

# **Non-Linearity in the Determinants of Capital Structure: Evidence from UK Firms**

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## **Abstract**

Drawing on the agency cost theory of capital structure, we consider a non-linear relation between firms' leverage and the determinants of their capital structure choice in a model where the maximization program of the firm includes a function that captures the agency costs of debt. We test for the existence of such a non-linearity by conditional quantile regression methods using a sample of UK firms.

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## 1. Introduction

In the context of asymmetric information and market imperfections firms' choice of debt-equity ratio can be modeled as determined by agency costs. Agency costs themselves are a function of firms' characteristics and in a number of empirical studies proxies for those arguments have been found to have a significant impact on firms' capital structure in US data (Titman and Wessels, 1988). Similar proxies have been significant in explaining the differences in firms' capital structure among the advanced industrialized countries (Rajan and Zingales, 1995; Wald, 1999). Recently, empirical studies similar to those of US have been concerned with the capital structure of UK firms. Interestingly, these empirical studies indicate that the determinants of capital structure suggested by conventional capital structure models and well established in US studies can also explain the debt structure of UK firms (Bennett and Donnelly 1993; Lasfer, 1995; Ozkan, 2001; Michaelas et al 1999 for UK SMEs). On balance, the evidence suggests that size, asset structure, growth opportunities, profitability and non-debt tax shields are important determinants of UK firms' capital structure.<sup>1</sup>

Those empirical studies assume that the impact of firm-specific variables on firm's capital structure is the same across firms with low and high leverage. However, other studies suggest that highly leveraged firms are likely to face high borrowing costs which restrict their ability to issue more debt (DeAngelo and Masulis, 1980; Castanias, 1983; Gilson, 1997; Peyer and Shivdasani, 2001). Highly leveraged firms may be reluctant to issue more debt because it raises the expected value of the costs of debt restructuring. Similarly, the closer the firm gets to bankruptcy, the more will lenders demand to be compensated for the risk of default. Some lenders will also require extra protection, such as restrictive covenants attached to their loans, which can prove very costly for highly leveraged firms. In such cases, the firm specific factors may exert a different impact on the capital structure choice of firms depending on their level of leverage.

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<sup>1</sup> However, there are conflicting conclusions regarding the impact of specific variables. For instance, Lasfer (1995) doesn't find a significant impact of corporate tax on the capital structure choice of UK firms whereas Ozkan (2001) provides limited support for a positive effect of firm's size. The only common finding among these studies is that more profitable firms have less debt in their capital structure. This has also been consistently found in studies of the determinants of capital structure outside the UK.

Drawing on the agency cost theory of capital structure, we incorporate the idea of a non-linear relation between firms' leverage and the determinants of their capital structure choice in a model where the maximization program of the firm includes a function that captures the agency costs of debt. We test for the existence of such a non-linearity by conditional quantile regression methods using a sample of UK firms. Conditional quantile regression methods allow us to examine the whole distribution of firms rather than a single measure of the central tendency of the capital structure distribution and consequently, we are able to evaluate the relative importance of explanatory variables on different regions of the distribution of firms' leverage. We find evidence that, consistent with our model, there are significant non-linearities in the capital-structure function.

## 2. Capital Structure and Agency Cost of Debt

Consider the following objective function for the firm:

$$(1) \quad \max V_t = E_t \left\{ \sum_{s=0}^{\infty} \beta_{t+s} (D_{t+s} - S_{t+s}^n) \right\}$$

where  $\beta_{t+s}$  is the time-varying discount factor,  $D_{t+s}$  are dividends, and  $S_{t+s}^n$  are new share issues. Dividends are given by:

$$(2) \quad D_t = [p_t F(K_t, L_t) - w_t L_t - r_t B_{t-1} - A(B_{t-1}; \mathbf{x}_t)] - p_t^k I_t + (B_t - B_{t-1}) + S_t^n$$

where  $K_t$  and  $L_t$  are the inputs of capital and labor services,  $B_t$  is the outstanding stock of debt,  $p_t^k I_t$  is nominal investment,  $p_t$  is output price,  $w_t$  is the wage rate,  $r_t$  is the interest rate on debt, and  $F(K_t, L_t)$  is the production function. The function  $A(B_{t-1}; \mathbf{x}_t)$  in equation (2) captures the agency costs of debt in terms of foregone revenue. The vector  $\mathbf{x}_t$  includes a set of variables that influence the agency cost of debt, such as firm's profitability, its growth rate and the structure of its assets.<sup>2</sup> We assume that  $A_B > 0$  and  $A_{BB} > 0$ : that is, the marginal cost of debt is positive and increasing in the outstanding stock of debt.

