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Correcting for Asymmetry of Information and Debt Capacity on Capital Structure Empirical Tests: Evidence from Europe

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Abstract: In this study, we examine the performance of the two competing theories of capital structure. We test the theories on sub-samples of firms that are expected to suffer from high asymmetry of information and that are believed to have enough debt capacity. To group the firms we have created two artificial indexes measuring asymmetric information and debt capacity. Present results show that the pecking order theory performs better when tested over the group of companies facing the highest level of asymmetric information. When the asymmetry of information is mixed, the above results are no longer significant.

Key words: Capital structure, trade-off theory, pecking order theory

INTRODUCTION

The static trade-off (Modigliani and Miller, 1958, 1963; Jensen and Meckling, 1976; DeAngelo and Masulis, 1980) and the pecking order (Myers, 1984; Myers and Majluf, 1984) theories are still today the most dominant explanations of how firms choose between debt and equity financing. Using a sample of 1,256 publicly traded European firms, we investigate whether the two theories are able to explain the firm's financing behaviour over the period between 1999 and 2008. In the light of Myers (2001) argument, we do not pretend to test whether the broad sample patterns are fully explained by a specific theory. On the contrary, following Fama and French (2002) and Lemmon and Zender (2004), present aim is to investigate how the theories perform when tested on sub-samples of firms with different levels of asymmetric information and debt capacity.

Until the late 90's, the empirical literature in capital structure research seemed to confirm the two principal predictions of the trade-off theory (mean-reverting behaviour of the debt ratio and cross-sectional explanatory factors). In a significant contribution, Shyam-Sunder and Myers (1999) designed a new empirical test that nested both the pecking order theory and the trade-off theories. Using a sample of 157 firms over the period 1971 to 1989, they find strong support for the pecking-order theory against these apparently confirmed predictions of the trade-off theory.

The attractiveness of their results is quite understandable. Their empirical specification is relatively parsimonious, it is descriptively reasonable and it has power against an identified alternative hypothesis. However, since Shyam-Sunder and Myers (1999), the evidence from subsequent studies is mixed and confronted.

The study of Shyam-Sunder and Myers (1999) opened an interesting discussion. Today, the only apparent consensus is that inferences obtained from empirical tests on capital structure need to be interpreted with considerable caution. Along these lines, the literature has raised serious questions that we have classified into two main categories, conceptual and methodological. In the following paragraphs, we give a brief overview of each of these problems.

Conceptual debate and theory interpretation: In general, researchers do not completely agree on whether a theory should be able to explain fully the aggregate firms' financing behaviour. In addition, researchers' interpretations of the theories vary on what the theories predict and what their empirical testable implications are.

One stream of the literature is concerned to find evidence that supports the superior performance of one theory over the other when tested at the aggregate level (Shyam-Sunder and Myers, 1999; Frank and Goyal, 2003).

On the other hand, other researchers try to reconcile the explanatory power of each theory (Myers, 2001; Fama and French, 2002; Lemmon and Zender, 2004). These authors think it might be more useful to design tests that are able to explain the financing behaviour of firms grouped according to common characteristics. They are in general, aware of the ability of both theories to explain financing decisions and recognise that theories of capital structure are not designed to observe all firms regardless of their specific characteristics.

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Table 1: Sample description

Variables		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
MVDR	Mean	0.229	0.255	0.290	0.321	0.286	0.247	0.222	0.199	0.217	0.338
	SD	0.202	0.214	0.225	0.238	0.221	0.202	0.188	0.172	0.187	0.248
COLL	Mean	0.345	0.331	0.342	0.339	0.333	0.329	0.322	0.310	0.302	0.307
	SD	0.241	0.245	0.248	0.251	0.251	0.254	0.256	0.256	0.252	0.250
NDTS	Mean	0.047	0.046	0.052	0.054	0.052	0.049	0.039	0.037	0.036	0.037
	SD	0.032	0.036	0.048	0.047	0.036	0.034	0.029	0.029	0.029	0.028
PROF	Mean	0.091	0.087	0.058	0.053	0.068	0.091	0.097	0.102	0.108	0.081
	SD	0.118	0.160	0.281	0.212	0.125	0.121	0.110	0.129	0.131	0.143
GRTH	Mean	-	0.507	0.162	0.071	0.105	0.981	0.435	20.918	0.892	0.151
	SD	-	2.651	0.491	0.517	0.710	28.797	3.862	751.935	17.169	0.369
SIZE	Mean	6.803	6.982	7.047	6.996	6.958	6.982	7.118	7.291	7.488	7.697
	SD	1.926	1.915	1.916	1.909	1.922	1.888	1.868	1.778	1.692	1.688
DEF	Mean	0.104	0.090	0.094	0.090	0.074	0.058	0.056	0.066	0.042	0.061
	SD	10.956	0.160	0.147	0.196	0.149	0.150	0.164	0.220	0.392	0.147
DIV	Mean	113.964	107.937	134.134	109.315	112.925	138.124	164.962	237.785	260.722	328.822
	SD	461.232	376.936	558.741	435.359	432.760	535.961	666.222	1509.630	1351.674	1380.487
INVS	Mean	443.141	507.351	504.144	419.853	363.668	383.523	435.796	515.063	546.076	703.896
	SD	1675.134	2054.649	1839.311	1646.980	1485.490	1689.359	1871.386	2294.417	2692.393	3178.151
WORCAP	Mean	515.827	414.203	440.334	415.424	529.578	581.788	458.779	533.105	527.421	568.280
	SD	3141.881	4484.545	4367.881	3780.028	3847.586	3957.168	3935.628	4300.432	4140.995	3920.876
CAPEX	Mean	631.851	754.567	531.252	440.278	583.606	742.240	797.839	909.865	1000.751	848.968
	SD	2153.760	2656.799	2381.919	2337.959	2315.705	3027.650	3032.913	3619.356	3761.762	3811.329
ST DEBT	Mean	537.559	746.630	750.496	636.345	518.580	462.553	587.422	590.988	658.472	809.817
	SD	2020.225	2770.775	2780.812	2423.476	2053.837	1961.319	2490.731	2554.719	2836.189	3208.740

