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Capital Structure in South Korea: A Quantile Regression Approach

By

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Abstract

This paper analyzes capital structure in South Korea from 1991 until 1999. The paper makes use of quantile regression methods to explore the changing distribution of debt-capital ratios across firms and over time. We find clear evidence of heterogeneity in the capital structure of firms. There is also strong evidence of heterogeneity in the determinants of capital structure choice. The size of the firm and its rate of growth have a positive impact on debt at low values of the debt ratios, but a negative impact at high values of the ratios. By contrast, the proportion of net fixed assets has a negligible impact at low values of the debt ratios, but a significantly positive impact at medium or high values of the ratios. The observed non-linearities in the determinants of capital structure are consistent with an agency cost theory of capital structure, and with both a non-negativity constraint and an upper bound on debt.

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1. Introduction

The central question of corporate finance, 'what determines firms' choice of capital structure?', has, since the crises of 1997, acquired new significance in the context of developing economies. The debt ratios of South Korean firms in particular have been a focus for attention since the high leverage ratios of Korean firms is believed to have had a role in the evolution of that country's crisis.

Studies of firms' capital structure in the context of asymmetric information and market imperfections have a theoretical rationale for treating firms' choice of debt-equity ratio as determined by agency costs (Harris and Raviv, 1991). Proxies for those arguments have been found to have a significant relationship with capital structure in US data (Titman and Wessels, 1988) and similar proxies have been significant in explaining the differences in firms' capital structure among the advanced industrialized countries (Rajan and Zingales, 1995). Recently empirical studies similar to those of US firms have been concerned with the capital structure of firms in developing countries, mainly Latin American and South East Asian companies (Booth et al, 2001).

Studies attempting to explain the capital structure of firms in developing countries have special value to the extent that the 1997 East Asian crisis and subsequent sharp declines in the region's investment and growth were due to the high debt ratio of East Asian firms at the start of the crisis (Kim and Stone, 1999; Harvey and Roper, 1999). While some identify high leverage as the principal factor, others locate the underlying cause of the crisis in deteriorating fundamentals with high leverage ratios having the important effect of linking fundamentals to the financial markets in a negative feedback (Harris, 2000). Although high leverage characterised all the East Asian crisis economies, in South Korea the effect of leverage was in some ways distinct, at least in that firms' leverage was reflected in equity valuation (Pomerleano and Zhang, 1999). Nevertheless Korean firms' high leverage has been identified as the main factor responsible for the Korean crisis and its depth (Lee, et al 1999; Classens et al, 1998). High and increasing debt ratios that accompanied Korean firms' growth in the 1980s and 1990s, particularly reliance on foreign debt, caused them to be highly vulnerable to deteriorating fundamentals and financial market shocks such as those of 1997. Their high leverage also prevented Korean firms from adjusting rapidly to the recession and credit crunch that followed the crisis, thereby intensifying its severity and slowing the pace of recovery. Consequently, reducing the reliance of firms on debt has become a central element of Korea's restructuring programme in the post-crisis period and studies of how Korean non-financial firms choose their capital structure have significance for that (Lee et al, 1999; Hahm et al, 1998).

Interestingly, empirical studies indicate that the determinants of capital structure suggested by conventional capital structure models and well established in US studies — a firm's size, profitability, asset tangibility and growth prospects — also explain the debt structure of Korean firms (Lee et al, 1999; Booth et al, 2000). Lee at al (1999) find that, additionally, Korean institutional features have an effect. Controlling for the other determinants, the capital structures of chaebol and non-chaebol firms differ significantly which may be explained by institutional factors, namely the heavy involvement of government in the pricing and allocation of credit, lack of appropriate risk control and credit assessment techniques, and the close relationship between chaebols and financial institutions.

This paper has two main related objectives. The first is to provide a detailed analysis of the evolution of capital structure of Korean firms prior to the 1997 crisis. We use quantile analysis to explore the changing distribution of debt ratios across firms and over time. This analysis provides new insights into the causes of the Korean crisis. Many studies of the origins of the Korean crisis argue that the Korean corporate sector suffered from very low profitability and experienced sharp rises in their debt-equity ratio during the period 1991-1997 (Pomerleano, 1998; Classens et al, 1998). This increased the fragility of the corporate sector and made the economy highly vulnerable to speculative attacks and to a reversal of foreign capital flows. These studies have drawn their conclusions from the mean values of profitability and leverage. The quantile analysis, however, reveals a clear evidence of heterogeneity in the capital structure of firms, the implications of which are obscured by inferences from variables' means. We show that contrary to existing evidence, most Korean firms achieved positive and relatively high profit margins and indeed were able to maintain stable profit margins prior to and during the crisis. Furthermore, although the mean leverage of Korean firms increased during the 1991-1998 period, this rise was caused by the steep increases in leverage in the very upper parts of the distribution. This analysis has important policy implications. It shows that the weaknesses in the Korean corporate sector prior to the crisis were not wide-ranging. However, the heightened fragility of a small number of firms was enough to convey bad signals to foreign investors and induce a swing to pessimism about the economy that precipitated a generalized crisis.