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<sup>2</sup> Jaramillo, Schiantarelli and Weiss (1996) provide an application of an agency cost function to the optimization program of the firm.

The maximization program for the firm is also subject to the dynamic equation on capital stock and to an upper constraint on debt<sup>3</sup>:

$$(3) \quad K_{t+1} = (1 - \delta)K_t + I_t$$

$$(4) \quad B_t \leq H_t$$

where  $H_t$  is the upper limit on the stock of debt for the firm. The upper constraint on the level of the debt captures the notion that the agency costs increase steeply when the risk of bankruptcy is perceived to become significant.<sup>4</sup> The first-order condition on the stock of debt at time  $t$  is:

$$(5) \quad \beta_{t+1}(1 + r_{t+1} + A_B) - \beta_t + \mu_t = 0$$

where  $\mu_t$  is the Kuhn-Tucker multiplier associated with the upper constraint on debt. The complementary slackness condition yields:

$$(6) \quad \mu_t \cdot (H_t - B_t) = 0$$

In an interior solution the upper constraint on debt is not binding and the Kuhn-Tucker multiplier  $\mu_t$  is equal to zero. The first-order condition (5) therefore becomes:

$$(7) \quad \beta_{t+1}(1 + r_{t+1} + A_B) = \beta_t$$

The comparative static effect on debt of a change in a variable  $x \in \mathbf{x}_t$  is given by:

$$(8) \quad \frac{dB}{dx} = -\frac{A_{Bx}}{A_{BB}}$$

which is positive iff  $A_{Bx} < 0$ .

When the upper constraint on debt is binding, the Kuhn-Tucker multiplier is positive:  $\mu_t > 0$ . The first-order condition (5) for a corner solution can thus be written as:

$$(9) \quad \mu_t = \beta_t - \beta_{t+1}(1 + r_{t+1} + A_B)$$

By totally differentiating (9), the effect of a variable  $x \in \mathbf{x}_t$  on  $B_t$  is given by:

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<sup>3</sup> We do not explicitly consider the non-negativity constraints on dividends and on new equity issues since these would not be relevant for our analysis.

<sup>4</sup> The upper constraint on debt is a special case where the firm faces an infinite cost of borrowing. The upper constraint on debt could equivalently be expressed in terms of the leverage ratio, without any changes to the main results..

$$(10) \quad \frac{dB}{dx} = -\frac{\mu_x + \beta_{t+1}A_{Bx}}{\mu_B + \beta_{t+1}A_{BB}}$$

When  $\mu_B > 0$ , that is when the opportunity cost of the upper constraint of debt is an increasing function of the stock of debt, the denominator of the right-hand-side of (10) is positive. A variable  $x \in \mathbf{x}_t$  therefore exerts a positive influence on  $B_t$  when  $\mu_x + \beta_{t+1}A_{Bx} < 0$ . This condition is satisfied when  $\mu_x < 0$  and  $A_{Bx} < 0$  in a neighborhood of  $B_t = H_t$ . The first condition requires that the variable  $x$  reduces the opportunity cost of the constraint, and the second condition requires that  $x$  reduces the marginal agency cost  $A_B$ . If we contrast (8) with (10), we see that the presence of the upper constraint on debt introduces non-linearity in the determinants of capital structure. In particular, a variable  $x \in \mathbf{x}_t$  will cease to have an influence on debt if  $\mu_x + \beta_{t+1}A_{Bx} = 0$  in a neighborhood of  $B_t = H_t$ . This would be the case if the variable  $x$  is unable to affect, at the margin, the agency cost of debt and the opportunity cost of the constraint, or if the variable  $x$  has different impacts on the agency cost of debt and the opportunity cost of the constraint which fully or partially offset each other.

### 3. Empirical Methodology

We test the implications of our model by using the conditional quantile regression estimator developed by Koenker and Basset (1978). Unlike the conditional mean regression estimators that concentrate only on the single central tendency measure, conditional quantile regression traces the entire distribution of leverage, conditional on a set of explanatory variables. An overview of the distribution of firms at different levels of financial leverage can be useful for our analysis since it allows us to estimate the slope parameters at different quantiles of the distribution. As our theoretical discussion suggests, the determinants of capital structure can be different depending on whether the upper constraint on the debt ratio is binding.