MVDR: Debt ratios in market values (total debt divided by total debt plus market value of equity). COLL: Collateral Value of Assets (Fixed assets scaled by total assets). NDTS: Non-debt Tax Shields (Depreciation scaled by total assets). PRFT: Profitability (EBIT scaled by total assets). GRTH: Growth (Increase in total assets). SIZE: Size (Natural logarithm of total sales). The elements in grey colour are the variables used to calculate the Deficit Cash-Flow (DEF). DIV: Total dividends paid in cash. INVS: Net investments other than those included in CAPEX (company acquisitions, etc,). WORCAP: Working capital. CAPEX: Capital Expenditures (Investments needed in order to continue with the operations of the firm). ST DEBT: Portion of the total debt that needs to be amortised in the year

Financing decisions are driven by different and in some instances, competing forces. Thus, different models may account for some explanatory power. A priori, when one observes the financing characteristics of a random sample of firms no theory prediction seems to be realistic in explaining the broad data (Table 1). For example, the pecking-order theory predicts that after an IPO, firms will never issue equity except in very rare occasions. On the contrary, firms issue more equity than what is predicted (Fama and French, 2005). Similarly, one of the main arguments of the trade-off theory is that firms issue debt in order to shield their interest payments. However, firms have used debt financing long before the existence of corporate taxes and therefore taxes are not the only explanation for the use of debt. So a priori, it seems that no theory holds perfectly and each theory could have some explanatory power. As noted by Lemmon and Zender (2004), this lead us to think that, if the broad data could not be explained by a sole theory, it seems plausible to focus on sub samples of firms and see if their financing behaviour is more likely to be explained by one particular theory.

As mentioned earlier, another particularly important aspect of the debate is that theory interpretation varies among researchers. In regards to the interpretation of the pecking-order theory, the key issue is that firms' claims suffer a general mis-pricing due to an adverse selection problem. In this framework, a good company strategy is to issue the claim that is less risky in the sense of its sensitiveness to differences of information between insiders and outsiders. However, some researchers interpret this risk as that associated with the claims' pay-offs variability, which is a completely different matter.

Another important consideration regarding the interpretation of the pecking order theory is that companies that suffer from a high asymmetry of information will issue debt but only if they are able to do so, this is, if they have enough debt capacity (Lemmon and Zender, 2004). Thus, a more flexible pecking order theory would permit some equity issues without this being a violation of the main predictions of the theory.

In reference to the interpretation of the trade-off theory, it seems that the literature commonly agrees that the time series of debt ratios is mean reverting. However, as shown by Shyam-Sunder and Myers (1999) and Chang and Dasgupta (2007) a mean reverting behaviour of the debt ratios does not necessarily involve companies adjusting their debt level to a hypothetical target debt level. They note that time dynamics on operating income and capital expenditures can make debt ratios mean-reverting even when a company follows the pecking order theory. In addition, they point out that due to mechanical rebalancing of the capital structure, debt ratios could appear to be mean reverting even when financing decisions are taken randomly and with no apparent target.

Methodological debate: Capital structure tests are affected by some important methodological problems. Among others the most mentioned problems are: sampling biases, test's power to alternative hypothesis, misspecification due to endogenous variables, treatment of serial and cross-sectional correlation and problems concerning the definitions and appropriateness of the accounting variables. Data requirements and data availability restrict the number of firms within the samples. This may bias the sample towards relatively large companies with more conservative financing characteristics. In addition, the researcher himself could introduce bias when cleaning the data and eliminating from the sample those companies with non-standard capital structure (financials and utilities).

Similarly, there is considerable evidence pointing out the low power of capital structure tests (Shyam-Sunder and Myers, 1999; Chirinko and Singha, 2000). Researchers used to present their results without examining whether their tests have power to detect other possible alternative explanations. This is understandable since a study of the power of a test presents various challenges. Firstly, one should identify an alternative explanation to the main theory and secondly one would have to rely on Monte-Carlo simulations to artificially generate the firms' financing behaviour.

Capital structure tests rely on the information from the firms' financial statements. Many of these variables are not explicitly presented in the balance sheets and the researcher has to estimate them. This opens the door to the well-known problem of errors-in-variables that can seriously affect the results of the tests.

Lastly, there is apparently little awareness of the importance of a proper econometric treatment of data. For example, Fama and French (2002) argue that most of the prior evidence is subjected to statistical problems that undermine the credibility of the inferences. They argue that both cross sectional and serial correlations are commonly ignored.

Along these lines, our paper investigates the performance of the theories when tested on sub sample of firms grouped according to two artificial indexes measuring asymmetric information and debt capacity. We predict that the pecking-order theory would have more explanatory power when tested against a group of companies with high levels of the above indexes. We use a panel data approach free of serial correlation that can be consistently estimated by the Generalised Method of Moments (GMM).

CONCEPTUAL FRAMEWORK

The trade-off theory: According to the static trade-off theory firms will issue debt up to the point where the marginal benefit of an extra unit of debt equals its marginal cost. The main benefits of debt include: (1) interests tax shields (Modigliani and Miller, 1963) and (2) alleviation of agency costs of equity and free cash-flow (Jensen and Meckling, 1976; Jensen, 1986). The main costs of debt include: (1) non-debt tax shields (DeAngelo and Masulis, 1980) and (2) agency costs of debt due to the risk-shifting problem (Jensen and Meckling, 1976) and the debt-overhang problem (Myers, 1977). The main implication of this optimization behaviour is that companies have an optimal mix of equity and debt.

Capital structure and taxes: Modigliani and Miller's (1963) correction demonstrates that debt financing increases the value of a firm because interest payments are deducted from the taxable income. This increases the after tax cash-flows hence creating extra value (present value of the shielded interest payments). Thus, if only taxes are considered in deciding capital structure, then companies should leverage up as much as possible in order to maximize value. However as debt increases, the likelihood of bankruptcy is higher. Bankruptcy is assumed to be costly and therefore the present value of these costs will reduce the enterprise's value. The above argument leads to the main implication of the trade-off theory: there is a specific mix of debt and equity that maximizes the firm's value.