The second objective of the paper is to analyse the determinants of the capital structure choice of Korean firms using conditional quantile regression methods. This approach, which is more information rich than least squares, takes into account the heterogeneity in the capital structure of firms, the large variation in the leverage ratios across Korean firms. Since the change in the mean of the leverage of Korean firms is determined by a few observations in the upper parts of the distribution, classical empirical methods based on the estimation of the conditional mean are inaccurate in explaining the capital structure of Korean firms. Due to heterogeneity, the leverage ratio may not be identically distributed across firms in which case we may expect to find significant differences in the impact of the determinants of the capital structure choice. Quantile regression allows us to examine the whole distribution of firms rather than a single measure of the central tendency of the capital structure distribution. Consequently we are able to evaluate the relative importance of explanatory variables at different points of the distribution of firms' leverage.

Our results show that there is strong evidence of heterogeneity in the determinants of capital structure choice. The size of the firm and its rate of growth have a positive impact on debt at low values of the debt ratios, but a negative impact at high values of the ratios. By contrast, the proportion of net fixed assets has a negligible impact at low values of the debt ratios, but a significantly positive impact at medium or high values of the ratios. The observed non-linearities in the determinants of capital structure are consistent with an agency cost theory of capital structure, in a model that includes both a non-negativity constraint and an upper bound on the debt-equity ratio.

The rest of the paper is organized as follows. Section 2 examines the debt structure and profitability of Korean firms during the 1991-1999 period. Section 3 presents an agency cost theory of capital structure, with both a non-negativity constraint and an upper bound on the debt ratio, which allows for non-linearities in the determinants of capital structure. Section 4 describes the data and the empirical methodology while Section 5 presents the empirical results. Section 6 summarizes the results and concludes.

2. Capital structure in South Korea

Heavy reliance on debt finance, mainly from the domestic banking system, was a major feature of the Asian miracle and is reflected in the high leverage of East Asian firms. During the 1988-1996 period, Korean firms had the highest leverage and highest growth of leverage ratios as measured by the mean of the leverage ratios of listed Korean firms (Classens et al, 1998; Lee et al, 1999). However, there was large variation across Korean firms in the evolution and the level of their leverage as well as in their economic performance. As such, it may not be accurate to draw conclusions based on mean values. In order to explore the capital structure and performance of Korean firms, we examine the entire distribution of short-term and long-term leverage. The data used in this section consist of selected variables from the balance sheets of Korean firms listed on the Korea Stock exchange over the period 1991-1999. The source of the data is *Datastream.* [1]

[1] Precise definitions of these firm related variables are given in the appendix.

Figure 1 depicts total debt-to-capital ratio over the period 1991-1999 at various quantiles of the distribution.[2] As can be seen from this figure, the mean debt-to-capital ratio increased significantly during the period 1991-1998. However, the figure also shows that the increase in the mean debt-to-capital ratio has been mainly driven by the upper quantiles of the distribution where firms in these quantiles experienced very steep increases in their debt to capital ratios, especially in 1997. In fact, Figure 1 shows that very little increase in the debt-to-capital ratio occurred at the lower quantiles of the distribution. For example, for firms in the 10th quantile, the debt-to-capital ratio increased very little from 26% in 1991 to 33% in 1997 and then declined to 21% in 1998. By comparison, the debt-to-capital ratio for the 95th quantile increased from 142% in 1991 to 286% in 1997 to decline slightly to 271% in 1998. Note also that the median of the debt capital ratio is consistently below the mean, indicating that the debt to capital distribution is right-skewed, and more so in later years.[3] Figure 2, which depicts the ratio of short-term debt to total capital employed, shows the same pattern. Although the mean of the short-term debt-to-capital ratio increased during the 1991-1998 period, this rise was mainly attributable to the steep increases in the short-term debt-to-capital ratio in the upper quantiles of the distribution. By contrast, not much increase in the short-term debt-to-capital ratio occurred in the lower parts of the distribution.

Figure 3 depicts the operating profit margin during 1991-1999 at various quantiles of the distribution. The main advantage of this as a measure of profit is that it is not influenced by the liability structure of the firm as it excludes interest payments on the debt, financial income, and other income and expenses. As can be seen from this figure, there are major differences in the change in the operating profit margin across quantiles. While firms in the lower quantiles achieved negative profit margins and witnessed a steady and steep decline in their operating profit margins especially during the period 1996-1998, firms in the upper quantile achieved positive and relatively high operating profit margins. More importantly, the figure shows that the operating profit margins for firms in the upper quantiles did not witness any decline, but instead remained relatively stable during the period under study. Note also that at the end of the sample period, the median of operating profit margin remained

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[2] The choice of debt-to-capital ratio (which is equivalent to debt to total assets), instead of debt to equity ratio, is driven by the fact that many firms in our sample have small or even negative equity. This is especially true in later years of our sample when equity values fell dramatically as a result of the crisis, inflating the debt to equity ratios.

[3] Note that in figures 1 and 2, the distance between the quantiles widened in the upper segments of the distribution while became narrower in the lower segments of the distribution. This indicates that the distribution has become more skewed towards high leverage over the sample period. This could have led to heightened financial fragility (see Bernanke et al, 1988).

consistently above the mean, indicating a shift in the operating profit margin distribution in later years. Thus while studies of average performance show that the Korean economy suffered from low profitability and low rate of return on assets before the crisis, analysis of the distribution shows that many Korean firms achieved positive and relatively high profit margins and indeed were able to maintain stable profit margins prior to and during the crisis.

