

CORPORATE LEVERAGE PREFERENCES: SOME EVIDENCE FROM GREEK FIRMS*

By

*Dimitrios Vasiliou** and *Grigoris Kontolaimos***

* Professor of Bank Management, Hellenic Open University,

** MBA, Athens University of Economics and Business

Abstract

This paper presents empirical evidence on the determinants of capital structure of listed Greek firms from 1997 to 2001. We use panel data for a sample of 138 firms listed in Athens Stock Exchange. The hypothesis that is tested in this paper is that the leverage ratio depends upon eight explanatory variables: liquidity, asset structure, interest coverage ratio, profitability, firm size, effective tax rate, risk and Tobin's q. We apply the three following models in order to estimate the effect of each independent variable in leverage: the total model, the fixed effects model and the random effects model. The main conclusion from this study is that firms prefer internal from external financing. This is a hint that pecking order may exist. However, when it comes to external financing there is no evidence that firms prefer debt to equity. Most of the results are consistent with the theoretical background, which is presented in the second section of the paper. JEL classification: G3, G32.

Keywords: Capital Structure, Pecking Order, Corporate Finance, Financial Leverage, Greek Firms.

1. Introduction

The concept of capital structure is one of the most controversial concepts in corporate finance. In recent years, a number of theories have been proposed to explain the variation in debt ratios across firms. The theories suggest that firms determine their capital structure depending on attributes that determine the various costs and benefits associated with debt and equity financing. There is no universal theory of the debt – equity choice, and no reason to expect one. All these theories constitute the so-called *capital structure puzzle*. And *puzzle* is a particularly appropriate term, because our understanding has evolved in

* The authors would like to thank an anonymous referee of this journal for valuable comments and suggestions that substantially improved the original paper.

much the same way in which a puzzle is pieced together. Pieces are still being added, and we still do not have the complete picture. Theories of capital structure ought to be useful in explaining the cross – sectional and over time variation. Indeed, the success of such theories in explaining variation in leverage across firms would be testimony to their validity.

Since the seminal work by Modigliani and Miller (1958), a vast amount of literature has been generated. Part of this literature materialized into a series of theoretical and empirical studies whose objective has been to determine the explanatory factors of capital structure. Thus, there is a transition from Miller's (1977) postulate of tax neutrality – later refuted by DeAngelo and Masulis (1980), who introduced the concept of non-debt tax shields – to the static theory, which postulates the optimum debt level as a consequence of a trade-off between the tax advantages of borrowed money and financial distress costs. Finally, some aspects related to asymmetric information and the agency theory (pecking order and free cash flow theories) have been introduced into the analysis, not forgetting the well-known relationship between debt and investment.

This paper attempts to examine the relative merits of different hypothesis regarding capital structure choice by examining the cross-sectional and over time variation in leverage among Greek listed firms. We attempt to explain this variation using variables suggested by different capital structure theories thus testing the empirical validity of such theories. Furthermore, this study constitutes an important upgrade and extension of the other relevant research that has been accomplished for Greece, by including additional variables in determining the capital structure of the Greek firms.

Moreover, this study takes place during the period 1997 – 2001, when major macroeconomic changes occurred in Greece. Greece became a member of the Economic and Monetary Union in 1996 and it was announced in 1997 that it would host the Olympic Games of 2004. These two events triggered a set of major investments in Greece and as a result, growth rate was increased, interest rate and inflation rate were reduced¹. We believe that it is very interesting to determine the explanatory factors of capital structure of a developing country during a period of major institutional and macroeconomic changes².

In the next section, we briefly trace the theoretical developments that underlie this study. In section 3 we describe the justification and computation of the variables used in this study. Section 4 outlines previous studies conducted for the Greek market. In section 5 we describe our data and the methodology

that is used in this study. The sixth section contains a discussion of the results. Finally, our conclusions are summarized in section 7.

2. Theoretical Background

Prior to Miller (1977) the commonly accepted view was that each firm had a unique optimal structure, which was determined by the characteristics of that particular firm. The general underlying theoretical argument was based on Modigliani & Miller's (1963) hypothesis that there was a corporate tax advantage to debt financing coupled with recognition of an increased probability of bankruptcy that was positively related to the level of debt financing. The bankruptcy cost argument relies on the assumption that such costs are not trivial.

Miller (1977) citing Warner (1977) argues that bankruptcy costs are trivial. Assuming a personal tax rate on equity income of zero and a positive and progressive tax rate on interest from debt, Miller shows that in equilibrium, the marginal personal tax rate on debt is equal to the corporate tax rate. Accordingly, the corporate tax advantage to debt is cancelled by the personal tax disadvantage. While there may be an optimal amount of borrowing at the economy wide level determined by the differential between personal and corporate tax rates, there is no such unique optimum at the level of the individual firm.

Miller's paper sets up the theoretical framework for recognizing the impact of personal taxes as well as corporate taxes. The validity of his argument depends on (a) a correct modeling of the tax regime and (b) trivial leverage related costs e.g. agency and bankruptcy costs. DeAngelo and Masulis (1980) show that under a more realistic model of the tax regime that includes non-debt tax shields, a unique optimum degree of leverage may exist for each firm regardless of whether or not leverage-related costs are significant. In addition, they show that the existence of non-trivial leverage related costs in the absence of non-debt tax shields also suggests a unique optimum leverage ratio at the individual firm level.

Theoretical justification of the existence of agency and bankruptcy costs of leverage comes from Jensen & Meckling (1976), Scott (1977) and Myers (1977). Overall, the theory supports the notion of each firm having a unique interior optimal degree of leverage. However, this interpretation depends on the costs and benefits of leverage being economically significant. Ultimately, the significance of the costs and benefits of leverage suggested by the theory is a matter for empirical investigation.

Myers (1984) and Myers & Majluf (1984) who provide a theoretical justification for a “pecking order” theory present an alternative to the optimal trade-off theory of capital structure. This theory, simply put, suggests that firms will first rely on internally generated funds (i.e. undistributed earnings), then they will turn to debt if additional funds are needed and finally they will issue equity to cover any remaining capital requirements.