In subsequent contributions authors have helped improve the above reasoning by considering important additional issues. Along these lines, Miller (1977) examined the effect of personal taxes and showed that in equilibrium investors' personal taxes disadvantage and corporate taxes' advantage would cancel out. Hence, with the aggregated tax shields equal to zero there should not be an optimal capital structure anymore.

DeAngelo and Masulis (1980) examined the effect of other non-debt tax shields on the above framework. Other accounting items such as depreciation or R and D expenditure are in some way left to the discretion of managers. By adequately writing-off or capitalizing these expenses, managers can reduce the amount of taxes paid during a year. Their generalization of the Modigliani and Miller (1963) and Miller (1977) models show that when other non-debt tax shields are taken into consideration regardless of bankruptcy or agency costs, an optimal capital structure emerges.

Capital structure and agency costs: The separation of ownership and control leads to conflicts of interests between shareholders and managers. Managers have no incentives to run a company efficiently because they do not face the consequences of wasted resources. These wasted resources reduce the firm's overall value and give rise to equity agency costs (Jensen and Meckling, 1976). In order to alleviate these costs, it is believed that leveraging up the firm will make managers run the company more efficiently by reducing the spare resources that could have otherwise been wasted at their discretion (Jensen, 1986).

However, the former measure does not come costless. As stated by Jensen and Meckling (1976), when the leverage is high enough the firm's owners will have additional incentives to enter in sufficiently risky projects even when their expected value is negative. From a purely theoretical point of view, this is true because a stake on the equity of a firm can be viewed as a call option. In this case, the assets of the firm would be the underlying whilst debt would be the strike price. Thus, the stake of the owner becomes more valuable as the firm's assets become more volatile. This risk-shifting problem arises because at high levels of debt (close to bankruptcy), the manager has little to lose and the debt-holder assumes all the possible costs. This can be interpreted as the manager gambling with the debt-holder's money.

In a similar line of reasoning, Myers (1977) argues that when firms are highly leveraged (close to bankruptcy) the owner of the firm has no incentives to invest additional capital in small but positive NPV investments. This is because the debt-holder will profit from almost all the benefits of the new investment while the owner who commits the capital will only receive an insignificant proportion of the value created. This agency problem is known as the debt overhang problem (Myers, 1977).

The pecking-order theory: Alternative theories aiming to explain how companies decide between debt and equity financing make use of the developments made on information economics. The trade-off theory assumes that all agents involved in the game share the same common information. Particularly, the works on adverse selection and asymmetric information has helped researchers develop new theories on capital structure. Myers and Majluf (1984) developed a model in which firms decide their mix of debt and equity in order to alleviate the effects of asymmetric information. In a market with information asymmetries it is very likely that discrepancies in a firm's value will emerge.

Those inside the firm know more about the value of the existing assets than those outside the firm (investors) do. The main reasoning of the pecking-order theory is as follows: investors do not know which companies are more valuable than those less valuable and are not able to differentiate among them. In this context, investors have no choice but to estimate the value of all firms at their expected (average) value. This will result in a general mis-pricing in which those firms with the lower valuable assets will be overpriced and those with the higher valuable assets will be underpriced. To avoid mis-pricing, highest value companies will try not to sell their claims in the market and use generated internal funding. Solely when the internal funding is insufficient to implement their investment policy, these companies will sell their claims in the market. In the latter case, firms will choose those securities that are less sensitive to information discrepancies (debt will be used first and equity in the last case). This implies that capital structure will follow a particular hierarchy or pecking order (Myers, 1984). Differently from the trade-off theory, the pecking order does not predict that firms have a well-defined optimal capital structure.

MATERIALS AND METHODS

The empirical models

The trade-off model: The static trade-off theory implies that each firm will try to achieve its optimal capital structure through strategic financing decisions. This behaviour could be manifested in: (1) we will expect the debt ratio to be mean-reverting towards its optimal value; (2) the cross section of firm's capital structure being captured by some common explanatory variables.

Past studies have used a partial adjustment process to test the mean reverting interpretation of the trade-off theory and we will follow this approach (Shyam-Sunder and Myers, 1999; Fama and French, 2002). The model is specified as follows:

$$D_{it} - D_{it-1} = \delta\left(D_{it}^{TARGET} - D_{it-1}\right) + \varepsilon_{it} \qquad \varepsilon_{it} \sim IDD\left(0, \sigma_{\varepsilon}^{2}\right) \qquad (1)$$

Where:

D_{it} : Debt ratio for the firm i at time t
δ : Speed of adjustment,
D_{it}^{TARGET} : Target debt ratio for the firm i at time t
ε_{it} : Error term for the firm i at time t

Estimating Eq. 1 requires the knowledge of the unobservable variable D_{it}^{TARGET}. As we have argued before, the static trade-off theory implies that the cross-section of firms' capital structure should be captured by some common explanatory variables. Hence, the obvious approach is to determine the target debt ratio as a function of some firm characteristics. These characteristics have been well documented in various cross-section studies (Harris and Raviv, 1991; Rajan and Zingales, 1995). In order to follow the standard practice we have considered five important determinants of debt:

- Non-debt tax shields
- Collateral value of assets
- Profitability
- Firm size
- Growth opportunities

Following the study on cross-sectional and panel data econometrics (Baltagi, 2001; Wooldridge, 2002) we adopt a two-way-error-component regression model with time and firm fixed effects. The time effects take into account the macroeconomic state variables that affect all companies and are intrinsic to the economic environment. The firm effects capture the firm and industry characteristics. According to Baltagi (2001), a fixed effects specification is required when one aims to investigate the behaviour of a specific dataset of firms and make inference within them.