In Table 1, we compare the characteristics of the firms in the 95th quantile of the short-term leverage distribution with other firms in the sample for 1997.[4] If firms in the upper quantile were also the largest, it could be argued that their leverage would outweigh the remaining firms in the sample. According to this table, however, the firms in the 95th quantile are, on average, smaller in size. This is true whether we use the number of employees or total capital employed as proxies for size. This indicates that it is not necessarily true that the largest firms are also the most highly leveraged ones, as some studies suggest. Table 1 also shows that, on average, these highly leveraged firms have significantly lower operating profit margins, lower return on capital employed, lower net fixed assets and higher proportion of short-term debt to total debt. Table 2, which compares the firms in the 90th quantile to the rest of firms in the sample, suggests similar conclusions.

Thus, examination of the distribution of data shows that before and after the crisis of 1997 there were large differences in the level and the evolution of debt structure and performance across Korean firms. This heterogeneity in our sample warrants examination of the whole distribution of leverage rather than focus on a single central tendency measure. Given the heterogeneity of firms, we would expect the determinants of leverage to have a different impact depending on the firm's degree of leverage. In the next section, we present a simple model that allows for a differential impact of determinants on leverage.

3. Determinants of capital structure

The theoretical literature on capital structure suggests a number of considerations to account for the debt-equity ratio chosen by corporations based on the agency cost of debt and equity (Jensen and Meckling, 1976; Harris and Raviv, 1991). Agency costs of debt are borne by firm owners because of the potential conflicts between debt holders and equity holders and between equity holders and managers of the firm. This theoretical literature has testable implications regarding the determinants of leverage.

One such implication is the relationship between free cash flow and firm leverage. According to agency cost theory free cash flow increases managers' power relative to

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[4] We report the results for 1997 only, but the same pattern is observed in other years.

principals' and debt can be an effective instrument to reduce the cash flow available for discretionary spending by managers (Jensen, 1986). The main testable implication is that we should observe a direct relationship between internal funds and a firm's leverage.

Another testable implication is the relationship between leverage and a firm's growth opportunities. First, firms with a high proportion of non-collateralisable 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 and hence are likely to rely more on equity funds. By contrast, firms with high collateralisable assets (proxied by measures of tangible assets) could face lower costs of debt. First, 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 make it more likely that liquidation would be the best strategy (Harris and Raviv 1991). As a consequence, firms with higher collateralisable assets are likely to exhibit higher debt-equity ratios.[5]

Another potential determinant of capital structure is the size of the firmLarger 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 operationsand therefore have a lower risk of default (Titman and Wessels, 1988). These arguments suggest a positive relationship between firm size and leverage.

The above considerations can be incorporated into a formal model of maximization of the firm's value. The objective function for the firm can be written as:

$$(1) \qquad \max V_t = E_t\left\{\sum_{s=0}^{\infty} \beta_{t+s}(D_{t+s} - S^n_{t+s})\right\}$$

where β_{t+s} is the (time-varying) discount factor, D_{t+s} are dividends, and S^n_{t+s} are new share issues. Dividends are given by:

$$(2) \qquad D_t = [p_t F(K_t, L_t) - w_t L_t - r_t B_{t-1} - A(B_{t-1}; \mathbf{x})] - p^k_t I_t + (B_t - B_{t-1}) + S^n_t$$

[5] 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).

where K_t and L_t are capital and labor respectively, B_t is the stock of debt, $p^k_t I_t$ 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.[6] The function $A(B_{t-1};\mathbf{x})$ measures the costs of finance to the firm in terms of foregone output. The vector **x** includes a set of variables that influence the agency cost of debt, such as net fixed assets, the rate of growth of the firm or its operating profits.[7] The function $A(B_{t-1};\mathbf{x})$ thus captures the agency effects we have discussed. We shall assume that $A_B > 0$ and $A_{BB} > 0$: the marginal cost of debt is positive and increasing in the stock of debt.

The maximization program for the firm is also subject to the dynamic equation on capital stock, a non-negativity constraint on debt and an upper bound on the total stock of debt:[8]

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

(4) $B_t \geq 0, \qquad B_t \leq H$

The first-order condition on the stock of debt at time t is:

(5) $\mu_{B,t} - \mu_{H,t} = \beta_{t+1}(1 + r_{t+1} + A_B) - \beta_t$

where $\mu_{B,t}$ and $\mu_{H,t}$ are the Kuhn-Tucker multipliers associated with the non-negativity constraint and with the upper bound on debt respectively. Furthermore, the complementary slackness conditions yield:

(6) $\mu_{B,t} \cdot B_t = 0$

(7) $\mu_{H,t} \cdot \left(H - B_t\right) = 0$

In order to interpret these conditions, note that, when neither constraint is binding, the Kuhn-Tucker multipliers $\mu_{B,t}$ and $\mu_{H,t}$ are both equal to zero and the first-order condition (5) becomes:

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

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

$$\frac{dB}{dx} = -\frac{A_{Bx}}{A_{BB}}$$

which is positive when $A_{Bx} < 0$, that is, when an increase in x reduces the marginal cost of debt.

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6 For simplicity, we ignore adjustment costs of capital.

7 See Jaramillo, Schiantarelli and Weiss (1996) for an early application of an agency cost function to the objective function of the firm.

8 We abstract from the non-negativity constraints on dividends and on new equity issues since these would be irrelevant for our analysis.

