and Raviv (1991), Rajan and Zingales (1995), and Boot *et al.* (2001), among others, have highlighted that the debt ratio is inversely related to profitability.

In our study, profitability (PROF) is estimated as earnings before interest and taxes (EBIT) plus depreciation expenses and provisions (non-cash deductions from earnings) divided by total assets (Ozkan, 2001; Miguel and Pindado, 2001; Gaud *et al.*, 2005).

c) Growth opportunities

The trade-off model predicts that, controlling for the profitability of assets in place, firms with more investment opportunities have less leverage because: (1) Greater investment opportunities in the firm are associated with a lower free cash flow and less need for the disciplinary role of debt over manager behaviour (Jensen, 1986); (2) Firms with growth opportunities have more agency conflicts between stockholders and

bondholders because shareholders in these firms have stronger incentives to underinvest and greater possibilities of risk-shifting substitution (Myers, 1977, Smith and Warner, 1979); (3) Finally, as the value of growth opportunities is close to zero in the case of bankruptcy, the cost of financial distress associated with the use of debt will be higher in firms in which the investment opportunities represent a greater percentage of the current value of the firm (Myers, 1984; Harris and Raviv, 1991). All these reasons lead the TOT to predict a negative relationship between investment opportunities and debt in the firm. These arguments are consistent with firms using equity to finance their growth (Jung *et al.*, 1996) and with firms with less growth prospects using debt because of its disciplinary role (Jensen, 1986; Stulz, 1990).

In contrast, the POT predicts a positive marginal relation between leverage and growth opportunities because investment opportunities originate strong financing needs and, all things being equal, will lead to the issuing of more debt. Moreover, as information asymmetries with respect to investment opportunities are higher than with respect to assets in place, the POT predicts a higher preference for debt relative to equity in firms with greater growth opportunities.

Following Titman and Wessels (1988), growth opportunities (GROWTH) has been measured in this paper as the growth rate of total assets. Since non-publicly traded firms are considered, we cannot use the market-to-book value of assets to proxy growth opportunities, as in Flannery and Rangan (2006), Gaud *et al.* (2005) or Rajan and Zingales (1995).

d) Intangibility of assets

According to the TOT, intangibility of assets has an impact on the borrowing decisions of a firm for at least two reasons: 1) intangible assets have a lower value than tangible assets in the case of bankruptcy and thus increase the cost of financial distress associated with the use of debt, and 2) the agency costs between stockholders and creditors are greater when the firm does not offer tangible assets as collateral because the probability of risk-shifting by shareholders is solely limited to the assets that are not offered as collateral. Consistent with these arguments, most of the previous evidence highlights a negative relation between intangible assets and the level of debt (Rajan and Zingales, 1995; Kremp *et al.*, 1999; Frank and Goyal, 2003).

From the POT perspective, firms with more intangible assets are more subject to information asymmetries and will therefore issue debt rather than equity when they need external financing (Harris and Raviv, 1991). For this reason, *ceteris paribus* profitability and investment opportunities, the TOT predicts a positive relation between intangibility of assets and firm leverage.

We proxy the intangibility of assets (INTANG) as the ratio between intangible assets and total assets. This variable was used by Titman and Wessels (1988) as an indicator that is negatively related to the collateral value.

Given that our basic hypothesis forecasts a greater validity of the POT in smaller firms and that the POT and TOT differ in the predicted influence for profitability, growth opportunities, and asset intangibility on firm leverage, we may extend hypothesis H.1. as follows:

H.1.a. The greater predominance of the predictions of the POT in smaller firms leads to forecasting a greater negative influence of profitability and a greater positive influence of investment opportunities and of intangible assets on firm leverage in this type of firm.

2.2. Target firm leverage and adjustment costs

The existence of a target firm leverage that firms wish to maintain in each period is the other difference between the TOT and the POT. Under the TOT, there exists an optimum level of indebtedness resulting from compensating benefits with the costs of debt. As the determinants of the costs and benefits of debt, examined in the previous section, are relatively stable over time, the firm's optimum indebtedness will also be stable. However, the existence of adjustment costs impede a complete adjustment and hence the standard framework adopted for testing the TOT is a partial adjustment model in which the change in leverage partially absorbs the difference between target leverage and lagged leverage.