The cross-sectional specification of the target debt ratio is:

$$D_{it}^{TARGET} = \sum_{k=1}^{5} \beta_k^{EXP} X_{kit} + \gamma_i^{FIRM} + \eta_t^{TIME} + \varepsilon_{it} \qquad \varepsilon_{it} \sim IDD(0, \sigma_\varepsilon^2) \qquad (2)$$

Where:

D_{it}^{TARGET} : Target debt ratio of firm i at time t
β_k^{EXP} : Estimated coefficient for the kth explanatory
X_{kit} : kth explanatory variable of firm i at time t. Explanatory variables include: collateral value of assets (COLL), non-debt tax shields (NDTS), profitability (PRFT), growth opportunities (GRTH) and firm size (SIZE)
γ_i^{FIRM} : Time-invariant unobservable firm and/or industry-specific fixed effects
η_t^{TIME} : Firm-invariant time-specific fixed effects

For the estimation of Eq. 1 and 2 one can use two different approaches. As in Shyam-Sunder and Myers (1999) and Fama and French (2002), the estimation can be done in two steps. The first step requires the estimation of the target debt (Eq. 2). In the second step, the obtained values from Eq. 2 are used as an independent variable for the mean-reversion (Eq. 1). In practice, this procedure is not recommended as it is very likely that any estimation error in Eq. 2 would be carried into Eq. 1.

The second approach is a one step-procedure, i.e., we plug (2) directly into (1) yielding a unique Eq. 3:

$$D_{it} = \phi_0 D_{it-1} + \sum_{k=1}^{5} \phi_k^{EXP} X_{kit} + \lambda_i^{FIRM} + \varphi_t^{TIME} + \varepsilon_{it} \qquad \varepsilon_{it} \sim IDD(0, \sigma_\varepsilon^2) \qquad (3)$$

Where:

$\phi_0 = 1 - \delta$
$\phi_k^{EXP} = \delta \beta_k^{EXP}$
$\lambda_i^{FIRM} = \delta \gamma_i^{FIRM}$
$\varphi_t^{TIME} = \delta \eta_t^{TIME}$

Now, as D_{it} and D_{it-1} are very likely to be correlated with the specific fixed firm effects error term λ_i^{FIRM}, the standard OLS estimator would be, in general, biased and inconsistent. To overcome the difficulty, the common approach in the literature is to transform the model using first differences, where eliminate the fixed firm effects:

$$\Delta D_{it} = \phi_0 \Delta D_{it-1} + \sum_{k=1}^{5} \phi_k^{EXP} \Delta X_{kit} + \Delta \varphi_t^{TIME} + \Delta \varepsilon_{it} \qquad \varepsilon_{it} \sim IDD(0, \sigma_\varepsilon^2) \qquad (4)$$

Once we have eliminated the possible serial correlation, we can estimate the model by the Generalised Method of Moments (hereafter GMM). This estimation procedure is widely used in panel data studies and has been proved to yield consistent, asymptotically normal and efficient estimators. As suggested in earlier study, we will use the Arellano and Bond (1991) GMM estimator and the Blundell and Bond (1998) GMM system of equations.

The Pecking-order model: The Pecking-order theory establishes a hierarchical order for the different sources of financing. Shyam-Sunder and Myers (1999) proposed a simple testable implication for the pecking-order theory that has been subsequently used in capital structure empirical studies. They argued that firms' capital structure will depend on the net requirement for external finance, this is, the external funds needed once the internal funds have been consumed. As such, if firms follow the Pecking-order theory this deficit in cash flow will be entirely financed by debt financing. Thus, the empirical model is:

$$\Delta D_{it} = \alpha_{PO} + \beta_{PO} DEF_{it} + \varepsilon_{it} \qquad \varepsilon_{it} \sim IDD(0, \sigma_\varepsilon^2) \qquad (5)$$

Where:

Δd_{it} : First difference of the debt ratio
α_{PO} : Constant term for the pecking-order model
β_{PO} : Slope coefficient of the pecking-order model
DEF_{it} : Deficit cash-flow for the firm i at time t

The deficit cash-flow variable is not directly observable. Hence, the researcher needs to estimate it from the information available on the financial statements. As in Shyam-Sunder and Myers (1999), we have identified five main variables that account for the deficit cash flow:

$$DEF_t = DIV_t + I_t + \Delta W_t - C_t + R_t \qquad (6)$$

Where:

DIV_t	:	Cash dividends in year t
I_t	:	Net investment in year t
ΔW_t	:	Change in working capital in year t
C_t	:	Cash flow after interest and taxes
R_t	:	Current portion of the long-term debt in year t

The strict pecking-order theory will hold if $\alpha_{PO} = 0$ and $\beta_{PO} = 1$, however, a weak form may be consistent with slope coefficients lower but relatively closer to one.

The nested model: In order to compare the performance of one theory against the other, we need a combined framework that unifies both theories. Shyam-Sunder and Myers (1999) and Frank and Goyal (2003) proposed to introduce Eq. 5 into Eq. 4 and jointly estimate the unified model. The nested model is therefore:

$$\Delta D_{it} = \phi_0 \Delta D_{it-1} + \sum_{k=1}^{5} \phi_k^{EXP} \Delta X_{kit} + \Delta\varphi_t^{TIME} + \beta_{PO} DEF_{it} + \Delta\varepsilon_{it} \qquad \varepsilon_{it} \sim IDD\left(0, \sigma_\varepsilon^2\right) \tag{7}$$

As before, if the pecking order is what really determines the financing behaviour of firms we will expect $\alpha_{PO} = 0$ and $\beta_{PO} = 1$. However, a weak form may be consistent with slope coefficients lower but relatively closer to one. Furthermore, if the coefficients of the explanatory variables in Eq. 4 lose their statistical significance, then one can reject the trade-off theory in favour of the pecking order theory.

Data: We have collected a relatively large sample of European firms from the Thomson Financial (Worldscope) database. The initial sample is the European developed countries research list, which is constructed by Thomson and contains 279 Large Cap firms, 919 Medium Cap firms and 640 Small Cap firms. The list includes companies with a current market capitalization equal or above \$200 million. The accounting data for all the firms was collected from December 1999 up to December 2008, resulting in an unbalanced dataset of 13,000 year observations.