There are two main approaches that explain the pecking order financing pattern. The first refers to external financing transaction costs and the second to asymmetric information theory. According to the approach of transaction costs, the choice of the type of funds to be raised will depend critically on the costs of issue. Those with the lowest issue costs being used first and those with the highest issue costs last. According to the approach of asymmetric information, internal financing totally avoids the scrutiny of suppliers of capital. Debt is preferred from equity because debt issues are regarded as a positive signal by investors who possess less information than managers. This is because investors believe that management will never issue an undervalued security. Thus, if debt is issued, investors will assume that management believes that the stock is undervalued.

At this point we should mention that the pecking order is actually composed from two parts: first that internal funds are preferred from external financing and second that when it comes to external financing, debt is preferred from equity. In this study we focus our analysis mainly on the first part of the pecking order. Thus, we analyze if internal funds constitute a more preferable source of financing when compared to external financing. However, we should bear in mind that in case we find adequate evidence that this first part is verified, we should not derive hasty results concerning the existence of the pecking order theory, as there will be no evidence that new debt is preferred to new equity.

3. Determinants of Capital Structure

In this section, we present a brief discussion of the attributes that may affect the firm's debt vs. equity choice according to different capital structure theories. These attributes are denoted liquidity, asset structure, interest coverage ratio, profitability, size, effective tax rate, risk and Tobin's q . The attributes, their relation to the optimal capital structure choice, and their observable indicators are discussed below. However, we first describe the measure of the dependent variable that we used in our model.

Leverage Ratio (LR_{it}) – Dependent Variable

The measure of leverage ratio used in this study is total liabilities divided by total assets³. Data limitations force us to measure debt in terms of book values rather than market values. It would have been better if market values were available for both debt and equity. However, Bowman (1980) demonstrated that the cross-sectional correlation between the book value and the market value of debt is very high, so the misspecification due to using book value measure is probably fairly small. Furthermore, according to Titman and Wessels (1988), we have no reason to suspect that the cross-sectional differences between market values and book values of debt should be correlated with any of the determinants of capital structure suggested by theory, so no obvious bias will result because of this misspecification.

There are, however, some other important sources of spurious correlation. The dependent variable used in this study might be correlated with the explanatory variables even if debt levels are set randomly. Consider first the case where managers set their debt levels according to some randomly selected target ratio measured at book value⁴. If managers set debt levels in terms of book value rather than market value ratios, then differences in market values across firms that arise for reasons other than differences in their book values (such as different growth opportunities) will not necessarily affect the total amount of debt they issue. Since these differences do, of course, affect the market value of their equity, this will have the effect of causing firms with higher market/book value ratios to have lower debt/market value ratios. Since firms with growth opportunities and relatively low amounts of collateralizable assets tend to have relatively high market value/book value ratios, a spurious relation might exist between debt/market value and these variables, creating significant coefficient estimates even if the book value debt ratios are selected randomly⁵.

Similar spurious relations will be induced between debt ratios measured at book value and the explanatory variables if firms select debt levels in accordance with market value target ratios. If some firms use book value targets while others use market value targets, both dependent variables will be spuriously correlated with the independent variables.

Liquidity (L_{it})

As we have already mentioned, the leverage ratio is measured as total liabilities divided by total assets, which means that short-term debt is included in our dependent variable. Thus, it is expected that the rate with which the firm

covers its short-term debt has a strong influence in the leverage ratio. Furthermore, the short-term leverage coverage is an indication of the liquidity of the firm. That is why we examine the relation between the liquidity of the firm and its capital structure in our study.

Our proxy of liquidity is the sum of cash and accounts receivables divided by current liabilities. This variable, also known as the quick ratio, shows the ability of the firm to cover its current liabilities and measures the liquidity of the firm. We expect that there will be a negative relationship between the leverage ratio of the firm and its liquidity simply because the more debt the firm uses the more current liabilities this will imply and the fewer current assets will remain after dealing with the liabilities. However, the fact that a firm employs more current assets implies that it can generate more internal inflows, which can then use to finance its operating and investment activities. Thus, should the negative relationship be confirmed, this will mean that firms prefer internal from debt financing, which is in turn an indication that firms may finance their activities following the financing procedure implied by the pecking order theory.

Asset Structure (AS_{it})

Scott (1977) argues that the optimal capital structure of a firm consists of as much secured debt as possible. This result stems from the fact that the agency costs of secured debt are lower than those of unsecured debt. Accordingly, we would expect that firms with securable assets should issue more debt. Myers (1977) hypothesizes that capital intensive firms will employ relatively more debt. While his argument is different from that of Scott, his conclusions regarding the relationship between asset structure and leverage are essentially the same. Marsh (1982) also found evidence that the probability of an equity issue is inversely related to the ratio of fixed assets to total assets.

Therefore, there should be a positive relationship between tangibility and debt. That is, the more a firm's tangible assets worth, the more debt it will use. Assets that serve as a collateral, in fact, provide an explicit guarantee over debt and reduce the investment risk from the banks. Apparently, lenders may demand higher loan rates when firms do not have many assets that can serve as collateral. Our proxy for the securability of assets is fixed assets divided by total assets.

Interest Coverage Ratio (IC_{it})

The informational content of debt is twofold. First, the mere ability of the firm to make its contractual payments to debt holders provides information. *

Second, in case of default, management must placate creditors to avoid liquidation, either through informational negotiations or through formal bankruptcy proceedings. This suggests that, if investors are uncertain about the quality of management and the efficacy of business strategy, they can use debt to generate information policy [Jensen (1989)].

Moreover, according to Harris and Raviv (1990), the amount and usefulness of the information generated from debt depends on the schedule of debt payments, both timing and quantity. Consequently, managers will design debt payments (i.e., capital structure over time) at least in part to exploit the ability of debt to generate useful information.