In contrast, under the POT there exists no target leverage that firms aim to maintain in each period, but rather the leverage varies from one period to another depending on the profitability and investment opportunities in the firm. Thus, higher earnings, *ceteris*

paribus investment opportunities, increase the possibilities of retaining benefits and result in less leverage. Higher investment opportunities, *ceteris paribus* earnings, result in higher leverage.

The different predictions of the TOT and the POT concerning the existence of a target leverage mean that our main hypothesis (H.1) a propos a greater validity of the POT in small firms may be extended in the following way:

H.1.b. The greater predominance of the predictions of the POT in smaller firms leads to forecasting a lower or non significant speed of adjustment to the target leverage in this type of firm.

3. Econometric specification and database

3.1. Methodology

The empirical model proposed in this paper accounts for the potentially dynamic nature of a firm's capital structure. Dynamic models of capital structure suggest that firms will periodically readjust their capital structures toward a target ratio that reflects the costs and benefits of debt financing found in the static trade-off models. The model tests whether there is a leverage target and if so, what the adjustment speed is with which a firm moves toward its target. The form of the target adjustment model states that changes in the debt ratio ($D_{it} - D_{it-1}$) partially absorb the difference between target leverage (D_{it}^*) and lagged leverage (D_{it-1}):

$$(D_{it} - D_{it-1}) = \alpha (D_{it}^* - D_{it-1})$$
 [1]

where the transaction costs that impede a complete adjustment to the target leverage are measured by the coefficient α , which varies between 0 and 1 and is inversely related to adjustment costs. Solving the firm leverage:

$$D_{it} = \alpha D_{it}^* + (1 - \alpha) D_{it-1}$$
^[2]

On the one hand, if transaction costs are zero, i.e. $\alpha=1$, $D_{it}=D_{it}*$ and firms automatically adjust their debt level to the target level. On the other hand, if $\alpha=0$, $D_{it}=D_{it-1}$, which implies that transaction costs are so high that firms do not adjust their debt level. The

adjustment process is a trade off between the adjustment costs towards a target ratio and the costs of being in disequilibrium.

As the target debt is unobservable, we model it as a linear function of the determining factors of capital structure reviewed in the previous section (non-debt tax shields, profitability, growth opportunities and intangible assets) obtaining: ³

$$D_{it}^* = a_0 + a_1 NDTS_{it} + a_2 PROF_{it} + a_3 GROWTH_{it} + a_4 INTANG_{it} + \mu_{it}$$
[3]

where D_{it}^* is the target leverage of firm i in year t and its explanatory variables are the non-debt tax shields (NDTS), profitability (PROF), growth opportunities (GROWTH) and the intangibility of the firm's assets (INTANG).

Incorporating Eq. (3) into Eq. (2) and considering that estimations were carried out with panel data, we get:

$$D_{it} = \alpha a_0 + (1 - \alpha) D_{it-1} + \alpha a_1 NDTS_{it} + \alpha a_2 PROF_{it} + \alpha a_3 GROWTH_{it} + \alpha a_4 INTANG_{it} + \sum_{t=1995}^{2003} Y_t + \sum_{j=1}^{n} I_j + \gamma_i + \mu_{it}$$
[4]

where $\sum_{t=1995}^{2003} Y_t$ is a set of dummy time variables for each year capturing any unobserved firm-invariant time effect not included in the regression. We also include industry dummy variables according to SIC codes $(\sum_{j=1}^{n} I_j)$ to capture any industry effect not included in the explanatory variables, γ_i is the firm effect, which is assumed constant for firm i over t; and μ_{it} is the error term.

In the estimations, we apply the generalized-method-of-moments (GMM) estimators developed for dynamic models of panel data by Arellano and Bond (1991). This methodology is specifically designed to address three econometric issues relevant to the present paper: (i) the presence of unobserved individual effects (in the present case, firm-specific effects). The individual effects are eliminated by taking first-differences of all variables; (ii) the autoregressive process in the data regarding the behaviour of leverage ratio (i.e. the need to use a lagged-dependent-variables model to capture the dynamic nature of the capital structure decisions); and (iii) the likely endogeneity of the

explanatory variables. The panel estimator controls for this potential endogeneity by using internal instruments, i.e. instruments based on lagged values of the explanatory variables.