As in similar studies, we have imposed the following restrictions to the data: (1) Firms from the financial and utilities sector have been removed due to their non-standard capital structures; (2) any observations that have missing data for the variables of interest have also been removed. After these restrictions, we end up with a sample size formed of 1,256 companies (7,739 balanced year observations). The structure of the sample is shown in Table 1.

Narrowing the sample: Asymmetry and debt capacity indexes: Inspired by the study of Lemmon and Zender (2004), we have grouped the firms of our sample using two artificial indexes for asymmetry of information and debt capacity. Along these lines, we expect that the pecking order theory will have more explanatory power when applied to companies that are predicted to face more asymmetry of information. In addition, as noted by Lemmon and Zender (2004), companies will further follow the pecking order if they are able to issue non-risky debt. If their debt capacity is limited (already very leveraged, no agency's rating, poor quality of assets, etc.) they will issue equity even though they were strictly pecking-order followers.

For the asymmetry index, we have obtained data of three different proxies that have been identified in the accounting literature as indicators of asymmetry of information. The proxies are: (1) trading volume as suggested by Leuz and Verrecchia (2000) and Andrew-Lo *et al*. (2004), (2) bid-ask spread as suggested by Diamond and Verrecchia (1991) and (3) equity analysts' errors in forecast estimates as suggested by Barry and Brown (1985).

For the debt capacity index, we have partially followed Lemmon and Zenders (2004). These authors have identified, among others, two variables that are proxies of debt capacity: (1) property plant and equipment and (2) the market-to-book ratio. For the exact definitions and all the data items collected.

To create the indexes we have divided the sample of companies into percentiles according to the value of these variables. Next, we have given scores for each 20% and assigned each company a value between one and five for each year in the sample. This allowed us to divide the sample into groups with different levels of debt capacity and asymmetry of information.

RESULTS

We have used the DPD Statistical Package integrated in Oxmetrics to carry out our econometric analysis. For each empirical specification, we provide the estimated coefficients for each explanatory variable and its associated p-values (for their calculation asymptotic we have used standard errors robust to heteroskedasticity). We also provide the regressions' RSS and the results for five different tests. These tests include: (1) Wald tests on the joint significance of the parameters and the dummy (constant) variable, (2) AR (autoregressive) tests for first and second-order autocorrelation on the residuals and a (3) Sargan test for the over identification and validity of moment conditions when GMM is applied.

Table 2: Regression results for the Trade-off theory

	Dependent variable: Debt ratios							
	MVDR							
	Broad data		Highest asymmetry index		Highest debt capacity		Highest asymmetry index and debt capacity	
	1	2	3	4	5	6	7	8
Independent variables	GMM _Diff	GMM sys_Diff	GMM _Diff	GMM sys_Diff	GMM _Diff	GMM sys_Diff	GMM _Diff	GMM sys_Diff
D_{t-1}	0.751***	0.812***	0.799***	0.830***	0.791***	0.812***	0.802***	0.835***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$COLL_t$	0.089***	0.035***	0.079***	0.028***	0.067**	0.072**	0.034	0.042
	[0.001]	[0.000]	[0.008]	[0.007]	[0.027]	[0.020]	[0.246]	[0.181]
$NDTS_t$	-0.390**	-0.077**	-0.182	-0.111**	0.036	0.022	0.067	0.038
	[0.023]	[0.048]	[0.108]	[0.036]	[0.821]	[0.899]	[0.676]	[0.795]
$PRFT_t$	-0.109***	-0.066***	-0.047	-0.055	-0.035*	-0.037*	-0.022	-0.025
	[0.000]	[0.000]	[0.196]	[0.196]	[0.079]	[0.067]	[0.308]	[0.308]
$GRTH_t$	0.005*	0.004***	0.002***	0.002***	0.002	0.001	0.000	-0.001
	[0.076]	[0.001]	[0.010]	[0.006]	[0.741]	[0.847]	[0.984]	[0.915]
$SIZE_t$	0.013***	0.005***	0.015***	0.005***	0.011**	0.012**	0.006	0.006**
	[0.000]	[0.000]	[0.001]	[0.001]	[0.035]	[0.017]	[0.039]**	[0.042]
Wald test 1	4,110.000***	5,996.00***	2,439.00***	2,636.00***	190.70***	238.40***	105.20***	113.40***
(Joint)	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Wald test 2	4.984**	0.002368	6.95***	0.1733	4.858**	6.512**	4.803**	4.317**
(constant)	[0.026]	[0.961]	[0.008]	[0.677]	[0.028]	[0.011]	[0.028]	[0.038]
AR(1) test	5.510***	2.959***	3.097***	1.91*	2.3**	2.537**	1.171	1.324
	[0.000]	[0.003]	[0.002]	[0.056]	[0.021]	[0.011]	[0.242]	[0.185]
AR(2) test	5.927***	4.135***	2.806***	1.153	2.099**	2.422**	1.679*	1.612
	[0.000]	[0.000]	[0.005]	[0.249]	[0.036]	[0.015]	[0.093]	[0.107]
Sargan test	194.900***	371.4***	90.65***	199.4***	78.66**	90.25	72.83*	77.71
	[0.000]	[0.000]	[0.002]	[0.000]	[0.020]	[0.811]	[0.054]	[0.970]
Instruments	GMM	GMMSyst	GMM	GMMSyst	GMM	GMMSyst	GMM	GMMSyst
No. of obs.	7,739	7,739	2,288	2,288	1,610	1,610	646	646
No. of indiv.	1,256	1,256	359	359	593	593	208	208
RSS	23.066	18.219	6.343	5.132	3.595	3.747	0.877	0.880
TSS	89.078	89.08	29.73	29.73	13.61	13.61	4.19	4.19