When the lower constraint on debt is binding (and therefore the upper constraint is not binding), $\mu_{B,t}$ >0 and $\mu_{H,t}$ = 0 and the first-order condition (5) becomes:

$$(10) \quad \mu_{B,t} = \beta_{t+1}(1 + r_{t+1} + A_B) - \beta_t$$

The effect on the stock of debt of an increase in $x \in \mathbf{x}$ is:

$$(11) \quad \frac{dB}{dx} = -\frac{\beta_{t+1} A_{Bx} - \mu_{Bx}}{\beta_{t+1} A_{BB} - \mu_{BB}}$$

We have already assumed that $A_{BB} > 0$. In order to sign the direction of the effects of changes of x on B, we assume that the following set of sufficient conditions holds.

Assumption 1.

- *i.* $A_{Bx} < 0$: an increase in x reduces the marginal cost of debt;
- *ii.* $\mu_{Bx} < 0$: an increase in x reduces the marginal cost of the non-negativity constraint on debt;
- *iii.* $\mu_{BB} < 0$: an increase in the stock of debt reduces the marginal cost of the non-negativity constraint on debt; and
- *iv.* $|\mu_{Bx}| < \beta_{t+1} |A_{Bx}|$: the effect of x on the marginal cost of the non-negativity constraint is less, in absolute value, than its discounted effect on the marginal agency cost of debt.

It is then straightforward to verify the following Proposition.

Proposition 1.

When $\mu_{B,t} = \mu_{H,t} = 0$ and when *Assumption 1* holds, we have that $dB/dx > 0$: an increase in x is associated with an increase in debt.

When the upper constraint on debt is binding (and therefore the non-negativity constraint is not binding), the Kuhn-Tucker multipliers are such that $\mu_{B,t}$ = 0 and $\mu_{H,t}$ > 0, and therefore the first-order condition (5) becomes:

$$(12) \quad \mu_{H,t} = \beta_t - \beta_{t+1}(1 + r_{t+1} + A_B)$$

The effect of a variable $x \in \mathbf{x}$ on B is given by:

$$(13) \quad \frac{dB}{dx} = -\frac{\beta_{t+1} A_{Bx} - \mu_{Hx}}{\beta_{t+1} A_{BB} - \mu_{HB}}$$

We now make the following set of assumptions.

Assumption 2.

- *i.* $A_{Bx} < 0$: an increase in x reduces the marginal cost of debt;
- *ii.* $\mu_{Hx} < 0$: an increase in x reduces the marginal cost of the upper constraint on debt;

iii. $\mu_{HB} > 0$: an increase in the stock of debt increases the marginal cost of the upper constraint on debt;

iv $\mu_{HB} > \beta_{t+1} A_{BB}$: as the stock of debt B increases, its effect on the marginal cost of the upper constraint on debt exceeds its effect on the discounted value of the marginal agency cost of debt; and

v $\beta_{t+1} |A_{Bx}| < |\mu_{Hx}|$: the effect of x on the discounted marginal cost of debt is less than its effect on the marginal cost of the upper constraint.

Proposition 2.

When $\mu_{B,t} = 0$ and $\mu_{H,t} > 0$ and when *Assumption 2* holds, we have that $dB/dx > 0$: an increase in x is associated with an increase in debt.

The impact of x on B is instead negative when *Assumption 2* is replaced by *Assumption 2'* below.

Assumptions 2'.

i - *iv*. as in Assumption 2; and

v. $\beta_{t+1} |A_{Bx}| > |\mu_{Hx}|$: the effect of x on the discounted marginal cost of debt exceeds its effect on the marginal cost of the upper constraint.

We then have the following result.

Proposition 2'.

When $\mu_{B,t} = 0$ and $\mu_{H,t} > 0$ and when *Assumptions 2'* holds, we have that $dB/dx < 0$: an increase in x is associated with a reduction in debt.

Comparing equation (9) with equations (11) and (13) shows that the determinants of the optimal capital structure of firms will be different, depending on whether either constraint (or neither) is binding. Hence, we should expect to find evidence of structural changes in the parameters of the capital structure model, depending on the leverage ratio.

4. Empirical Methodology and Data

We test the implications of our model using the conditional quantile regression estimator developed by Koenker and Basset (1978). The quantile regression method helps us to achieve the following two main objectives. First, conditional mean regression estimators, namely least square regressions, concentrate only on a single central tendency measure. Conditional quantile regression, on the other hand, 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 a very informative descriptive device, especially when the data are heterogeneous. Due to heterogeneity, the dependent variable may not be identically distributed across firms in which case we expect to find significant differences in the estimated slope parameters at different quantiles. As our theoretical discussion suggests, the determinants of capital structure will be different depending on whether the lower or the upper constraint on the debt ratio is binding, or neither. Second, since our sample contains large outliers and the distribution of the disturbances is non-normal, applying conditional mean estimators to our equation is not suitable since these estimators are not robust to departure from normality or long tail error situations and therefore are likely to produce inefficient and biased estimates. This is in contrast to quantile regression, which is robust to departures from normality and skewed tails (Mata and Machado, 1996).