If a firm fails to repay the debt, then a costly investigation that reveals both current income and some additional information about the firm quality is triggered. Specifically, Harris and Raviv (1990) assume that managers want to avoid any investigation that might result in liquidation and prefer not to pay out cash to investors. Managers may want to avoid liquidation to preserve rents and may prefer to retain cash either to avoid revealing that returns are low or because they benefit from having access to cash as argued in Jensen's (1986) "Free Cash Flow Theory"⁶. Hence, managers avoid default if possible but never pay more than is required to do so.

Given the above assumptions, Harris and Raviv (1990) argue that the only variable on which investors can base their decision to investigate is loan amortization schedule, and the debt contract is an optimal method for triggering investigations. One could argue that the debt contract could be interpreted as a dividend payout requirement. It is difficult, however, for investors to force liquidation or any change in operating policy on an entrenched management for not paying dividends. Debt, on the other hand, allows investors ready access to the courts and the legal enforcement mechanism to accomplish these ends when the firm defaults.

Therefore, in our study we use as a variable the ability of a firm to pay out its debts (interest coverage ratio) measured as operating income after taxes divided by interest expenses. In accordance with the argument of Harris and Raviv (1990), there should be a negative relationship between interest coverage ratio and leverage.

Profitability (P_{it})

Myers (1984) cites evidence from Donaldson (1961) that suggests that firms

prefer raising capital, first from retained earnings, second from debt and third from issuing new equity. He suggests that this behavior may be due to the costs of issuing new equity. These can be the costs discussed in Myers and Majluf (1984) that arise because of asymmetric information, or they can be transaction costs. In either case, the past profitability of a firm, and hence the amount of earnings available to be retained, should be an important determinant of its capital structure.

In our study, we use return on assets (ROA), measured as earnings after taxes divided by total assets, as an indicator of profitability. If we find evidence that there is a negative relationship between profitability and leverage, this could mean that firms retained a large amount of their earnings after taxes in order to finance their operations. On the other hand, if there is a positive relationship, this could mean that the highly profitable firms used their earnings to pay large amounts of dividends preferring to issue new debt to cover any financing requirements.

Size (S_{it})

A number of authors have suggested that leverage ratios may be related to the firm size. Warner (1977) and Ang, Chua, and McConnell (1982) provide evidence that direct bankruptcy costs appear to constitute a larger proportion of a firm's value as that value decreases. Furthermore, relatively large firms tend to be more diversified and less prone to bankruptcy. These arguments suggest that large firms should be more highly leveraged. Kim and Sorensen (1986) also report that firm size is an important determinant of debt ratios. According to them, the rationale is that larger and/or more diversified firms may have greater debt capacity and find favorable terms in the debt market when compared to smaller firms. Moreover, Myers (1977) argues that asymmetric information and/or management discretion can be more significant in smaller firms. Therefore, smaller firms seem to be riskier from the lenders' point of view.

The cost of issuing debt and equity securities is also related to the firm size. In particular, small firms pay much more than large firms to issue new equity⁷ and also somewhat more to issue long-term debt. This suggests that small firms may be more leveraged than large firms and may prefer to borrow short term (through bank loans) rather than issue long-term debt because of lower fixed costs associated with this alternative. Moreover, Marsh (1982) reports that size may also be related to accessibility to the capital markets and economies of scale with regard to the issue of securities. Because of this, smaller companies*

may tend to rely on bank loans and internally generated equity. Therefore, smaller firms may have lower long-term target debt ratios and higher short-term debt ratios than larger firms.

Barclay, Smith and Watts (1995) examined whether firm size has a systematic effect on leverage and dividend yields. As we have already noted, larger firms might be expected to have higher leverage ratios because they have lower direct bankruptcy costs. Yet, to the extent that book values are more likely to understate the debt capacity of larger firms (because they tend to be older), larger firms might even have lower leverage.

In our study we measure size as the logarithm of sales. The logarithm transformation of sales reflects our view that a size effect, if it exists, affects mainly the very small firms. We expect a positive relationship between size and leverage, which means that larger firms borrow more than smaller firms. However, there is also a good explanation for the potential finding of a negative relationship, as already mentioned above.

Effective Tax Rate (TAX_{it})

Tax liabilities play a major role in the theoretical development of debt usage. Corporate income taxes have long been a justification for corporate debt. As the interest on loan is tax-deductible, firms with high expected tax liabilities are assumed to use larger amounts of debt. Therefore, a positive relationship between effective tax rate and leverage ratio is expected⁸.

This argument holds only if firms have a sufficient amount of taxable income. On the other hand, higher corporate tax rates would result in lower internal funds as well as higher cost of capital. As a result, fixed capital formation and demand for external funds would decrease⁹.

This implies a negative relationship between the level of debt and the effective tax rate. However, Titman and Wessels (1988), among others, failed to find any significant effect of corporate tax on financial decisions. Due to these complexities the overall relationship between effective tax rate and leverage remains an empirical matter.

We have to highlight that it is difficult to measure cross-sectional variation in marginal tax rates. In a major study on tax rates, Zimmerman (1983) used the ratio of taxes paid to pretax income or operating cash flows as a measure of the "effective tax rate". He reports that his analysis is not sensitive to

alternative methods of calculating tax rates. In our study, we measure the effective tax rate as the ratio of tax paid divided by earnings before taxes.

Risk (R_{it})

Traditional finance textbook discussion presents the notion of debt capacity. It is sometimes argued that firms with high degrees of business risk have less capacity to sustain high financial risk, and thus will use less debt. However, Myers (1977) arrives at the opposite conclusion. Firms with large business risk may have a lower agency cost of debt, and thus optimally borrow more. Specifically, Myers concludes: "We have an interesting, perhaps surprising conclusion. The impact of risky debt on the market value of the firm is less for firms holding investment options on assets that are risky relative to the firms' present assets. In this sense we may observe risky firms borrowing more than safe ones" [Myers (1977), p. 167].