1: See description of the explanatory variables in Appendix 1. 2: MVDR: Debt ratios in market values (Total debt divided by total debt plus market value of equity). COLL: Collateral Value of Assets (Fixed assets scaled by total assets). NDTS: Non-debt Tax Shields (Depreciation scaled by total assets). PRFT: Profitability (EBIT scaled by total assets). GRTH: Growth (Increase in total assets). SIZE denotes Size (Natural logarithm of total sales). 3: Odd columns adopt the two-step Arellano and Bond (1991) GMM estimation method using (D_{it-2}, D_{it-3},...D_{i1}) and ΔX as instruments. Even columns adopt the two-step Blundell and Bond (1998) GMM system of equations with (D_{it-2}, D_{it-3},...D_{i1}) and ΔX in the differenced equations and ΔD_{i1}, X in the level equations. 4: Dummy variables are not included in any of the specifications. 5: *,**,*** denotes the coefficient's level of significance at 10, 5 and 1%, respectively

The Trade-off theory model: We first run a model where the increments of debt ratios are regressed against the increments of the set of conventional explanatory variables of debt (trade-off theory: Eq. 4). The results appear in Table 2 and are dividend into four main categories: total sample of companies, companies with the highest level of asymmetry, companies with the highest debt capacity and companies with both the highest level of asymmetry and debt capacity. For each sub sample two estimation procedures are used: the Arellano and Bond (1991) GMM (GMM) and the Blundell and Bond (1998) System of equations (GMM_Syst). This provides 8 different columns (1-8).

Of the two estimators, the Arellano and Bond GMM (Odd columns: 1, 3, 5 and 7) tends to perform better. One can observe that for this estimator, the specification tests (AR and Sargan) are widely satisfied: no autocorrelation in residuals and correct identification of moment conditions.

It calls our attention that the performance of the specification tests appears to deteriorate when the model is applied to the different sub samples. In reference to the estimated coefficients, our findings are in line with previous research but mixed. The coefficient on Collateral Value of Assets (COLL) is significant, positive and consistent with Rajan and Zingales (1995) and Titman and Wessels (1988). This result is in accordance with the trade-off theory: companies with higher collateral will incur less bankruptcy costs and hence will tend to be more leveraged.

Non-Debt Tax Shields (NDTS) is significant, negative and consistent with Titman and Wessels (1988) and Wald (1999). This result is in accordance with the trade-off theory: companies with substitutes for debt tax shields need less debt to shield their profits.

Profitability (PRFT) is significant, negative and consistent with Rajan and Zingales (1995), Titman and Wessels (1988) and Wald (1999). This result is not consistent with the trade-off theory: companies with higher profits will tend to be more leveraged to fully exploit the benefits of debt. Moreover, this result is more consistent with the pecking-order theory: companies with high profits (internal funds) will not need to turn to the market that often, not issuing debt or equity.

Growth (GRTH) is significant (however is the least significant), positive and consistent with Wald (1999). This result is not consistent with the trade-off theory: managers and equity holders of companies with high growth will be tempted to undertake more risky projects and gamble with the money of debt holders. Thus, debt is more costly for these firms and hence they will be less leveraged.

Size (SIZE) is significant and positive (Rajan and Zigales, 1995; Wald, 1999). This result could be consistent with both theories: large firms have fewer troubles to get debt financing due to their higher credibility in the markets. If they are trade-off followers, they will try to exploit the tax shields of debt and be more leveraged. If they are pecking-order followers, they will have no problems to issue debt once the internal funds have been used.

Interestingly, present results show that when the sample is narrowed to those companies expected to suffer from the highest asymmetry of information the coefficient of PRFT, for which we had obtained evidence against the trade-off theory, loses its significance. Moreover, significance is recovered when we considered companies with the highest debt capacity and different levels of asymmetry. This puzzling result could be interpreted as the trade-off theory gaining explanatory power for that concrete sample of firms. For the rest of coefficients, when we consider the companies suffering from the highest asymmetry of information but with high debt capacity, the coefficients appear not to be significant anymore. This finding suggests that the trade-off theory may be loosing its explanatory power for companies with high asymmetry of information but with capability to issue debt. Further, we can interpret this result as following, companies with debt capacity and that face more asymmetry of information, apparently do not make their financial decisions in order to achieve an optimal debt-equity mix.

The Pecking-order model: For this test we have used exactly the same procedure as in the previous section. We have run a model where the increments of debt ratios are regressed against the unique variable Deficit Cash-Flow (DEF) as stated by Eq. 5. The results are shown in Table 3. However, in this section we have used a static panel data model since there were no lagged variables in our specification. For this type of models, researchers commonly used two estimation procedures: Ordinary Least Squares (OLS pooled regression) and Generalised Least Squares (GLS). We have estimated the models by the two methods, this provides the 8 different columns (1-8).

Table 3: Regression results for the Pecking order theory

	Dependent variable: Debt ratios							
	ΔMVDR							
	Broad data		Highest asymmetry index		Highest debt capacity		Highest asymmetry index and debt capacity	
	1	2	3	4	5	6	7	8
Independent variables	OLS	GLS	OLS	GLS	OLS	GLS	OLS	GLS
DEF_t	0.169***	0.166***	0.187***	0.185***	0.121***	0.105***	0.098	0.066***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.116]	[0.000]
Constant	0.007***	0.006***	0.002***	0.001***	-0.004*	-0.010***	-0.004	-0.014***
	[0.000]	[0.000]	[0.316]	[0.502]	[0.056]	[0.002]	[0.244]	[0.003]
Wald test 1	46.77***	580.00***	16.67***	174.00***	87.26***	341.20***	2.47	20.03***
(Joint)	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.116]	[0.000]
Wald test 2	42.85***	23***	1.005	0.4513	3.658*	9.845***	1.358	8.954***
(constant)	[0.000]	[0.000]	[0.316]	[0.502]	[0.056]	[0.002]	[0.244]	[0.003]
AR(1) test	4.877***	5.78***	-0.5781	-0.7804	1.835*	-4.755***	1.413	1.413
	[0.000]	[0.000]	[0.563]	[0.435]	[0.066]	[0.000]	[0.158]	[0.158]
AR(2) test	-6.54***	-7.666***	-3.173***	-3.862***	-0.8235	-4.692***	1.742	1.742*
	[0.000]	[0.000]	[0.002]	[0.000]	[0.410]	[0.000]	[0.081]*	[0.081]
Sargan test	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
No. of obs.	7,739	7,739	2,288	2,288	1,610	1,610	646	646
No. of indiv.	1,256	1,256	359	359	593	593	208	208
RSS	77.252	75.547	18.682	18.539	7.347	2.843	2.453	0.922
TSS	83.90	81.90	20.30	20.10	8.88	3.67	2.61	0.96