The Econometric Framework

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

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

and

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

and

(16) $$Quant_\theta(u_{\theta i} \mid x_i) = 0$$

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

The estimator for β_θ is obtained from:

(17) $$\min \sum_i^n \rho_\theta(y_i - x_i'\beta_\theta)$$

Where $\rho_\theta(u)$ is the "check function" defined as

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

The estimator does not have an explicit form, but the resulting minimization problem can be solved by linear programming techniques (Koenker and Basset, 1978).[9]

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.[10] In this paper, we employ the design matrix bootstrap method to obtain estimates of the standard errors for the coefficients in quantile regression (Buchinsky, 1995, 1998). Based on a Monte Carlo study, Buchinsky (1995) recommends the use of this method as it performs well for relatively small samples and is robust to changes of the bootstrap sample size relative to the data sample size.[11] More importantly, the design matrix bootstrap method is valid under many forms of heterogeneity.[12] In addition to the design matrix bootstrap method, we use the percentile method recommended by Koenker and Hallock (2000). This method enables us to construct confidence intervals for each parameter in β_θ, where the intervals are computed from the empirical distribution of the sample of the bootstrapped $\hat{\beta}*_\theta$'s.[13] Unlike the standard asymptotic confidence intervals, the bootstrap percentile intervals will not generally be symmetric around the underlying parameter estimate, which is highly useful when the true sampling distribution is not symmetric. It is important to note that these bootstrap procedures can be extended to deal with the joint distribution of various quantile regression estimators, allowing us to test for the equality of slope parameters across various quantiles (Koenker and Hallock, 2000).

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9 In this study, the minimisation problem is solved by the linear programming techniques suggested by Amstrong, Frome and Kung (1979).

10 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.

11 The design matrix bootstrap method amounts to sampling pairs $(y*_i, x*_i)$ $i = 1,...,n$ at random from the original observations with replacement and re-computing the least square estimator $\hat{\beta}*_\theta$ for each sample. Repeating this process B times yields a sample of B *p*-vectors whose sample covariance matrix constitutes a valid estimator of the covariance matrix of the original estimator. The number of bootstrap replications should be large enough to guarantee a small sample variability of the covariance matrix. In this paper, we use 1000 bootstrap replications to obtain the standard errors.

12 The design bootstrap matrix performs very well (better than the other methods considered in Buchinsky's paper) even when the errors are homoskedastic.

13 See Buchinsky (1998) for a detailed description of the percentile method.

Empirical specification and data

Based on the theoretical discussion of section 3, we specify the following panel data model:

$$(19) \quad Quant_{\theta}(y_{it} \mid x_{it}) = \alpha + \beta_{\theta}' x_{it} + \gamma' z_t + \delta w_i$$

where y_{it} is the dependent variable at quantile θ. We use two measures of the dependent variable: the ratio of short-term debt to total capital employed (STDCAP) and the ratio of total debt to total capital employed (TDCAP). Data limitations confine us to measure debt only in book value.

The x_{it} vector includes determinants that vary across firms and time. Based on the reasoning in Section 3 and others' empirical findings, we focus on four determinants: net fixed assets, size, profitability and growth.[14] In addition to these covariates, we use industry dummies to control for industry 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 64 industry groups using the business description reported in *Datastream*. We also include time dummies to control for factors that have the same effect for all firms at a given point in time, but vary across time. These time-specific effects include macroeconomic variables such as the price level and risk-free competitive interest rates.[15]

Profitability can influence the debt structure of firms by increasing the availability of cash flows or internal funds. Consistent with the free cash flow model, we would expect higher internal funds to be associated with a reduction in the marginal agency cost of debt since this gives firms an incentive to increase debt (A_{Bx}< 0 in Assumption 2). However, for highly leveraged firms, the availability of internal funds induces firms to move further away from the upper constraint and lower their optimal debt ratio since this will reduce the opportunity cost of the upper constraint on debt (μ_{Hx}<0 in Assumption 2). This effect is in line with the pecking order hypothesis which suggests that firms prefer to rely on internal funds than on outside sources of finance (Myers, 1984; Myers and Majluf, 1984). Thus, for highly leveraged firms, the impact of free cash flow on debt could be negative if the second effect dominates (Proposition 2'). In line with the empirical literature, this paper uses the ratio of

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[14] To avoid simultaneity, all explanatory variables (except for growth which is a forward looking variable) are lagged once.

[15] We also included depreciation to control for non-debt tax shield. This variable was not statistically significant in any of the regressions and hence was dropped from the analysis.

operating profits to total sales (also known as the operating profit margin) as a proxy for profitability and the availability of free cash flow.

Based on the discussion of Section 3, we expect size to have a negative impact on the agency cost of debt and therefore a positive impact on the observed debt ratio ($A_{Bx}< 0$ in Assumption 2). However, high leveraged firms would like to move away from the upper constraint of debt by resorting to alternative source of finance e.g. raise equity through the stock market ($\mu_{Hx}<0$ in Assumption 2). In this respect, larger firms are in a better position to access alternative sources of finance. Thus, for highly leveraged firms, the effect of size on the marginal cost of debt could be lower than its effect on the marginal cost of the upper constraint (condition v' in *Assumption 2'*: see *Proposition 2'*) resulting in a negative relationship between size and leverage. In our empirical analysis, we use the log of the total capital employed as a proxy for the size of the firm.[16]

We also expect the ratio of net fixed assets to have a negative effect on the marginal agency cost of debt and hence a positive impact on leverage. Our model suggests that the impact of an increase in net fixed assets on leverage is likely to be higher for the debt constrained firms than for intermediate and low debt firms because the increase in net fixed assets does not only reduce the marginal cost of debt for the former firms, but also relaxes their upper constraint on debt (equations 9 and 13).