In our study, our proxy for risk is beta coefficient¹⁰. Beta coefficient has the advantage that it embodies the valuation of market value of equity in the estimation of risk. In reality, it contains business risk (which is determined by the operating decisions of the firm) and financial risk (which is determined by the decisions relative to the capital structure of the firm). This is confirmed by Robert Hamada's equation:

$$b = b_U \times \left[1 + (1 - T) \times \left(\frac{D}{E} \right) \right]$$

where, b_U is the beta coefficient the firm would have if it used no financial leverage, T is the corporate tax rate and D/E is the ratio of debt over equity which is the measure of financial leverage.

The expected sign of this variable is difficult to predict. On the one hand, Myers' (1977) theory would predict a positive relationship. On the other hand, one can argue on at least two grounds that the relationship might be negative. First, the probability that interest will be a redundant tax shelter may increase as the variance in operating earnings increases. Therefore, the greater the risk (as is depicted by the increase in the variance in operating earnings) the more redundant will be the use of interest expenses as a tax shelter and consequently firms should borrow less because of the decrease in the tax advantages of the use of debt. Second, operating risk increases the probability of bankruptcy, and thus bankruptcy costs, which may tend to lower debt capacity. Thus, we argue*

that the expected relationship between risk and leverage could be either positive or negative.

Tobin's q (Q_i)

According to Barclay, Smith and Watts (1995), for those companies that do consist largely of assets in place and that produce stable operating cash flows, heavy debt financing may actually add value by improving managers' investment incentives. As Michael Jensen (1986) has argued, large, mature public companies generate substantial "free cash flow", that is, operating cash flow that cannot be profitably reinvested within the firm. The natural inclination of many corporate managers is to use such free cash flow to sustain growth at the expense of profitability, either through misguided efforts to gain market share in mature businesses or (perhaps worse) through diversifying acquisitions. To maximize firm value, the managers, who follow the natural inclination mentioned above, must distribute corporate free cash flow to investors.

Paying higher dividends is one way of distributing excess capital. But major substitutions of debt for equity (say, in the form of leveraged stock repurchases) are likely to be a more effective means of addressing this free cash flow problem¹¹. This is because contractually obligated payments of interest and principal are more effective than discretionary dividend payments in squeezing out excess capital. And, as Jensen (1986) argues, in industries that generate substantial cash flows but face few growth opportunities, debt financing can have a beneficial effect. It can cause managers otherwise inclined to over-invest to be more critical in evaluating capital budgeting plans. Moreover, in these industries heavy debt financing has the added benefit of facilitating the concentration of equity ownership. Finally, the use of debt rather than equity lowers the agency costs.

In the pioneering work of Tobin (1969,1978), q is defined as the ratio of firm's market power to the replacement cost of its tangible assets and argued that, if q exceeded unity, firms have an incentive to invest. Tangible assets consist of property, plant and equipment, current assets and investments in stocks and long-term bonds. Intangible assets consist of patents, R&D, trademarks, etc. A value of q greater than one means that firms have intangible assets as well, which augment the earning power of their physical assets.

In our study we used Tobin's q as a proxy for overinvesting. As Lang and Litzenberger (1989) have proved, an average Tobin's q greater than unity is a

necessary condition for a firm to be at the value-maximizing level of investment and an average Tobin's q less than unity is the sufficient condition for a firm to be overinvesting. Therefore, Tobin's q is used in this study as a dummy variable, which equals 1 when q is less than 1 and equals 0 when q is greater than or equal to 1. As we have already mentioned, firms that are overinvesting, should increase their leverage ratio in order to cope with the free cash flow problem. Consequently, we expect a positive relationship between Tobin's q and leverage ratio for those firms that Tobin's q is less than 1.

Several studies have calculated Tobin's q values. The most theoretically correct is the calculation provided by Lindenberg and Ross (1981). This procedure requires data availability and complex calculations. Instead, several studies employ simpler versions. Chung and Pruitt (1994), calculated an approximate q by the following formula,

$$\text{Approximate Tobin's } q = \frac{(MVE + Ps + DEBT)}{TA}$$

where, MVE is the product of the firm's share price times its common stock shares outstanding, Ps is the liquidating value of the firm's short-term liabilities net of short-term assets, DEBT is the book value of the firm's long-term debt, TA is the book value of the firm's total assets. They have found that at least 96.6% of the total variability of the more theoretically correct Lindenberg and Ross (1981) method is explained by their approach. Perfect and Wiles (1994) found that the correlation coefficient between Lindenberg and Ross (1981) method and the simple Tobin's q is 0.931.

We have calculated Tobin's q using the following formula, which is very similar to Chung's and Pruitt.

$$\text{Tobin's } q = \frac{(Comval + Prefval + Debt)}{TA}$$

where, Comval is the year-end market value of the firm's common stock, Prefval is the year-end book value of the firm's preferred stock, Debt is the year-end book value of the firm's total debt and TA is the year-end book value of total assets.

4. Previous Studies

There are a few recent relevant studies conducted for the Greek market. These studies can be divided into two groups. The first group contains studies that derive results based on econometric analysis of quantitative sets of data, whereas the second group consists of studies based on the examination and analysis of qualitative data.

According to the econometric studies, all these studies employ the panel data procedure for samples of Greek firms listed in the Athens Stock Exchange during the period 1997 – 2001. Eriotis et al. (2004) found that there is a negative relationship between the debt ratio of the firms and their growth, their quick ratio and their interest coverage ratio. Size appeared to maintain a positive relationship and according to their dummy variable there is a differentiation in the capital structure among the firms with a debt ratio greater than 50% and those with a debt ratio lower than 50%. Eriotis and Vasiliou (2004) found evidence which suggest that the dividend per share is positively associated with the current earnings and the leverage of the firm. Finally, Vasiliou (2004) found that there is a positive relation between leverage and the size of the firm and a negative relation between the debt ratio and the non-debt-tax-shields (defined as depreciation over total assets), the tax payout ratio (defined as the tax payment of the firm divided by its earnings) with one year lag, and the growth of the firm (defined as the annual change in earnings).