The consistency of the GMM estimator depends on the validity of the instruments. To address this issue, we consider two specification tests suggested by Arellano and Bond (1991). The first is a Sargan test of over-identifying restrictions, which tests the overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process. This test confirms the absence of correlation between the instruments and the error term in our models. The second test examines the hypothesis of lack of second-order serial correlation in the first difference residuals (m_2). In our models, this hypothesis of second-order serial correlation is always rejected. Although there is first-order serial correlation (m_1) in the differentiated residuals, it is due to the first difference of models.

3.2. Database

The partial adjustment model of firm leverage described in Equation [4] is estimated in a sample of non-financial Spanish firms over the period 1995-2003. The financial data were obtained from SABI, which is a database that contains financial information on 144,982 public limited companies. Secondly, financial firms (SIC 6000-6999) were excluded, as their financing decision follows other determinants, the number of firms after application of this criterion being 102,250. Finally, firms with less than 10 employees were removed from the sample (these are considered as micro-enterprises according to European Union criteria), resulting in the figure of 26,369 firms and 65,331 firm-year observations. After eliminating those observations in which it was not possible to estimate the dependent and explanatory variables, the number of observations was 24,827. Since we apply the GMM first difference estimator with one lag of the dependent variable in the empirical analysis, firms with fewer than two consecutive years of data must be excluded. Finally, the number of firms included in the sample was 3,439. The complete sample consists of 16,284 firm-year observations.

As a measure of firm leverage, we use the ratio between the book value of debt (both long term and short term) and the book value of total assets. This measure provides a good indication of financial leverage, since total liabilities also includes items like accounts payable, which may be used for transactions purposes rather than for financing (Rajan and Zingales, 1995) and has been used, among others, by Flannery and Rangan (2006). Since we test the model on firms that do not quote on the stock market, we cannot use a market value of leverage as other authors do, e.g. Gaud *et al.* (2005) and Rajan and Zingales (1995). Flannery and Rangan (2006) report evidence that the results do not present any changes across a range of different definitions for leverage, including market-valued debt ratios.

We have split the sample into small, medium and large enterprises applying the criteria of firm size defined by the European Union in the Commission Recommendation of 3rd April 1996 (96/280/EC).⁴ A small firm is defined as an enterprise that has fewer than 50 employees but more than 10, and has either an annual turnover not exceeding seven million euros or an annual balance-sheet total not exceeding five million euros. Medium-sized firms are defined as enterprises that have between 50 and 249 employees, and have either an annual turnover not exceeding 40 million euros, or an annual balance-sheet total not exceeding 40 million euros, or an annual balance-sheet total not exceeding 40 million euros, or an annual balance-sheet total not exceeding 40 million euros, or an annual balance-sheet total not exceeding 27 million euros. Firms that exceed these limits are considered large firms.

In Table 2 we can observe that for the total sample the mean leverage ratio is 29.54% with an average profitability of 10.82% and a mean growth rate of total assets of 10.97%. However, these values vary according to firm size. Large firms show a higher leverage ratio, profitability and growth rate of assets than small firms. The differences in these variables among small, medium and large firms are likewise significant when using a t-test such as the Wilcoxon signed-rank test in Panel B of Table 2. The differences in NDTS and INTANG between small and large firms are also significant according to the two tests.

Table 3 reports the correlation matrix. According to most of the previous empirical evidence, debt ratio correlates positively with firm size and negatively with the amount of non-debt tax shield in the firm. Moreover, the negative correlation of firm debt with profitability and the positive correlation with growth opportunities and intangible assets would be consistent with the predictions of the POT. In the next section, in order to test how the validity of the TOT and the POT varies across firm size we apply a multivariate analysis incorporating confounding effects that have so far been omitted in the mean difference and correlation analysis.

4. Results

Table 4 shows the results of the partial adjustment model [4] for the whole sample of firms. Column (1) contains the estimates of the basic model without controlling for size, while columns (2), (3) and (4) control for three different size measures, namely, the natural logarithm, respectively, of total assets, sales and the number of employees. In all the estimates, we control for the industry by introducing a dummy variable for each industry, and for time effects by including a dummy variable for each year. All the variables are considered endogenous and are estimated in first differences, except the industry dummies. The coefficients of time and industry dummies are not reported in the tables to save space.