By contrast, firms with important growth opportunities are likely to face high agency costs of debt and hence are likely to have lower debt ratios. However, growth opportunities could exhaust the pool of internal funds, pushing firms to increase their debt ratio. This is especially true for low leveraged firms where the non-negativity constraint becomes more binding and firms try to move away from this constraint by increasing their debt. Thus, for low leveraged firms, we expect to find a positive or insignificant relationship between growth opportunities and leverage due to the latter effect. This pattern should mirror the effect of collateralisable assets, such as net fixed assets, which are instead likely to be mostly critical for the high-leveraged firms. We use the percentage change of sales year over year as a proxy for growth.

Data

All the data used are constructed from the balance sheet of Korean firms listed on the Korean stock exchange. The data source for these variables is *Datastream* database. Three types of firms are omitted from our sample: firms with negative debt to capital

[16] This measure is highly correlated with the number of employees (available only from 1995 onwards) and hence serves as a good proxy for size. We also used the logarithm of sales as a proxy for size and obtained very similar results.

ratios, firms that operate in the financial sectors, and firms with less than three consecutive observations over the period 1992-1999. This leaves us with an unbalanced sample of 576 firms and 4,256 observations.

5. Empirical Results

Equation 19 is estimated for different values of θ which allows us to examine the impact of explanatory variables at different points of the distribution of firms' leverage. Specifically, we estimate the regressions at seven quantiles, namely 0.05, 0.10, 0.25, 0.50, 0.75, 0.90, and 0.95 quantiles, using the same list of explanatory variables for each of these quantiles. Table 3 reports the results of estimating equation 19 using the ratio of short-term debt to capital as the dependent variable while in figures 4a-4d, we plot the estimated coefficients against the various quantiles and the 95% confidence interval, constructed using the percentile method with 1000 replications.

For comparison purposes, table 3 also reports the OLS estimates. The only statistically significant variable is the ratio of net fixed assets to total assets (NFA), which attracts a positive coefficient. Size and operating profit margin (OPM) are statistically insignificant whereas GROWTH is significant only at the 10% level. The poor performance of OLS is expected given the heterogeneity of firms' capital structure.

The estimation of conditional quantile regressions allows us to explore the determinants of the debt ratio more accurately. The expected different effects of the explanatory variables at the different quantiles of the distribution are reflected in the size, sign and significance of estimated coefficients on the different covariates. Regarding the impact of size on the firm's capital structure choice (SIZE), there is large variation in the magnitude and sign of the estimated coefficients as we move up the conditional distribution. Specifically, size enters significantly and with a positive coefficient at the lower quantiles indicating that, at the lower quantiles, larger firms tends to have higher debt ratios. However, there is flip in the sign of the estimated coefficient at the 75th, 90th, and 95th quantiles and the estimated coefficients become much larger in absolute value, indicating that at high levels of short-term leverage, large firms are likely to reduce their debt ratios and move further away from the upper constraint. Figure 4a provides a graphical illustration of this pattern.

The impact of profitability on capital structure also differs across the conditional distribution of firms' short-term leverage. While OPM is negative and statistically significant at the 95th quantile, this variable seems to have no influence on the leverage choice of firms at the lower quantiles (see also Figure 4d). This may reflect the fact that highly leveraged firms are likely to rely more on internal sources for their funding, especially since the cost of debt is likely to be very high for these firms in relation to internal sources of finance.[17]

As to the ratio of net fixed assets to total assets (NFA), this is statistically insignificant at the lowest quantiles, whereas this variable becomes significant at the 25th quantile onwards. Interestingly, the estimated coefficients increase in importance as we move up the conditional distribution of firms' short-term leverage. This result is consistent with our theoretical model. The impact of an increase in net fixed assets on leverage is likely to be higher for the debt constrained firms because the increase in net fixed assets relaxes their upper constraint on debt. The role of net fixed assets for different values of the leverage ratio is illustrated in Figure 4b.

GROWTH, which captures non-collateralisable assets, mirrors the behavior of NFA. It enters significantly with a positive sign at the 5th, 10th, 25th and 50th, but becomes insignificant at the upper quantiles of the distribution (see Figure 4c). This result suggests that it may not be possible for highly leveraged firms to borrow against non-collateralisable assets because of the high agency costs associated with these real options (Myers, 1977). This is in contrast with tangible assets which can serve as collateral against external loans.

Whether or not the independent variables exert a different impact on the dependent variable at different points of the distribution can be examined formally by testing for the equality of the estimated coefficients across quantiles. In table 4, we report the F-tests and the associated p-values for the equality of quantile slope coefficients across the various pairs of quantiles. These tests are based on the bootstrapped standard errors using 200 replications.[18] As noted by Koenker and Hallock (2000), the bootstrap procedure can be extended to deal with joint distribution allowing us to construct tests of equality of slope parameters across quantiles. The tests confirm the visual inspection. The F-tests of equality reject the null hypothesis of homogenous coefficients at the 1% significance level for almost all pairs of quantiles with the exceptions of the 5th and 10th quantile, the 25th and 50th quantile and the 90th and 95th quantile where we can't reject the null hypothesis that the estimated coefficients are equal across these pair of quantiles. For example, there is a statistically significant (p-value=0.00) difference between the 10th quantile (the lower quantile of the distribution) and the 90th percentile (the upper quantile of the distribution). The same conclusions can be drawn across the different tails of the distribution. These findings

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[17] The F-tests reported in the last two columns of table 3 suggest that both the industry dummies and time dummies are significant in explaining the capital structure choice of firms.