1: Dummy variables are not included in any of the specifications. 2: *,**,*** denotes the coefficient's level of significance at 10, 5 and 1%, respectively. 3: OLS: Pooled regression estimation method, GSL: Estimated using OLS residuals

Of the two estimators, the GLS (Even columns: 2, 4, 6 and 8) tends to perform better. As such, one can observe that for this estimator, the specification tests (No Sargan test is provided since there are no moment conditions to be identified) are widely satisfied: no autocorrelation or order 1 or 2 in the residuals. This is intuitively reasonable since one may expect residuals of different groups to have different variances and therefore one may expect the estimator that takes into account the possible heteroskedasticity to perform better.

Here as well, it calls our attention that the performance of the specification tests appears to deteriorate when the sample is narrowed down successively. In reference to the estimated coefficients, the results are in line with previous research. Deficit Cash Flow (DEF) is significant and positive (Shyam-Sunder and Myers, 1999; Frank and Goyal, 2003) and the constant is not statistically different from zero. Although, these results are consistent with the pecking-order theory, the magnitude of the DEF coefficient is significantly lower than what would be expected if the theory was to hold strictly: the deficit cash flow perfectly tracks the changes in debt, in other words, when firms run out of internal funds they next will try to issue debt and only as a last resource they will issue equity.

Interestingly, one can observe that the magnitude of the DEF coefficient increases (although the increase is moderate) when we narrow the sample down to those companies that with higher expected level of asymmetry. This suggests that the pecking-order theory has greater explanatory power for companies with higher asymmetry of information. Yet, it should be noted that the changes in magnitudes are small relative to the absolute magnitudes and hence, results must be interpreted with considerable caution. More interestingly and reinforcing our predictions, when we run our model within the companies with the highest debt capacity but mixed asymmetry, the coefficients magnitude decreases considerably.

Table 4: Regression results for the Trade-off theory vs. Pecking order theory

	Dependent variable: Debt ratios							
	ΔMVDR							
	Broad data		Highest asymmetry index		Highest debt capacity		Highest asymmetry index and debt capacity	
	1	2	3	4	5	6	7	8
Independent variables	GMM _Diff	GMM sys_Diff	GMM _Diff	GMM sys_Diff	GMM _Diff	GMM sys_Diff	GMM _Diff	GMM sys_Diff
D_{t-1}	0.545***	0.713***	0.668***	0.807***	0.789***	0.929***	0.659***	0.805***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$COLL_t$	0.024**	0.020**	0.026**	0.019**	0.047*	0.018	0.008	0.003
	[0.022]	[0.022]	[0.019]	[0.034]	[0.083]	[0.113]	[0.707]	[0.843]
$NDTS_t$	0.065	0.085	-0.115*	-0.057	0.116	0.056	0.271**	0.222*
	[0.657]	[0.373]	[0.090]	[0.227]	[0.382]	[0.433]	[0.026]	[0.054]
$PRFT_t$	-0.036***	-0.045***	-0.071***	-0.050***	-0.057	-0.076***	-0.026	-0.045
	[0.004]	[0.000]	[0.010]	[0.010]	[0.204]	[0.005]	[0.461]	[0.461]
$GRTH_t$	0.038*	0.038**	0.021*	0.025***	0.069***	0.066***	0.072***	0.073***
	[0.084]	[0.031]	[0.071]	[0.005]	[0.001]	[0.000]	[0.002]	[0.001]
$SIZE_t$	0.062***	0.015**	0.056***	0.012***	0.008	0.003**	0.010*	0.004
	[0.000]	[0.000]	[0.000]	[0.000]	[0.135]	[0.015]	[0.051]	[0.180]
DEF_t	0.182***	0.169***	0.161***	0.180***	0.036	0.043**	0.077*	0.074
	[0.000]	[0.000]	[0.000]	[0.000]	[0.126]	[0.047]	[0.040]	[0.129]
Wald test 1	1,094.00***	6,163.00***	966.60***	4,913.00***	350.90***	1,107.00***	108.10***	499.80***
(Joint)	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Wald test 2	71.17***	27.4***	43.82***	10.55***	3.292*	9.323***	4.569**	3.59*
(constaant)	[0.000]	[0.000]	[0.000]	[0.001]	[0.070]	[0.002]	[0.033]	[0.058]
AR(1) test	9.094***	3.06***	5.459***	1.301	1.821*	0.8904	1.817*	1.28
	[0.000]	[0.002]	[0.000]	[0.193]	[0.069]	[0.373]	[0.069]	[0.200]
AR(2) test	8.102***	0.7442	5.074***	-0.2918	1.85*	0.8797	2.325**	2.159*
	[0.000]	[0.457]	[0.000]	[0.770]	[0.064]	[0.379]	[0.020]	[0.031]
Sargan test	342***	664.8***	133.6***	216.6***	111.5***	207.5***	87.55**	145.1
	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]	[0.065]	[0.106]
Instruments	GMM	GMMSyst	GMM	GMMSyst	GMM	GMMSyst	GMM	GMMSyst
No. of obs.	7,739	7,739	2,288	2,288	1,610	1,610	646	646
No. of indiv.	1,256	1,256	359	359	593	593	208	208
RSS	124.9626364	65.974	28.338	16.041	6.488	6.148	2.062	1.868
TSS	291.9912662	291.99	84.97	84.97	36.44	36.44	12.53	12.53

1: Dummy variables are not included in any of the specifications. 2: Odd columns adopt the two-step Arellano and Bond (1991) GMM estimation method using (D_{it-2}, D_{it-3},...D_{i1}) and ΔX as instruments. Even columns adopt the two-step Blundell and Bond (1998) GMM system of equations with (D_{it-2}, D_{it-3},...D_{i1}) and ΔX in the differenced equations and ΔD_{i1}, X in the level equations. 3: *,**,*** denotes the coefficient's level of significance at 10, 5 and 1%, respectively

A general examination of the results will show the results fail to support the strict implication of the pecking-order theory. For it to hold the coefficient of DEF would need to be equal to 1. Considering previous evidence this result is not consistent with Shyam-Sunder and Myers (1999). On the contrary, it is consistent with Frank and Goyal (2003) who documented evidence against the strict implication of pecking-order theory. However, our interpretation is positive as we think the evidence suggests that the performance of the theories is not to be examined in the broad data but within samples of companies that share some common characteristics.