The results partially support both the TOT and the POT. We obtain two results consistent with the predictions of the TOT. First, NDTS has a negative coefficient in column (2), suggesting that the existence of non-debt tax shields reduces the tax-advantage from debt and thus also reduce the use of debt for the firms. Second, the positive and statistically significant coefficients of $DEBT_{t-1}$ suggest that the firms have a target leverage to which they partially adjust in each period.

Our results show that the value of the coefficient that accompanies the variable DEBT_{t-1} takes values of around 0.60, which implies values of α of approximately 0.40. Previous evidence has shown values of α ranging between 0.79 for Spain and 0.14 for the Swiss market. Miguel and Pindado (2001) find an α of 0.79 for a panel data set for 133 Spain companies, Shyam-Sunder and Myers (1999), Jalivand and Harris (1984) and Auerbach (1985) a value of 0.59-0.70 for the USA, Kremp *et al.* (1999) a value of 0.53 for German firms and a value of 0.28 for France, Ozkan (2001) a value of 0.52-0.57 for a panel data set for 390 UK companies and Gaud *et al.* (2005) a value of 0.14-0.29 for the Swiss market.

Since α close to one indicates a fast adjustment of the current capital structure to the target or optimal capital structure, according to the results of Miguel and Pindado (2001) transaction cost are not very high for Spanish firms.⁵ The lower speed of adjustment in our sample compared with Miguel and Pindado (2001) may be originated by two aspects. First, contrary to Miguel and Pindado (2001) we consider not only large and publicly traded firms, but have also taken smaller and non-publicly traded firms

into account in the analysis. Due to the fact that adjustment costs for smaller firms could be unusually large, this could explain the results (Flannery and Rangan, 2006). However, subsequent results show that there are no differences between the adjustment speed to target leverage of small and large firms. Second, since in Miguel and Pindado (2001) all the variables are scaled by the replacement value of capital, measured as the replacement value of fixed assets plus the replacement value of inventories plus the book value of the rest of assets, and in our paper all the variables are scaled by the book value of assets, this could be the determinant of the difference of the estimated α . Most papers also use book total assets in order to scale the variables, thus making our results more comparable with the rest of the international evidence (Ozkan, 2001; Gaud *et al.*, 2005; Flannery and Rangan, 2006).

While the negative coefficient of NDTS and the existence of a partial adjustment to the target leverage are favorable to the arguments of the TOT, the negative coefficient of PROF and the positive ones of GROWTH and INTANG are consistent with the predictions of the POT. Under the POT, higher profitability increases the possibility of retaining earnings and reduces the needs of debt whereas greater growth opportunities, all else being equal, increases the needs of debt. Moreover, as intangible assets originate greater information asymmetries than tangible assets, the preference for debt relative to equity would increase with the percentage of intangible assets in the firm under the POT.

These results in Spanish firms constitute greater support for the POT than is generally found in prior studies for other countries. Although studies in other countries coincide in reporting a negative relation between profitability and debt, they differ in their findings in that the intangibility of assets and growth opportunities are usually negatively associated with firm leverage (Titman and Wessels, 1988; Rajan and Zingales, 1995; Fama and French, 2002; Frank and Goyal, 2003; Flannery and Rangan, 2006; Gaud *et al.* 2005). The greater support obtained for the POT compared to other studies is consistent with the inclusion in the present study of small firms, if the POT has more validity in this type of firm.

Moreover, our results are consistent with those of Miguel and Pindado (2001) for Spanish publicly traded firms. These authors found an inverse relationship between cash-flow and debt, and a direct relationship between investment and debt, in support of the POT when indicating that cash-flow is preferred to the use of debt, and debt is preferred to equity issues as proposed by the POT.

Firm size, measured by LN(TA) and LN(EMP), has the traditional positive impact on leverage that has been documented in many empirical studies for other countries (Rajan and Zingales, 1995; Fama and French, 2002; Frank and Goyal, 2003; Flannery and Rangan, 2006; Gaud *et al.* 2005).

The estimation of the model [4] depending on firm size is reported in Table 5. We classified firms in small, medium and large firms following the criteria of firm size applied by the European Union. The first three columns in Table 5 show the results obtained separately for each group of firms.