[18] See Arias, Hallock, and Sosa-Escudero (2001) for a similar application.

are consistent with our hypothesis that the impact of explanatory variable on leverage varies as we move up the distribution.

Table 5 reports the results of estimating equation (19) using the ratio of total debt to capital as a dependent variable. The results are similar to those of long-term debt where the expected different impact of the explanatory variables at the different quantiles of the distribution is also reflected in the size, sign and significance of estimated coefficients. While the ratio of net fixed assets to total assets enters positively and is statistically significant in all the quantiles considered, the estimated coefficients on this variable become increasingly important as we move up the distribution (see figure 5b). Specifically, the absolute magnitude of the estimated coefficient increases monotonically from 0.22 for the 10^{th} quantile to 0.73 for the 95^{th} quantile. As to the size of the firm, this variable enters significantly with a positive coefficient for all quantiles except for the two highest quantiles where the estimated coefficients are insignificant at the conventional levels. As to the impact of profitability on capital structure, there is large variation across the conditional distribution of firms' long-term leverage. While it is insignificant at the lowest quantiles, the operating profit margin enters with a negative and statistically significant coefficient, starting from the 50^{th} quantile. On the other hand, growth prospects of the firm seem to have only an impact at the lowest quantiles (see figures 5a-5d). The F-tests of equality reported in table 6 also reject the null hypothesis of homogenous coefficients at the 1% significance level for almost all pairs of quantiles.

We next check whether our results are robust to the exclusion of the crisis period. Table 7 reports the regression results for short-term leverage over the period 1992-1997.[19] The results are very similar to those obtained previously. The ratio of net fixed assets to total assets enters positively and is statistically significant in all the quantiles considered and the estimated coefficients on this variable become increasingly important as we move up the distribution. Specifically, the absolute magnitude of the estimated coefficient increases monotonically from 0.07 for the 5^{th} quantile to 0.61 for the 95^{th} quantile. The size of the firm enters significantly with a positive coefficient at the lowest quantiles, but changes sign as we move up the conditional distribution of leverage. The operating profit margin enters with a negative and statistically significant coefficient at the 90^{th} and 95^{th} quantiles while it is not significant at lower quantiles. The only difference from our previous results is the GROWTH variable, which is now insignificant in all the quantiles considered.

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[19] We obtain very similar results for the ratio of total debt to capital. The results (not reported here) are available from authors upon request.

6. Conclusions

This paper analyzes capital structure in South Korea from 1991 until 1999. This issue has attracted considerable interest in the literature, in the light of the large observed increase in the average debt ratios of South Korean corporations. The paper makes use of conditional quantile regression methods to explore the changing distribution of debt ratios across firms and over time.

We find clear evidence of heterogeneity in the capital structure of firms. The large increase in the average debt ratios since 1997 is entirely attributable to the companies in the top decile of the distribution. Symmetrically, the decline in the average profit margin in the same period can be traced to the companies in the lowest decile of the firms according to their debt ratio.

There is also strong evidence of heterogeneity in the determinants of capital structure choice. The size of the firm and its rate of growth have a positive impact on debt at low values of the debt ratios, but a negative impact at high values of the ratios. By contrast, the proportion of net fixed assets has a negligible impact at low values of the debt ratios, but a significantly positive impact at medium or high values of the ratios.

The empirical results of the paper are consistent with an agency-cost based theory of capital structure, and with the presence of both a non-negativity constraint and an upper bound on the debt ratio of individual firms. The theoretical model developed in the paper is able to account for the observed non-linearities in capital structure behavior in South Korean firms.

These results have significant implications for the post 1997 policy-led corporate restructuring in Korea. Insofar as restructuring is designed to reduce leverage ratios, our results demonstrate that the factors influencing the capital structure choices made by highly leveraged firms have a different impact from those of less highly leveraged firms. Therefore, well-designed policy should have a differentiated approach to influencing capital structure.

Data Appendix:

Short-term debt comprises borrowing repayable within 1 year *(Item 309)*.

Long-term debt comprises loans repayable within 5 years, other long-term loans, convertible loans and leasing finance *(Item 321)*.

Total Debt equals to short-term plus long-term debt both measured in book value (*Item 1301*).

Total capital employed comprises total share of capital and reserves, total loan capital, total provisions and minority interests *(Item 322)*. This corresponds to total assets employed (*Item 391*).

Operating profit margin is the ratio of operating profits to total sales (*Item 713)*. Operating profits consists of net profit derived from the normal trading activities as defined by the company.

Net fixed assets is total gross fixed assets (*Item 330*) minus total depreciation of fixed assets (*Item 338*). Gross fixed assets comprise total land and buildings, plant, machinery and equipment, and other fixed assets (includes items that don't fall into the categories above and which are usually special to certain industries).

Total employees correspond to the number of employees in a firm *(Item 219)*.

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Table 1 – Features of firms in the 95th quantile of the short-term debt-capital distribution, compared with the rest of the sample.

	Firms in 95th quantile (Means, 1997)	**Rest of firms** (Means, 1997)
Total Employees	1098	1576
Total Capital Employed	8.27×10^{7}	4.56×10^{8}
Net Fixed Assets	1.50×10^{8}	3.18×10^{8}
Operating Profit Margin	-4.78	4.53
Return on Capital Employed	-13.421	4.02
Proportion of short term Debt	0.43	0.35
Number of Observations	*30*	*565-569*

Table 2 – Features of firms in the 90th quantile of the short-term debt-capital distribution, compared with the rest of the sample.