#### *The Econometric Framework*

Let  $(y_i, x_i)$ ,  $i=1, \dots, n$ , be a sample from some population where  $x_i$  is a  $(K \times 1)$  vector of regressors. Assuming that the  $\theta$ -th quantile of the conditional distribution of  $y_i$  is linear in  $x_i$ , we can write the conditional quantile regression model as follows:

$$(11) \quad y_i = x_i' \beta_\theta + u_{\theta i}$$

and

$$(12) \quad Quant_{\theta}(y_i | x_i) \equiv \inf\{y : F_i(y | x) \geq \theta\} = x_i' \beta_{\theta}$$

and

$$(13) \quad Quant_{\theta}(u_{\theta_i} | x_i) = 0$$

where  $Quant_{\theta}(y_i | x_i)$  denotes the  $\theta$ -th conditional quantile of  $y_i$ , conditional on the regressor vector  $x_i$ ,  $\beta_{\theta}$  is the unknown vector of parameters to be estimated for different values of  $\theta$  in  $(0,1)$ ,  $u_{\theta}$  is the error term which is assumed to have a continuously differentiable c.d.f.,  $F_{u_{\theta}}(.|x)$ , and a density function  $f_{u_{\theta}}(.|x)$ , and  $F_i(.|x)$  denotes the conditional distribution function. By varying the value of  $\theta$  from 0 to 1, we can trace the entire distribution of  $y$ , conditional on  $x$ .

The estimator for  $\beta_{\theta}$  is obtained from:

$$(14) \quad \min \sum_i^n \rho_{\theta}(y_i - x_i' \beta_{\theta})$$

Where  $\rho_{\theta}(u)$  is the ‘‘check function’’ defined as

$$(15) \quad \rho_{\theta}(u) = \begin{cases} \theta u & \text{if } u \geq 0 \\ (\theta - 1)u & \text{if } u < 0 \end{cases}$$

The estimator does not have an explicit form, but the resulting minimization problem can be solved by linear programming techniques (Koenker and Basset, 1978).<sup>5</sup> We employ the design matrix bootstrap method to obtain estimates of the standard errors for the coefficients in quantile regression (Buchinsky, 1995, 1998).<sup>6</sup> Based on a Monte Carlo study, Buchinsky (1995) shows that this method performs well for relatively small samples, is robust to changes of the bootstrap sample size relative to the data sample size and is valid under many forms of heterogeneity.<sup>7</sup> Furthermore, the bootstrap procedure can be extended to deal with the joint distribution of various

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<sup>5</sup> In this study, the minimisation problem is solved by the linear programming techniques suggested by Armstrong, Frome and Kung (1979).

<sup>6</sup> Two general approaches exist for the estimation of the covariance matrix of the regression parameter vector. The first derives the asymptotic standard error of the estimator while the second uses bootstrap methods to compute these standard errors and construct confidence intervals. Although the literature is not definite as to the ‘best’ path to follow, this does not pose a serious problem. As noted by Koenker and Hallock (2000), the differences between competing methods of inference for quantile regression are very small in practice and are more robust than other forms of inference in econometrics.

<sup>7</sup> The design bootstrap matrix performs very well (better than the other methods considered in Buchinsky’s paper) even when the errors are homoskedastic.

quantile regression estimators, allowing us to test for the equality of slope parameters across various quantiles (Koenker and Hallock, 2000).

#### *Empirical specification, data, and data sources*

The dataset is constructed from the balance sheets of UK firms listed on the London Stock exchange. The data source for these variables is the *Datastream* database. We exclude from the sample financial firms and insurance companies. We also exclude firms with missing values and with negative or zero debt to asset ratios leaving us with a cross section of 660 firms.

We specify the following empirical model

$$(16) \quad \text{Quant}_\theta(y_i | x_i) = \alpha + \beta'_\theta x_i + e_i$$

where  $y_{it}$  is the dependent variable at quantile  $\theta$ . We use the ratio of total debt to total assets in 1998 to measure leverage. We focus on four determinants: asset tangibility, growth, size and profitability. We use the four-year average (1994-1997) of the corresponding explanatory variables.<sup>8</sup> The averages of the explanatory variables are likely to reduce the noise and to account for slow adjustments (see Rajan and Zingales, 1995).