The Trade-off vs. the Pecking-order model: Our earlier findings lead us to an interesting question: how will the pecking-order theory perform when tested jointly against the trade-off theory? The results are shown in Table 4. For each sub sample two estimation procedures are used: the Arellano and Bond (1991) GMM (GMM) and the Blundell and Bond (1998) GMM System of equations (GMM_Syst). This provides the 8 familiar columns (1-8).

Of the two estimators, the Arellano and Bond GMM (Odd columns: 1, 3, 5 and 7) tends to perform better. One can observe that for this estimator, the specification tests (AR and Sargan) are widely satisfied: no autocorrelation in residuals and moment conditions are correctly identified. However, the difference in performance is not as evident as in the case of Eq. 4. It is again noticeable how the performance of the specification tests deteriorates when the sample is narrowed down successively.

In comparing the results to those in the previous models (Table 2, 3), one can notice that the presence of the Deficit Cash-Flow (DEF) does not add any explanatory power. More importantly, the coefficient β_{PO} remains relatively small compared to what is expected if the pecking-order theory was to hold strictly.

Not surprisingly however, the coefficients β_{PO} are still positive and statistically significant. This is consistent with our previous result that the Deficit Cash Flow (DEF) exhibits a strong relationship with the changes in debt. Again, when the sample is narrowed down to those companies with the highest debt capacity but mixed asymmetry of information, the coefficient β_{PO} is almost reduced to zero and it loses its statistical significance. This result suggests that the pecking-order has a greater explanatory power for companies that exhibit a higher level of asymmetry of information.

With respect to the coefficients of the conventional explanatory variables of debt ratios, their sign and level of significance are almost unaffected by the inclusion of the Deficit Cash Flow (DEF) variable. It seems that the Non-Debt Tax-Shields (NDTS) loses its significance. This puzzling result could be due to the fact that the Deficit Cash Flow (DEF) incorporates a depreciation component which is the main building block of the Non-Debt Tax Shields (NDTS), thus reducing the importance of the latter.

CONCLUSIONS

We have studied the financing behaviour of a relatively large sample of European companies. Our believes are that capital structure theories are not designed to be general, in other words, capital structure decisions are driven by different, in some cases, competing forces and one would not expect a theory to fully explain the financing behaviour of firms at the aggregate level.

Capital structure tests require careful interpretation of the theories behind them. There are situations in which a company strictly following the pecking-order could issue equity without this being considered a violation of this theory's main predictions. We need to think flexibly to accommodate the cases where companies following the pecking-order have no choice but to issue equity due to its incapacity to issue debt. Further, it is also important to narrow the sample of companies to those for which the theory has been designed and test the performance of the theory within that group of companies.

The results provide evidence to support the following arguments

- Both theories of capital structure have some explanatory power
- The pecking order theory holds better when tested in a sub-sample of firms that are expected to face more asymmetry of information but that have capacity to issue debt
- Debt capacity alone is not sufficient for companies to issue debt
- The trade-off theory appears to perform well at the aggregate level and the pecking-order theory does not offset its performance when both theories are tested jointly
- The strict version of the pecking-order does not hold

Finally, we should note that evidence from capital structure tests is debatable as it rests on the validity of some methodological and econometric issues. First, researchers are facing data constraints since the variables needed for this type of studies are not generally available prior to 1970. Secondly, the reliance on commercial financial databases could bias the sample towards firms with specific financial characteristics and size; this is the case because data are more easily collected from larger public companies than from small privately owned companies. Thirdly, not only the databases themselves could bias the sample. The data-cleaning process and the constraints imposed in the raw data by the researcher could also bias our samples. Fourthly, many of the variables used in these studies are not directly observable in the company's financial statements. This could lead to the well-known problem of errors-in-variables that could make our tests' results inconsistent and biased.

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APPENDIX

Appendix 1: Description of explanatory variables

Debt ratios (MVDR): Consistent with previous research the main proxy employed in this study is the total debt scaled by the Total Market Value of Equity and Debt. The market value of equity plus debt is preferred to book value, since the theoretical framework has so far considered capital structure in terms of market values. Moreover, book values of equity are highly subject to manipulation by the use of various creative accounting techniques, which make it difficult to compare among firms on a cross-sectional basis. It should also be noted that, in principle, the market value is the sum of the market value of equity and that of debt. However, due to the lack of the market data of debt, the book value of debt is used instead. This should not be regarded as a serious limitation because the market value and book value of debt can be highly correlated.

Collateral value of assets (COLL): This study follows the major body of the past empirical literature that applies fixed assets scaled by total assets as the measure of this variable.

Non-Debt Tax Shields (NDTS): The most widely used measure for non-debt tax shields in past research is depreciation divided by total assets. This measure is employed in our study, although caution should be taken due to its potential correlation with the measure of COLL.

Profitability (PRFT): Prior research generally agrees on the measurement of profitability with the common proxy being profit divided by total assets. Differences are only concerned with what specific measure of profit should be used, be it trading profit, EBIT, EBITDA or retained earnings. This study uses EBIT to Total assets as the proxy for profitability.

Growth (GRTH): According to previous studies, there are two popular proxies for growth, including (1) the change in total assets or (2) the firm Market-to-Book Value ratio. Since the former measure tends to capture the past growth rather than the expected growth, this study employs the latter.

Size (SIZE): There is a considerable consensus among previous research regarding the measurement of size. In general, there are two proxies for size, including (1) the natural logarithm of total assets or (2) the natural logarithm of total sales. This study adopts the former measure

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