As far as the qualitative studies are concerned, they are all based in the analysis of the answers in a detailed questionnaire which was filled in by several listed firms in the Athens Stock Exchange. Vasiliou and Daskalakis (2004a) show that firms in Greece prefer short-term financing from long-term borrowing. Vasiliou and Daskalakis (2004b) show that the Greek market inefficiency may be the main reason why some main theoretical implications do not seem to apply in the situation of the Greek firms. Finally, Vasiliou et al. (2004) show that although Greek firms seem to prefer internal from external financing, which is a hint of the pecking order, when it comes to external financing firms prefer new equity to new debt.

This paper extends the findings of the previous studies by including two more variables in determining the capital structure of the Greek firms, namely the Tobin's q and the risk variable of the beta coefficient. Thus, it constitutes an important upgrade and extension of the other relevant research that has been accomplished for Greece.

5. Data and Methodology

Our empirical investigation about the determinants of capital structure uses a sample of firms listed in the Athens Stock Exchange during the period 1997 – 2001. For a firm to be included in the sample, it had to be listed on the Athens Stock Exchange for the whole period under consideration. The sample was further reduced to 138 firms, as a result of missing data. The data used in our empirical analysis are derived from the database of Athens Stock Exchange.

In our study we used a panel data model because this kind of model enables us to use time-series cross-sectional data to examine issues that could not be studied in either cross-sectional or time-series settings alone. The general form of our model is the following:

$$y_{it} = x_{it}'\beta + z_i'\alpha + \varepsilon_{it} \quad (1)$$

where, y_{it} is the dependent variable, x_{it} is the matrix with the independent variables, and z_i is a matrix that contains a constant term and a set of individual or group specific variables, which may be observed or unobserved, all of which are taken to be constant over time t . This is a classical regression model. If z_i is observed for all individuals, then the entire model can be treated as an ordinary linear model and fit by least squares.

First, according to the pooled regression, if z_i contains only a constant term, then ordinary least squares provide consistent and efficient estimates of the common α and the slope vector β .

Secondly, if z_i is unobserved, but correlated with x_{it} , then the least squares estimator of β is biased and inconsistent as a consequence of an omitted variable. The fixed effects method takes into account these problems and gives an unbiased and consistent estimator of β and α . However, in this instance, the model

$$y_{it} = x_{it}'\beta + \alpha_i + \varepsilon_{it} \quad (2)$$

where $\alpha_i = z_i'\alpha$, embodies all the observable effects and specifies an estimable conditional mean. The fixed effects approach takes α_i to be a group-specific constant term in the regression model. It should be noted that the term “fixed”

as used here indicates that the term does not vary over time, not that it is nonstochastic, which need not be the case.

Thirdly, if the unobserved individual effects, however formulated, can be assumed to be uncorrelated with the included variables, then the model may be formulated as

$$y_{it} = x_{it}'\beta + \alpha + u_i + \varepsilon_{it} \quad (3)$$

that is, as a linear regression model with a compound disturbance that may be consistently, albeit inefficiently, estimated by least squares. This random effects model specifies that u_i is a group specific random element, similar to ε_{it} except that for each group, there is but a single draw that enters the regression identically in each period. Again, the crucial distinction between these two cases is whether the unobserved individual effect embodies elements that are correlated with the regressors in the model, not whether these effects are stochastic or not.

The hypothesis that will be tested in this paper is that capital structure depends upon the liquidity, the asset structure, the interest coverage ratio, the profitability, the size, the effective tax rate and the risk of the firm, and Tobin's q . Modeling the Greek market in accordance with the explanatory variables described in the previous section, we estimate the following model:

$$LR_{it} = \alpha_t + \beta_1 L_{it} + \beta_2 AS_{it} + \beta_3 IC_{it} + \beta_4 P_{it} + \beta_5 S_{it} + \beta_6 TAX_{it} + \beta_7 R_{it} + \beta_8 Q_{it} + \varepsilon_{it}$$

where, LR_{it} is the leverage ratio of the firm i at time t , L_{it} is the liquidity of the firm i at time t , AS_{it} is the asset structure of the firm i at time t , IC_{it} is the interest coverage ratio of the firm i at time t , P_{it} is the profitability of the firm i at time t , S_{it} is the size of the firm i at time t , TAX_{it} is the effective tax rate of the firm i at time t , R_{it} is the risk of the firm i at time t , Q_{it} is Tobin's q of the firm i at time t and ε_{it} is the error term.

6. Empirical Results

In our study we use three models in order to estimate the effect of each explanatory variable at the leverage ratio: the total model, the fixed effects model and the random effects model. In order to carry out the estimation of the total

model we use generalized least square process where cross section weights and White heteroscedasticity have been taken into account. The results of the total model are presented in Table 1, the results of the fixed effects model are presented in Table 2 and the results of the random effects model are presented in Table 3.

TABLE 1
Total model

Dependent Variable: LR				
Method: GLS (Cross Section Weights)				
Model: Total				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.123712	0.026292	4.705243	0.0000
L	-0.030549	0.002166	-14.10387	0.0000
AS	-0.201891	0.009582	-21.06970	0.0000
IC	-9.71X 10 ⁻⁵	1.38X 10 ⁻⁵	-7.034264	0.0000
P	0.261629	0.060235	-4.343458	0.0000
S	0.026087	0.001606	16.24829	0.0000
TAX	-0.000545	2.31X 10 ⁻⁵	-23.61457	0.0000
R	-0.037125	0.003838	-9.673713	0.0000
Q	0.010337	0.003239	3.191488	0.0015
Weighted Statistics				
R-squared	0.999337	Mean dependent var.	0.904579	
Adjusted R-squared	0.999329	S.D. dependent var.	6.204955	
S.E. of regression	0.160720	Sum squared resid.	17.59086	
F-statistic	128285.8	Durbin-Watson stat.	0.943498	
Prob (F-statistic)	0.000000			

The results from the total model denote that the leverage ratio of the firms is determined by the independent variables at 99.93%. The adjusted R-squared is almost equal to the R-squared. The F-statistic proves the validity of the estimated model. Furthermore, all the coefficients are statistically significant in level of confidence 99%.