In accordance with the results reported above, the coefficient associated with the variable DEBT_{t-1} is positive and statistically significant and takes similar values regardless of firm size. The variable NDTS is shown to be explanatory of firm leverage, in line with the predictions of the trade-off theory, in the case of small and medium firms. That is to say, smaller-sized firms are the ones that use debt for tax reasons, while the decision to take on debt in large firms responds to a lesser degree to tax reasons. The remaining variables, PROFIT, GROWTH and INTANG, present coefficients consistent with the pecking order theory, especially for small firms. The variable PROFIT presents negative coefficients in line with the fact that firms with higher profitability use less debt due to the greater possibility of using retained earnings. The positive coefficients of GROWTH for small firms is consistent with the fact that greater growth opportunities, ceteris paribus profitability, increases the needs for debt, and the positive coefficient of INTANG supports the prediction of the POT that firms with more intangible assets are subject to higher information asymmetries and that they will issue debt rather than equity if the retained earnings are not enough. The greater positive influence of intangible assets and growth opportunities and the greater negative influence of profitability on the debt ratio in the case of small firms, compared to medium and large firms, would be consistent with the predominance of the predictions of the POT in small firms.

In order to analyze whether there are statistically significant differences in the determinants of leverage across firms of different size, we define interaction terms of

firm size with each explanatory variable in columns (4) and (5) of Table 5. In fact, we define a dummy variable, SMALL, that takes a value of 1 for small firms and 0 otherwise, which interacts with the remaining explanatory variables. In this specification, the coefficients of the interaction terms (DEBT_{t-1}*SMALL, NDTS*SMALL, PROFIT*SMALL, GROWTH*SMALL and INTANG*SMALL) indicate the differences in the respective explanatory variable in small firms with respect to the remaining firms. On the other hand, the coefficients of the explanatory variables now show the influence that they have on firm leverage for those firms that are not small in size. Thus, in column (4) we compare small firms versus medium and large firms and in column (5) we exclude medium firms in order to capture the differences between small and large firms.

The results of columns (4) and (5) do not indicate differences in the adjustment speed to the target leverage between small and large firms, as the coefficients of DEBT_t- $_1$ *SMALL are not statistically significant. However, the coefficients of NDTS*SMALL are negative and statistically significant, revealing that the tax benefit of debt is more important in small than in large firms in determing the leverage ratio.

The remaining interaction terms present coefficients that are consistent with the hypothesis of a greater validity of the predictions of the POT in small firms. The coefficients of GROWTH*SMALL and INTANG*SMALL are positive and statistically significant, whereas the coefficients of GROWTH and INTANG are not statistically significant. These results indicate that growth opportunities and intangible assets are positively related to firm leverage, as predicted by the POT, only in small firms. Also consistent with a greater validity of the POT in small firms, we observe that the negative influence of profitability on leverage is heightened in small firms since PROF*SMALL has negative statistically significant coefficients.

5. Conclusions

This paper analyzes whether the validity of the trade-off theory and the pecking order theory to explain firm capital structure varies with firm size. To do so, we apply a dynamic model partial adjustment to the target leverage in a panel database of Spanish firms over the period 1995-2003. In the empirical analysis, we control for the specific firm characteristics not explicitly incorporated as explanatory variables and for the

potential endogeneity of the explanatory variables using the GMM first difference estimator. Results are partially consistent with both explanations in Spanish firms. Consistent with the TOT, firms have a target leverage which they adjust to in each period, using more debt as the tax advantages of debt grow. Consistent with the POT, firm leverage is positively related to investment opportunities and the percentage of intangible assets, and negatively related to profitability.

Furthermore, our results indicate that the predominance of the TOT and the POT varies across firm size. The positive relationship of firm leverage with investment opportunities and intangible assets and the negative relation with firm profitability are stronger in small firms than in medium and large firms. This evidence is consistent with the hypothesis that higher information asymmetries in small firms originate greater validity of the pecking order theory in this type of firm. Despite the greater validity of the pecking order predictions in small firms, there are no differences in the adjustment speed to the target leverage across firms with a different size, and all types of firms have a similar adjustment speed of around 40% (α =0.4) of the target leverage. These results highlight the convenience of controlling for firm size when testing the validity of explanatory theories of firm capital structure.