Firms with high collateralisable assets (proxied by measures of tangible assets) could face lower costs of debt because the presence of collateralisable assets reduces the scope for asset substitution (Titman and Wessels, 1988). Second, firms with higher liquidation value (e.g. with more tangible assets) will have higher debt since higher liquidation value makes it more likely that liquidation would be the best strategy (Harris and Raviv, 1991).<sup>9</sup> Thus, we expect asset tangibility to have a positive impact on the observed debt ratio. However, if the debt constraint is binding, the increase in asset tangibility also increases the opportunity cost of the upper constraint on debt inducing firms not to take any more debt. Thus, asset tangibility may have a negligible impact on debt ratios for highly leveraged firms. In contrast, growth opportunities represent non-collateralisable assets and thus are likely to mirror the behavior of asset tangibility. Firms with a high proportion of non-collateralisable

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<sup>8</sup> See the data appendix at the end of the paper for a detailed description of the variables.

<sup>9</sup> Tangible assets can also serve as collateral against external loans. Due to imperfect information regarding the behaviour of firms, those with little tangible assets may find it difficult to raise funds via debt financing (Scott, 1977). By contrast, growth opportunities can be thought of as real options. Given the agency costs associated with these options, it is more difficult for a firm to borrow against them than against tangible fixed assets (Myers, 1977).

assets (such as growth opportunities) could find it more expensive to obtain credit because of the asset substitution effect (Titman and Wessels, 1988). Similarly, firms in growing industries may have greater flexibility in their choice of investments, allowing equity holders to capture wealth from bondholders. Either way, firms with important growth opportunities are likely to face high agency costs of debt. The ratio of net fixed assets to total assets is used to measure tangibility while the ratio of market value to the book value of the company is used as a proxy for growth opportunities.

Larger firms could have easier access to capital markets and borrow at more favourable interest rates (Ferri and Jones, 1979) perhaps because larger firms are more diversified in their investments and therefore have a lower risk of default. However, as firms become highly leveraged, they might no longer be able to borrow at favourable terms regardless of their size. Thus, size may have a positive impact at low and moderate debt ratios but a negligible or zero impact on firms with high debt ratios. We use the logarithm of net sales as measures of size.

Consistent with the pecking order hypothesis, most empirical studies have found a negative relationship between profitability and debt ratios (Myers, 2001). We expect profitability to have negative impact on debt ratios and for this impact to be larger for firms with high debt ratios. This is the case because the cost of debt financing is likely to be high for these firms relative to the cost of internal sources of finance inducing them to have lower debt in their capital structure. We use the earnings of a company before total interest expense, depreciation, amortization, provisions and taxes (EBIT) divided by total assets as a measure of profitability.

We include industry dummies to control for industry specific effects. Each industry may have specific features that affect the debt structure of firms in that industry. These may arise – among other factors – from the different business environment of each industry, the degree of competition in each product market and the skill composition of the industry's workforce. We classify the firms in the sample into 30 industry groups using the FTSE classification.<sup>10</sup>

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<sup>10</sup> We also included the non-debt tax shield (measured by the ratio of depreciation to total assets) and volatility (measured by the standard deviation of the percentage change in operating profits) as additional explanatory variable (see Titman and Wessels, 1988). These variables were not significant in any of the regressions and hence were dropped from our empirical analysis. The full results using these variables are available from the authors upon request.

## *Empirical Results*

Table 1 reports the results of estimating equation (16) using ordinary least squares and the conditional quantile estimator at seven different quantiles (0.05, 0.10, 0.25, 0.50, 0.75, 0.90, and 0.95). We employ the design matrix bootstrap method to obtain estimates of the standard errors for the coefficients in quantile regression (Buchinsky, 1995, 1998). We then formally test whether the explanatory variables exert a different impact on the debt asset ratio at different parts of the distribution. The bootstrap procedure can be extended to deal with the joint distribution allowing us to construct tests of equality of slope parameters across quantiles. We use the F-test to test for the equality of the estimated coefficients across various pairs of quantiles.<sup>11</sup>