The results from the fixed effects model are similar to those of the total model, but there are some differences between them. The results from the fixed effects model denote that the leverage ratio of the firms is determined by the independent variables at 81.49%. The adjusted R-squared is 73.03%. The F-statistic proves the validity of the estimated model. Furthermore, all the coefficients are statistically significant in level of confidence 99%, but the t-statistics are lower in the case of the fixed effects model. However, the sign of

Tobin's q is altered as well as in the case of random effects (we will refer to this change of sign later in this section). Moreover, the interest coverage ratio is no longer statistical significant as well as in the case of the random effects problem. The standard error of regression is improved from 0.161 in the total model to 0.098 in the fixed effects model.

TABLE 2
Fixed effects model

Dependent Variable: LR Method: Pooled Least Squares Model: Fixed Effects White Heteroskedasticity-Consistent Standard Errors & Covariance				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
L	-0.010938	0.004822	-2.268223	0.0238
AS	-0.146374	0.049718	-2.944107	0.0034
IC	1.85X 10 ⁻⁶	1.84X 10 ⁻⁵	0.100334	0.9201
P	-0.095514	0.039489	-2.418736	0.0160
S	0.019873	0.009452	2.102442	0.0360
TAX	-0.000336	0.000157	-2.137957	0.0330
R	-0.024148	0.009100	-2.653643	0.0082
Q	-0.041489	0.010035	-4.134461	0.0000
R-squared	0.814871	Mean dependent var.		0.396244
Adjusted R-squared	0.730330	S.D. dependent var.		0.187994
S.E. of regression	0.097625	Sum squared resid.		4.507989
F-statistic	297.4245	Durbin-Watson stat.		1.998697
Prob (F-statistic)	0.000000			

The results from the random effects model are similar to those of the total model, but there are some differences between them. As we have already stated, the sign of Tobin's q is altered, the interest coverage ratio is no longer statistical significant and the effective tax rate as well. The R-squared and the adjusted R-squared are 80.75% and 80.52% respectively. Furthermore, all the coefficients are statistically significant in level of confidence 99%, but the t-statistics are lower in the case of the random effects model compared to the total model and close enough compared to the fixed effects model. The standard error of regression is 0.083, which is better than both of the total and fixed effects model.

TABLE 3

Random effects model

Dependent Variable: LR Method: GLS (Variance Components) Model: Random Effects				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.129513	0.108322	1.195628	0.2323
L	-0.014163	0.002223	-6.370564	0.0000
AS	-0.174048	0.034295	-5.075032	0.0000
IC	-2.20X 10 ⁻⁵	1.78X 10 ⁻⁵	-1.237653	0.2163
P	-0.119214	0.048788	-2.443521	0.0148
S	0.024389	0.006119	3.985821	0.0001
TAX	-0.000374	0.000378	-0.988027	0.3235
R	-0.024512	0.010126	-2.420631	0.0158
Q	-0.034858	0.010107	-3.448952	0.0006
Unweighted Statistics including Random Effects				
R-squared	0.807488	Mean dependent var.		0.396244
Adjusted R-squared	0.805226	S.D. dependent var.		0.187994
S.E. of regression	0.082968	Sum squared resid.		4.687773
Durbin-Watson stat	1.971962			

As far as the change in the sign of Tobin's q (in the case of both the fixed effects and the random effects model) is concerned, there is one possible explanation both mathematical and logical. Firstly, the change in the sign is probably due to the fact that z_i in equation (1) contains a set of individual or group variables, which are unobserved, but influence the computation of the coefficient of Tobin's q . For instance these variables could be the managerial ownership and the degree of ownership concentration¹².

We did not take these variables into account in our model because of lack of this kind of data. Secondly, during the period 1997 – 2001, there was a great volatility in the market value of stocks. Arguing about the factors that caused this volatility, we could say that they might be psychological factors such as the great enthusiasm of investors between 1997 and late-1999 and the great disappointment of investors between late-1999 and 2000¹³. Thus, the computation of the market value of common stock in the numerator of Tobin's q might be biased by the factors stated above.

Nevertheless, the general results from the use of both the fixed effects model and the random effects model can be considered reliable. In conclusion,

we argue that the use of the total model fits better in explaining our dependent variable taking into account the explanatory variables used in this study, the specific sample and the specific time period. According to the total effects model, z_i in equation (1) is assumed to contain only a constant term. The value of the R-squared and the adjusted R-squared of the three models states that in our analysis z_i may indeed contain only a constant term. Therefore, we focus our analysis in the results of the total model.

According to the results of the total model, we observe that the liquidity of the firm is negatively related to its leverage ratio. This finding shows that firms prefer internal financing from debt financing. Firms with high liquidity maintain a relatively high amount of current assets, which means that they maintain high cash inflows. This means that they also generate high cash inflows. As a consequence, they are able to use these inflows in order to finance their operating and financing activities. Thus, they do not use much debt capital in comparison with firms that are not so profitable.

Furthermore, the negative sign of the asset structure of the firms is inconsistent with the expected sign. This negative relationship might come from one of the following reasons. The firms that maintain a large proportion of fixed assets prefer internal financing to debt. This behavior is an indication of the pecking order theory. Alternatively, we could argue that they prefer to issue new common stock than to use debt, which points to asymmetric information. Which one is more applicable could not be identified due to a lack of appropriate data. However, the relationship between asset structure and leverage ratio should be further investigated.¹⁴

In addition, the interest coverage ratio is negatively related to the leverage ratio. This result is also consistent with the pecking order theory. Firms with high interest coverage ratio have more than adequate operating income after taxes in order to cover their interest expenses. As a consequence, they are able to use the rest of their operating income after taxes in order to finance their operating and financing activities. Thus, the negative relationship between interest coverage ratio and leverage implies that they use the rest of their operating income after taxes as internal financing and they avoid using debt.