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¹ For an in-depth review of the literature on capital structure, see Harris and Raviv (1991).

 $^{^2}$ Booth *et al.* (2001) suggest that the same determinants of capital structure prevail in ten developing countries, and Harris and Raviv (1991) indicate that the financial literature coincides in highlighting these variables as the determinants of firm leverage. Sogorb-Mira (2005) also uses these variables for a sample of Spanish SME.

³ The same framework has been used in prior studies such as Miguel and Pindado (2001), Ozkan (2001), Flannery and Rangan (2006) and Gaud *et al.* (2005).

⁴ This criteria is the one in force during the period covered by our study. On 6^{th} May 2003 the Commission adopted a new Recommendation (2003/361/EC) regarding the definition of SMEs which replaced Recommendation 96/280/EC as from 1^{st} January 2005. We have found that the results do not vary with the new classification of firm size.

⁵ Since public debt has higher transaction costs than private debt (bank debt), the small transaction costs have been explained by the lower public debt ratio for Spanish firms.

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 Table 1

 Summary of predictions of the trade-off and pecking order theories

	Predictions on firm leverage				
Variable	ТОТ	РОТ			
Non-debt tax shields (NDTS) Profitability (PROF)	 a) Higher tax benefits b) Greater reduction of free cash 	 a) Higher possibilities of retaining earnings 			
Growth opportunities (GROWTH)	flow conflictc) Lower bankruptcy costsa) Greater reduction of free cash-	+ a) Higher information asymmetries			
Intoncible assets	flow conflict b) Higher conflicts between bondholders and shareholders c) Higher costs of financial distress	b) Higher financing needs			
(INTANG)	 a) Higher costs of financial distress b) Higher conflicts between 	a) Higher information asymmetries			

Table 2

Summary statistics of the dependent and independent variables

The table presents the summary statistics of the dependent and independent variables for the sample. DEBT is the ratio between the book value of debt (both long term and short term) and the book value of total assets; NDTS is the earnings before taxes minus the ratio between the taxes paid and the tax rate; INTANG is the ratio between the intangible assets and total assets; PROFIT is estimated as EBIT plus depreciation expenses and provisions (non-cash deductions from earnings) divided by total assets; GROWTH is the growth rate of total assets. In Panel B, the t-test and Wilcoxon's signed-rank test are estimated. ***, ** and * represent the significance at the 1%, 5% and 10% level, respectively.

		Panel A: Descriptive statistics					
Variables		Mean	Standard deviation	First Quartile	Median	Third Quartile	
		(1)	(2)	(3)	(4)	(5)	
	Total sample	29.54	21.00	12.51	27.97	42.89	
DEBT (%)	Small firms	26.51	21.35	9.09	23.98	39.59	
	Medium firms	29.68	20.65	13.29	28.09	42.93	
	Large firms	30.93	21.31	13.30	29.51	44.59	
	Total sample	0.26	13.75	0.00	0.14	1.41	
NDTS (%)	Small firms	-0.06	15.65	-0.04	0.01	0.88	
	Medium firms	0.16	15.83	0.00	0.16	1.48	
	Large firms	0.64	6.30	0.00	0.19	1.52	
	Total sample	10.82	15.36	6.00	10.32	15.88	
PROFIT (%)	Small firms	8.53	16.23	4.39	8.83	13.83	
	Medium firms	11.04	17.15	6.26	10.65	16.18	
	Large firms	11.65	10.26	6.28	10.59	16.16	
	Total sample	10.97	28.49	-2.30	6.74	19.09	
GROWTH (%)	Small firms	6.43	27.46	-5.59	3.52	14.79	
	Medium firms	10.47	26.30	-2.26	6.54	18.48	
	Large firms	14.40	32.41	-0.56	9.05	22.27	
	Total sample	4.50	8.43	0.17	1.17	4.71	
INTANG (%)	Small firms	4.59	9.21	0.09	1.02	4.66	
	Medium firms	4.63	8.46	0.20	1.22	4.89	
	Large firms	4.19	7.91	0.17	1.14	4.33	
			Panel B: Mean d	lifferences			
	Small vs. m	adium	Small	10 Jarga	Madium	va large	