Consistent with other empirical studies, the OLS results (line 1) suggest that size and tangibility are associated with a higher debt to assets ratio while profitability is associated with a lower debt to assets ratio.<sup>12</sup> However, the OLS estimator, by focusing only on the central tendency of the distribution, does not allow for the possibility that the impact of explanatory variables can be different for highly leveraged firms. The conditional quantile estimates reported in Table 1 (lines 2-8) show that this is in fact the case. The expected different impact of the explanatory variables is reflected in the size and significance of estimated coefficients on the covariates at different quantiles of the distribution. While size enters with a significantly positive coefficient at the lower quantiles, it becomes insignificant at the 90<sup>th</sup> and 95<sup>th</sup> quantiles. A similar pattern is observed for asset tangibility that enters with a significant and positive coefficient at the lower parts of the distribution, but becomes insignificant at the 75<sup>th</sup> quantile of the distribution. As expected, profitability is significant in almost all parts of the distribution however the coefficient on profitability becomes more significant and increases in magnitude as we move up the distribution. This indicates that highly leveraged firms rely much more on internal

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<sup>11</sup> See Arias, Hallock, and Sosa-Escudero (2001) for a similar application.

<sup>12</sup> To test for the robustness of our results, we used various measures of profitability, size, growth and tangibility. We used the following alternative measures: the ratio of net fixed assets divided by total assets (tangibility); the total number of employees (size); the ratio of operating profit to total assets (profitability); and the percentage change of sales over one year (growth opportunities). The regression results are very similar to those obtained in Table 1. We also estimated the model without the industry specific effects and results are almost identical. All the results are available from the authors upon request.

sources, especially since the cost of debt increases in relation to internal sources of finance. As for growth opportunities, they are insignificant across all quantiles.

The bootstrap procedure is extended to construct a joint distribution allowing us to devise F-statistics to test for the equality of the estimated coefficients across various pairs of quantiles.<sup>13</sup> Table 2 reports the F-tests and the associated p-values for the equality of quantile slope coefficients across the various pairs of quantiles. The F-tests reject the null hypothesis of homogenous coefficients between the 5<sup>th</sup>, 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup> quantiles and the 75<sup>th</sup>, 90<sup>th</sup>, 95<sup>th</sup> quantiles indicating that the impact of the explanatory variables is different across the lower and upper halves of the distribution.

To test the robustness of our results, we also estimate equation (16) using the once-lagged values of the explanatory variables (the 1997 values) rather than the four-year averages of the explanatory variables, which increases the size of the cross section to 916 firms (see Table 3). The OLS results suggest that size and tangibility are associated with higher total debt to assets ratio while profitability and growth opportunities are associated with lower debt to assets ratio. The conditional quantile estimates show again that while size enters with a significantly positive coefficient at the lower quantiles, it becomes marginally significant at the 75<sup>th</sup> quantile and insignificant at the 90<sup>th</sup> and 95<sup>th</sup> quantiles. A similar pattern is observed for asset tangibility where it enters with a significant and positive coefficient at the lower parts of the distribution and becomes insignificant at the upper parts of the distribution. This is in contrast with the impact of profitability where it enters with marginally significant or insignificant coefficients at the lower parts of the distribution, but becomes highly significant at the upper parts of the distribution. Also notice that the coefficient on profitability increases in magnitude as we move up the distribution indicating that profitability plays a much more important role for firms with very high debt asset ratios.

The F-tests and the associated p-values for the equality of quantile slopes (reported in Table 4) indicate that we can reject the null hypothesis of homogenous coefficients across the middle parts of the distribution and the upper parts of the distribution. Specifically, we reject the null hypothesis of homogenous coefficients between the 5<sup>th</sup>, 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup> quantiles on the one hand and the 90<sup>th</sup> and 95<sup>th</sup> quantiles on the

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<sup>13</sup> See Arias, Hallock, and Sosa-Escudero (2001) for a similar application.

other hand indicating that the impact of explanatory variable is different as we reach the upper parts of the distribution. In other words, the determinants of leverage are different across firm with low and moderate leverage and firm with high leverage. However, there seem to be no significant differences in the impact of determinants on leverage across lower and middle parts of the distribution as reflected in insignificant F-test between the 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup> and 75<sup>th</sup> quantiles. The only exceptions are the 5<sup>th</sup> and 25<sup>th</sup> and 50<sup>th</sup> quantiles where we cannot reject the null hypothesis across these pair of quantiles at the 5% level.