Moreover, there is a negative association between profitability and leverage. This is consistent with the predictions of the pecking order theory that firms prefer internal resources to finance their investments before raising external debt capital. This is based on the view that higher profitability increases

internal resources and hence reduces the need for external finance. Thus, firms that generate relatively high internal funds, generally tend to avoid gearing.

As far as the positive sign of the size variable is concerned, it indicates that the bigger the firm, the more debt it will use. This is consistent with the findings reported by Warner (1977), Kim and Sorensen (1986), Myers (1977) and Marsh (1982) mentioned in section 2 of this paper.

The effective tax rate is statistically significant and is negatively related to the leverage ratio. This is consistent with the findings reported by Kremp et al. (1999). An interpretation of this result is that higher corporate tax rates would result in lower internal funds as well as higher cost of capital. Thus, fixed capital formation and demand for external funds would decrease.

Additionally, we found evidence that the risk of the firm is negatively related to their leverage. This finding indicates that the riskier the firms, the less debt they use. Firstly, this means that the greater the risk the more redundant will be the use of interest expenses as a tax shelter and consequently high risk firms will borrow less because of the decrease in the tax advantages of the use of debt. Secondly, risk increases the probability of bankruptcy, which may tend to lower debt capacity.

Finally, Tobin's q is positively related to leverage. This result is consistent with the Jensen's "free cash flow theory". Therefore, we could argue that the firms, which are rated as overinvesting, increased their debt financing or repurchased their stock by using debt in order to overcome the problem of the free cash flow.

According to our results, we found evidence that firms prefer internal from external financing. This may be a hint that pecking order may exist. However, bearing in mind the findings of Vasiliou et. al. (2004) who showed that firms prefer new equity to new debt when it comes to external financing, we are skeptical that pecking order exists.

7. Conclusions

In this paper, we have developed a model to explain how firm characteristics determine the capital structure of the Greek firms. We have examined 138 firms listed in the Athens Stock Exchange from 1997 to 2001. We use the total model, the fixed effects model and the random effects model. Our dependent variable is the leverage ratio, i.e. total liabilities divided by total assets. All the regressors

in the three models that we used are statistically significant at 99%. However, the results showed that the total model is better in explaining the dependent variable in comparison with the fixed effects model and random effects model.

This study provides evidence that firms generally prefer internal financing from debt financing. The results show that liquidity, asset structure, interest coverage ratio and profitability are negatively related to leverage ratio. However, we have to underline that the negative relationship between asset structure and leverage ratio is not consistent with the theory. Moreover, we found a negative relationship between risk and the dependent variable, which suggests that high-risk firms employ less capital debt in comparison with low-risk firms. Additionally, the negative relationship between effective tax rate and leverage ratio suggests that higher corporate tax rates result in a decreased demand for external funds. Furthermore, firm size is related to gearing in the way we expected, which means that larger firms tend to maintain a higher debt ratio than smaller firms. Finally, the positive relationship between Tobin's q and leverage ratio suggests that overinvesting firms maintain a high debt ratio.

Notes

1. Growth rate was -1.2% in 1991 and escalated up to 4.5% during the examined period. Interest rate was a double-digit figure in 1994 and reduced to 3% during this period. Inflation rate was about 9% in 1993 and dropped to 2% in 1999.

2. For more information about the determinants of capital structure in developing countries, see Booth et al. (2001).

3. Another measure of leverage ratio used in this study is total debt over market value of equity plus book value of total debt. However, we found no evidence that this dependent variable is related to any of the independent variables used in this study. A possible explanation is that the great volatility in the market value of stocks during the period 1997 – 2001 might have been mainly caused by psychological factors.

4. There is evidence that managers do think in terms of book values. See, for example, the survey evidence presented in Stonehill et al. (1973).

5. It may be easier to understand how this spurious correlation arises in the case where all firms have the same book debt ratios. In this case, the cross-sectional variation in debt/market value will be determined entirely by the variation in the differences between book and market values across firms. Variables that are related to this difference will, therefore, also be related to debt/market value.

6. Note that Harris and Raviv (1990) are not assuming that managers can divert cash to their own uses or squander it. They simply assert that having access to the cash increases their utility.

7. See Smith (1977).

8. See Haugen and Senbet (1986).

9. See Kremp et al. (1999).

10. Another measure of risk used in this study is the variability of the return on assets over the available time period. This measure was suggested by an anonymous referee of this journal and is also used by many authors. However, this independent variable was found statistical insignificant.

11. See Barclay, Smith and Watts (1995).

12. There is empirical evidence that these variables may determine the capital structure of firms. For more details, see Wiwattanakantang (1999).

13. For instance, the Athens Stock Exchange index was equal to 2,602.72 in 30/11/1998, it reached 5,921.98 in 30/11/1999 and dropped to 3,246.78 in 30/11/2000.

14. The observed inverse relationship between asset structure and leverage ratio might be spurious for various reasons, e.g. the measure of asset structure used in this study might affect the leverage ratio.

References

- Ang J., Chua J. and McConnell J., (1982), "The Administrative Costs of Corporate Bankruptcy: A Note", *Journal of Finance*, Vol. 37, pp. 219 – 226.
- Barclay M. J., Smith C. W. and Watts R. L., (1995), "The Determinants of Corporate Leverage and Dividend Policies", *Journal of Applied Corporate Finance*, Vol. 7, pp. 4 – 19.
- Booth L., Aivajian V., Demirguc-Kunt A. and Maksimovic V., (2001), "Capital Structures in Developing Countries", *Journal of Finance*, Vol. 56, pp. 87 – 130.
- Bowman J., (1980), "The Importance of a Market Value Measurement of Debt in Assessing Leverage", *Journal of Accounting Research*, Vol. 18, pp. 242 – 254.
- Chung, K. H. and S. W. Pruitt, (1994), "A Simple Approximation of Tobin's q", *Financial Management*, Vol. 23(3), pp. 70-74.
- DeAngelo H. and Masulis R. W., (1980), "Optimal Capital Structure Under Corporate and Personal Taxation", *Journal of Financial Economics*, Vol. 8, pp. 3 – 29.
- Donaldson G., (1961), *Corporate Debt Capacity: A Study of Corporate Debt Policy and the Determination of Corporate Capacity*, Boston: Graduate School of Business Administration, Harvard University.
- Eriotis N. and Vasiliou D., (2004), "The Link between Dividend Policy and Corporate Leverage: An Empirical Analysis of the Greek Market", Unpublished Manuscript.
- Eriotis N., Vasiliou D., and Ventoura – Neokosmidi Z., (2004), "How Firm Characteristics Affect Capital Structure: An Empirical Study", *Managerial Finance* (Forthcoming).