		f	anel D. Mean C	interences			
	Small vs.	medium	Small	Small vs. large		Medium vs. large	
	(1)	1	((2)		3)	
	t-test Wilcoxon		t-test	Wilcoxon	t-test	Wilcoxon	
		test		test		test	
DEBT	-6.819***	-5.899***	-8.466***	-8.282***	-3.352***	-2.742***	
NDTS	-0.618	-5.986***	-2.191***	-6.991***	-2.568***	-2.672***	
PROFIT	-6.824***	-7.514***	-8.815***	-8.106***	-2.596***	-2.289***-	
GROWTH	-6.641***	-6.897***	-11.078***	-11.695***	-7.170***	-5.964***	
INTANG	-0.195	-0.452	1.838**	1.653*	2.988***	0.329	
DEBT NDTS PROFIT GROWTH INTANG	t-test -6.819*** -0.618 -6.824*** -6.641*** -0.195	Wilcoxon test -5.899*** -5.986*** -7.514*** -6.897*** -0.452	t-test -8.466*** -2.191*** -8.815*** -11.078*** 1.838**	Wilcoxon test -8.282*** -6.991*** -8.106*** -11.695*** 1.653*	t-test -3.352*** -2.568*** -2.596*** -7.170*** 2.988***	Wilcoxon test -2.742*** -2.672*** -2.289*** -5.964*** 0.329	

Table 3Correlations

The table presents the correlation matrix. DEBT is the ratio between the book value of debt (both long term and short term) and the book value of total assets; LN(TA) is the natural logarithm of total assets; LN(SALES) is the natural logarithm of sales; LN(EMP) is the natural logarithm of the number of the firm's employees; NDTS is the earnings before taxes minus the ratio between the taxes paid and the tax rate; INTANG is the ratio between the intangible assets and total assets; PROFIT is estimated as EBIT plus depreciation expenses and provisions (non-cash deductions from earnings) divided by total assets; GO is the growth rate of total assets. ***, ** and * represent the significance at the 1%, 5% and 10% level, respectively.

	DEBT	LN(TA)	LN(SALES)	LN(EMP)	NDTS	PROF	GROWTH
LN(TA)	0.1144***						
LN(SALES)	0.0148**	0.8337***					
LN(EMP)	0.0338***	0.7064***	0.7834***				
NDTS	-0.01611***	0.0066*	0.0280***	0.0108**			
PROF	-0.01792***	0.0478***	0.0393***	0.0196***	0.0600***		
GROWTH	0.0401***	0.1208***	0.0612***	0.0496***	0.0116***	0.0361***	
INTANG	0.1538***	-0.0392***	-0.0502***	-0.0197***	-0.0011	0.0164***	0.0343***

Table 4Determinants of firm leverage

Regressions are estimated using the Arellano and Bond (1991) GMM difference estimator for panel data with lagged dependent variables. The dependent variable is the ratio between the book value of debt (both long term and short term) and the book value of total assets. As explanatory variables, we include one lag of the dependent variable (DEBT_{t-1}). NDTS are the non-debt tax shields measured as the earnings before taxes minus the ratio between the taxes paid and the tax rate. INTANG is the ratio of intangible to total assets. PROF is the firm's profitability measured as earnings before interest and taxes (EBIT) plus depreciation expenses and provisions (non-cash deductions from earnings) divided by total assets. GROWTH measures the growth opportunities as the growth rate of total assets. Firm size is measured by three different variables: the natural logarithm of total assets, LN(TA), the natural logarithm of sales, LN(SALES), and the natural logarithm of employees, LN(EMP). The regressions are estimated for the period 1996-2002 and firm-specific fixed effects are controlled for. Year and industry dummy variables were included for all the estimations but are not reported. T-statistics are between brackets. ***, ** and * represent the significance at the 1%, 5% and 10% level, respectively.