#### **4. Conclusion**

Quantile regression estimates using UK data show that non-linearities exist in the relation between firms' capital structure and its determinants. This finding of non-linearities adds a new dimension to the knowledge of UK firms' financing behaviour reported in existing literature, and provides support for the use of quantile regression methods in the field of corporate finance.

**Data Appendix:**

*Total debt (Item 1301):* The total of all long and short-term borrowing including subordinate debt and debt like hybrid finance.

*Total Assets (Item 392):* The sum of net fixed assets, total intangibles, total investments, net current assets and other assets.

*Total sales (Item 104):* UK sales, exports and overseas sales minus inter-company sales and value added taxes and other duties and taxes.

*Number of employees (Item 219):* The average number of employees as disclosed by the company. The end number is used if the average is not disclosed.

*Gross fixed assets (Item 330):* The sum of total land and building, plant machinery and equipment and other fixed assets.

*Total Depreciation (Item 338):* Depreciation of total land and building, plant machinery and equipment and other fixed assets.

*Net fixed assets (Item 339)* are gross fixed assets (item 330) minus total depreciation (item 338).

*Earnings before interest and tax (EBIT) (Item 1300):* The earnings of a company before total interest expense, depreciation, amortization and provisions.

*Operating profit (Item 137):* Trading profit minus depreciation minus depreciation of leased assets minus adjustment for assets sold.

*Market value to book value (Item MTBV):* The market value of a company as a percentage of its total equity capital plus reserves minus intangibles.

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Table 1 : Determinants of Debt Ratios: OLS and Quantile Regression Results

	$LSALE_{t-1}^2 (\times 100)$	$TANG_{t-1}^2$	$PROF_{t-1}^2$	$MVTBV_{t-1}^2 (\times 100)$
<b>OLS</b>	0.734** (0.400)	0.062 (0.040)	-0.399*** (0.081)	0.014 (0.036)
<b>5</b>	0.894*** (0.205)	0.115*** (0.023)	-0.100*** (0.032)	-0.054 (0.064)
<b>10</b>	1.140*** (0.206)	0.126*** (0.024)	-0.086** (0.044)	-0.075 (0.071)
<b>25</b>	0.973*** (0.304)	0.165*** (0.039)	-0.064 (0.098)	-0.006 (0.082)
<b>50</b>	0.758* (0.459)	0.076** (0.039)	-0.178 (0.162)	-0.001 (0.090)
<b>75</b>	1.490** (0.529)	0.034 (0.045)	-0.628*** (0.173)	0.029 (0.78)
<b>90</b>	0.188 (0.733)	-0.013 (0.074)	-0.880*** (0.229)	0.009 (0.076)
<b>95</b>	0.196 (0.785)	-0.001 (0.105)	-0.852*** (0.253)	0.095 (0.089)

Notes:

- (1) The dependent variable is the ratio of total debt to total assets for year 1998. Bootstrapped standard errors in parentheses (except for the OLS equation). The bootstrap standard errors were obtained using 1000 replications. The regression includes industry dummies to control for industry specific effects. Number of observations = 660.
- (2) LSALE denotes the logarithm of total sales, TANG denotes the ratio of net fixed assets to total assets, PROF denotes the ratio of earnings before interest and taxes to total assets, MVTBV denotes market value of a company as a percentage of its total equity capital plus reserves minus intangibles. All explanatory variables are averaged over the 1994-1997 period.

\*\*\* Significant at 1% level; \*\* Significant at 5% level; \*Significant at 10% level

Table 2: F-Tests for Equality of Coefficients Across Quantiles

	<b>5</b>	<b>10</b>	<b>25</b>	<b>50</b>	<b>75</b>	<b>90</b>
<b>5</b>						
<b>10</b>	<b>0.82</b> <i>0.51</i>					
<b>25</b>	<b>0.67</b> <i>0.61</i>	<b>0.93</b> <i>0.44</i>				
<b>50</b>	<b>0.38</b> <i>0.82</i>	<b>0.82</b> <i>0.51</i>	<b>1.46</b> <i>0.21</i>			
<b>75</b>	<b>3.14</b> <i>0.01</i>	<b>3.59</b> <i>0.00</i>	<b>4.68</b> <i>0.00</i>	<b>3.08</b> <i>0.01</i>		
<b>90</b>	<b>4.80</b> <i>0.00</i>	<b>5.62</b> <i>0.00</i>	<b>5.32</b> <i>0.00</i>	<b>3.13</b> <i>0.01</i>	<b>2.25</b> <i>0.06</i>	
<b>95</b>	<b>4.39</b> <i>0.00</i>	<b>5.23</b> <i>0.00</i>	<b>4.66</b> <i>0.00</i>	<b>2.55</b> <i>0.03</i>	<b>1.58</b> <i>0.17</i>	<b>0.01</b> <i>0.99</i>