- Harris M. and Raviv A., (1990), "Capital Structure and the Informational Role of Debt", *Journal of Finance*, Vol. 45, pp. 321 – 349.
- Haugen R. A. and Senbet L. W., (1986), "Corporate Finance and Taxes: A Review", *Financial Management*, Vol. 15, pp. 5 – 22.
- Jensen M. C. and Meckling W. H., (1976), "Theory of the Firm: Managerial Behaviour, Agency Costs and Ownership Structure", *Journal of Financial Economics*, Vol. 3, pp. 305 – 360.
- Jensen M. C., (1986), "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers", *American Economic Review*, Vol. 36, pp. 323 – 329.
- Jensen M. C., (1989), "Active Investors, LBOs, and the Privatisation of Bankruptcy", *Journal of Applied Corporate Finance*, Vol. 2, pp. 35 – 44.
- Kim S. W. and Sorensen E. H., (1986), "Evidence on the Impact of the Agency Costs of Debt on Corporate Debt Policy", *Journal of Financial and Quantitative Analysis*, Vol. 21, pp. 131 – 144.
- Kremp E., Stoss E. and Gerdesmeier D., (1999), Estimation of a Debt Function: Evidence from French and German Firm Panel Data, A Joint Research of the Deutsche Bundesbank and the Banque De France, pp. 139 – 194.
- Lang L. H. P. and Litzenberger R. H., (1989), "Dividend Announcements: Cash Flow Signalling vs. Free Cash Flow Hypothesis?", *Journal of Financial Economics*, Vol. 24, pp. 181 – 191.
- Lindenberg, E. B. and Ross S. A., (1981), "Tobin's q Ratio and Industrial Organization", *Journal of Business*, 54, pp. 1-32.
- Marsh P., (1982), "The Choice between Equity and Debt: An Empirical Study", *Journal of Finance*, March, pp. 121 – 144.
- Miller M. H., (1977), "Debt and Taxes", *Journal of Finance*, Vol. 32, pp. 261 – 275.
- Modigliani F. and Miller M. H., (1958), "The Cost of Capital, Corporation Finance and the Theory of Investment", *American Economic Review*, Vol. 48, pp. 261 – 297.
- Modigliani F. and Miller M. H., (1963), "Corporate Income Taxes and the Cost of Capital: A Correction", *American Economic Review*, Vol. 53, pp. 433 – 443.
- Myers S. C., (1977), "The Determinants of Corporate Borrowing", *Journal of Financial Economics*, Vol. 5, pp. 147 – 176.
- Myers S. C., (1984), "The Capital Structure Puzzle", *Journal of Finance*, Vol. 39, pp. 575 – 592.
- Myers S. C. and Majluf N. S., (1984), "Corporate Financing and Investment Decisions when Firms have Information that Investors do not have", *Journal of Financial Economics*, Vol. 13, pp. 187 – 221.
- Perfect, S., and Wiles K., (1994), "Alternative Constructions of Tobin's q: An Empirical Comparison", *Journal of Empirical Finance*, pp. 313-341.

- Scott D., (1977), "Bankruptcy, Secured Debt and Optimal Capital Structure", *Journal of Finance*, March, pp. 1 – 19.
- Smith C., (1977), "Alternative Methods for Raising Capital: Rights Versus Under Written Offerings", *Journal of Finance*, Vol. 32, pp. 1 – 20.
- Stonehill A., Beekhuisen T., Wright R., Remmers L., Toy N., Pares A., Shapiro A., Egan D. and Bates T., (1973), "Determinants of Corporate Financial Structure: A Survey of Practice in Five Countries", Unpublished Paper.
- Titman S. and Wessels R., (1988), "The Determinants of Capital Structure Choice", *Journal of Finance*, Vol. 43, pp. 1 – 19.
- Tobin, J., (1969), "A General Equilibrium Approach to Monetary Theory", *Journal of Money, Credit and Banking*, 1, pp. 15-29.
- Tobin, J., (1978), "Monetary Policies and the Economy: The Transmission Mechanism", *Southern Economic Journal*, 37, pp. 421-431.
- Wiwattanakantang Y., (1999), "An Empirical Study on the Determinants of the Capital Structure of Thai Firms", *Pacific-Basin Finance Journal*, Vol. 7, pp. 371 – 403.
- Warner J., (1977), "Bankruptcy Costs: Some Evidence", *Journal of Finance*, Vol. 32, pp. 337 – 347.
- Zimmerman J. L., (1983), "Taxes and Firm Size", *Journal of Accounting and Economics*, Vol. 5, pp. 119 – 149.
- Vasiliou D., (2004), "The Choice Between Equity and Debt: An Empirical Investigation", *Espace Europe*, (Forthcoming).
- Vasiliou D. and Daskalakis N., (2004a), "The Effect of Capital Structure on Stock Price: The View of the Greek Managers", Paper presented in the European Applied Business Research Conference, Edinburgh, UK, 2004, pp. 1-15.
- Vasiliou D. and Daskalakis N., (2004b), "Investigating the Capital Structure of Greek Firms: Some Preliminary Evidence", *Espace Europe* (Forthcoming)
- Vasiliou D., Eriotis N. and Daskalakis N., (2004), "Testing the Pecking Order Theory: Evidence from the Greek Market", Paper Presented in the 1st International Conference on Advances in Applied Financial Economics, Samos, Greece.