	Predic	ted sign				
	TOT	POT	(1)	(2)	(3)	(4)
INTERCEPT			0.0113** (2.01)	0.0068 (1.21)	0.0110* (1.90)	0.0061 (0.97)
DEBTt-1	+		0.6382*** (26.30)	0.5942*** (23.36)	0.6357*** (29.56)	0.6429*** (23.85)
NDTS	-		-0.0343 (-0.59)	-0.1207** (-1.98)	-0.0268 (-0.45)	-0.0311 (-0.49)
PROF	+	-	-0.1544*** (-2.76)	-0.0743 (-1.25)	-0.1226** (-2.03)	-0.1045* (-1.65)
GROWTH	-	+	0.0497** (2.32)	0.0321** (2.02)	0.0300 (1.32)	0.0211 (0.96)
INTANG	-	+	0.0905 (1.46)	0.0538 (0.82)	0.1133* (1.79)	0.0979** (1.42)
LN(TA)	+	+/-		0.1974*** (4.42)		
LN(SALES)	+	+/-			-0.0065 (-0.48)	
LN(EMP)	+	+/-				0.0236* (1.85)
Time dummies			Yes	Yes	Yes	Yes
Industry dummies			Yes	Yes	Yes	Yes
m1			-9.57***	-11.06***	-9.71***	-8.51***
m ₂			-0.23	-0.53	-0.10	0.79
Sargan Test			152.77	160.22**	155.30	152.50
# observations			16284	16284	16246	14242
# firms			3439	3439	3430	3308

Table 5Firm size and determinants of leverage

Regressions are estimated using the Arellano and Bond (1991) GMM difference estimator for panel data with lagged dependent variables. The dependent variable is the ratio between the book value of debt (both long term and short term) and the book value of total assets. As explanatory variables, we include one lag of the dependent variable (DEBT_{t-1}). NDTS are the non-debt tax shields measured as the earnings before taxes minus the ratio between the taxes paid and the tax rate. INTANG is the ratio of intangible to total assets. PROF is the firm's profitability measured as earnings before interest and taxes (EBIT) plus depreciation expenses and provisions (non-cash deductions from earnings) divided by total assets. GROWTH measures the growth opportunities as the growth rate of total assets. SMALL is a dummy variable that takes the value of 1 if it is a small firm according to EU criteria and 0 otherwise. The regressions are estimated for the period 1996-2002 and firm-specific fixed effects are controlled for. Year and industry dummy variables were included for all the estimations but are not reported. T-statistics are between brackets. ***, ** and * represent the significance at the 1%, 5% and 10% level, respectively.

	Predicted	d sign					
	ТОТ	РОТ	Small	Medium	Large	Small vs. medium and large	Small vs. large
			(1)	(2)	(3)	(4)	(5)
INTERCEPT			-0.0065 (-0.45)	0.0097 (1.38)	0.0062 (0.73)	0.0109** (2.17)	0.0021 (0.27)
DEBTt-1	+		0.5261*** (15.15)	0.5363*** (18.29)	0.5302*** (16.49)	0.5804*** (26.55)	0.5806*** (23.69)
NDTS	-		-0.1577*** (-3.74)	-0.2328*** (-3.90)	-0.0211 (-0.31)	-0.0154 (-0.32)	-0.1179* (-1.75)
PROF	+	-	-0.2842*** (-4.45)	0.0870 (1.47)	-0.3395*** (-4.97)	-0.1442*** (-3.05)	-0.2598*** (-4.65)
GROWTH	-	+	0.0760*** (6.97)	-0.0329 (-1.36)	0.0402** (2.33)	0.0149 (1.02)	0.0027 (0.20)
INTANG	-	+	0.6174*** (8.12)	0.1342* (1.65)	0.0004 (0.00)	0.0738 (1.27)	0.1076 (1.50)
DEBTt-1 * SMALL						-0.0005 (-0.02)	0.0287 (1.23)
NDTS * SMALL						-0.3692*** (-4.56)	-0.4252*** (-4.49)
PROF * SMALL						-0.1868*** (-2.87)	-0.2008*** (-3.16)
GROWTH * SMALL						0.1118*** (6.27)	0.1008*** (6.73)
INTANG * SMALL						0.2289*** (2.77)	0.2237*** (2.76)
Time dummies						Yes	Yes
Industry dummies						Yes	Yes
m_1			-5.03***	-8.62***	-9.21***	-9.33***	-11.62***
m ₂			1.12	-0.59	1.00	-0.25	1.24
Sargan Test			164.59**	137.75	135.59	287.58	271.06
# observations			1958	7976	3454	16155	6175
# firms			706	1941	950	3418	1651

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