This table presents F-tests of equality of the slope coefficients across quantiles controlling for industry specific effects. The F-tests for equality of slope coefficients (in bold) and the corresponding p-values (in italic) are based on the bootstrap method. Bootstrap simulations are based on 1000 replications.

**Table 3 : Determinants of Leverage Ratios: OLS and Quantile Regression Results**

	$LSALE_{t-1}^2 (\times 100)$	$TANG_{t-1}^2$	$PROF_{t-1}^2$	$MVTBV_{t-1}^2 (\times 100)$
<b>OLS</b>	0.730*** (0.003)	0.104*** (0.029)	-0.164*** (0.033)	-0.010* (0.005)
<b>5</b>	0.637*** (0.232)	0.078*** (0.026)	-0.024 (0.016)	-0.013 (0.012)
<b>10</b>	0.885*** (0.183)	0.104*** (0.024)	-0.033 (0.023)	-0.013 (0.013)
<b>25</b>	0.892*** (0.218)	0.160*** (0.026)	-0.078* (0.043)	-0.012 (0.015)
<b>50</b>	1.114*** (0.346)	0.160*** (0.031)	-0.149*** (0.074)	-0.014 (0.012)
<b>75</b>	0.888* (0.479)	0.110*** (0.047)	-0.207*** (0.098)	-0.009 (0.017)
<b>90</b>	-0.045 (0.700)	0.022 (0.061)	-0.413*** (0.134)	-0.015 (0.014)
<b>95</b>	0.320 (1.074)	-0.095 (0.091)	-0.322** (0.167)	-0.009 (0.016)

Notes:

(1) The dependent variable is the ratio of total debt to total assets for year 1998. Bootstrapped standard errors in parentheses (except for the OLS equation). The bootstrap standard errors were obtained using 1000 replications. The regression includes industry dummies to control for industry specific effects. Number of observations=916.

(2) LSALE denotes the logarithm of total sales, TANG denotes the ratio of net fixed assets to total assets, PROF denotes the ratio of earnings before interest and taxes to total assets, MVTBV denotes market value of a company as a percentage of its total equity capital plus reserves minus intangibles. *All explanatory variables are lagged once.*

\*\*\* Significant at 1% level; \*\* Significant at 5% level; \*Significant at 10% level

**Table 4: F-Tests for Equality of Coefficients Across Quantiles**

	<b>5</b>	<b>10</b>	<b>25</b>	<b>50</b>	<b>75</b>	<b>90</b>
<b>5</b>						
<b>10</b>	<b>0.69</b> <i>0.59</i>					
<b>25</b>	<b>2.48</b> <i>0.04</i>	<b>1.78</b> <i>0.13</i>				
<b>50</b>	<b>2.68</b> <i>0.05</i>	<b>1.80</b> <i>0.12</i>	<b>0.43</b> <i>0.78</i>			
<b>75</b>	<b>1.14</b> <i>0.33</i>	<b>1.07</b> <i>0.36</i>	<b>0.95</b> <i>0.43</i>	<b>0.71</b> <i>0.58</i>		
<b>90</b>	<b>3.36</b> <i>0.00</i>	<b>3.99</b> <i>0.00</i>	<b>4.30</b> <i>0.00</i>	<b>4.15</b> <i>0.00</i>	<b>2.87</b> <i>0.02</i>	
<b>95</b>	<b>2.76</b> <i>0.02</i>	<b>3.25</b> <i>0.01</i>	<b>3.91</b> <i>0.00</i>	<b>3.65</b> <i>0.00</i>	<b>2.23</b> <i>0.06</i>	<b>1.02</b> <i>0.39</i>

This table presents F-tests of equality of the slope coefficients across quantiles controlling for industry specific effects. The F-tests for equality of slope coefficients (in bold) and the corresponding p-values (in italic) are based on the bootstrap method. Bootstrap simulations are based on 1000 replications.