	Firms in 90th quantile (Means)	**Rest of firms** (Means)
Total Employees	1349	1574
Total Capital Employed	1.91×10^{8}	4.65×10^{8}
Net Fixed Assets	2.07×10^{8}	2.07×10^{8}
Operating Profit Margin	-2.67	4.82
Return on Capital Employed	-7.65	4.35
Proportion of short term Debt	0.43	0.35
Number of Observations	*60*	*535-539*

Table 3: Ratio of short-term debt to capital employed: regression results.

	$SIZE_{t-1}$[2]	NFA_{t-1}[2]	$GROWTH_t$[2]	OPM_{t-1}[2]	CONS	F-test for TIME dummies[3]	F-test for IND dummies[4]
OLS	-0.046 (0.040)	0.190 (0.008)	-0.107 (0.060)	-0.175 (0.556)	1.246 (0.716)	F-test= 2.62 *p-value=0.01*	F-test=4.37 *p-value =0.00*
5	0.019 *(0.004)*	0.012 *(0.044)*	0.025 *(0.018)*	0.063 *(0.052)*	-0.032 *(0.156)*	F-test= 50.76 *p-value=0.00*	F-test=154.87 *p-value =0.00*
10	0.017 *(0.004)*	0.059 *(0.067)*	0.036 *(0.013)*	0.040 *(0.054)*	-0.015 *(0.138)*	F-test= 141.20 *p-value =0.00*	F-test=154.87 *p-value =0.00*
25	0.009 *(0.007)*	0.192 *(0.058)*	0.030 *(0.015)*	0.078 *(0.059)*	0.118 *(0.204)*	F-test= 173.51 *p-value =0.00*	F-test=160.04 *p-value =0.00*
50	0.003 *(0.009)*	0.191 *(0.042)*	0.024 *(0.010)*	0.070 *(0.041)*	0.291 *(0.235)*	F-test= 97.63 *p-value =0.00*	F-test=60.42 *p-value =0.00*
75	-0.020 *(0.013)*	0.190 *(0.109)*	0.012 *(0.020)*	0.073 *(0.113)*	0.780 *(0.305)*	F-test= 88.94 *p-value =0.00*	F-test=183.05 *p-value =0.00*
90	-0.060 *(0.017)*	0.519 *(0.216)*	-0.013 *(0.034)*	-0.395 *(0.292)*	2.012* *(0.783)*	F-test= 127.40 *p-value =0.00*	F-test=96.24 *p-value =0.00*
95	-0.083 *(0.027)*	0.640 *(0.253)*	-0.042 *(0.054)*	-1.059 *(0.563)*	2.465 *(0.844)*	F-test= 50.10 *p-value =0.00*	F-test=156.21 *p-value =0.00*

Notes:

1 The dependent variable is the ratio of short-term debt to total capital employed at time t. Bootstrapped standard errors in parentheses (except for the OLS equation). The bootstrap standard errors were obtained using 1000 replications. The estimation period is 1992-1999.

2 Size denotes the logarithm of total capital employed, NFA denotes the ratio of net fixed assets to total assets, OPM denotes the ratio of operating profits to total sales, GROWTH is the percentage change of sales year over year and CONS is the intercept. All explanatory variables except GROWTH are lagged once.

3 F-test for joint significance of time dummies.

4 F-test for the joint significance of industry dummies.

Table 4: Short Debt-Capital Ratio: Tests for Equality of Coefficients Across Quantiles

	5	**10**	**25**	**50**	**75**	**90**
5						
10	F-test=0.86 *p-val=0.48*					
25	F-test=4.58 *p-val=0.00*	F-test=2.03 *p-val=0.08*				
50	F-test=4.64 *p-val=0.00*	F-test=2.50 *p-val=0.04*	F-test=0.73 p-val=0.56			
75	F-test=4.87 *p-val=0.00*	F-test=6.17 *p-val=0.00*	F-test=4.52 *p-val=0.00*	F-test=3.79 *p-val=0.00*		
90	F-test=14.45 *p-val=0.00*	F-test=13.34 *p-val=0.00*	F-test=10.49 *p-val=0.00*	F-test=10.05 *p-val=0.00*	F-test=8.26 *p-val=0.00*	
95	F-test=11.20 *p-val=0.00*	F-test=11.88 *p-val=0.00*	F-test=9.64 *p-val=0.00*	F-test=11.48 *p-val=0.00*	F-test=9.79 *p-val=0.00*	F-test=1.84 *p-val=0.1174*

Notes: This table presents F-tests of equality of the slope coefficients (SIZE, NFA, OPM, and GROWTH) across quantiles, controlling for time and industry dummies and corresponding to table 3. The F-tests for equality of slope coefficients and the corresponding p-values are based on the bootstrap method. All bootstrap simulations are based on 200 replications.

Table 5: Ratio of total debt to capital employed: regression results.

	$SIZE_{t-1}$[2]	NFA_{t-1}[2]	$GROWTH_t$[2]	OPM_{t-1}[2]	CONS	F-test for TIME dummies[3]	F-test for IND dummies[4]
OLS	-0.012 (0.066)	0.248 (0.009)	-0.241 (0.125)	-2.90 (1.956)	1.278 (1.214)	5.64 p-value=0.00	1.11 p-value=0.356
5	0.055 (0.009)	0.052 (0.092)	0.027 (0.019)	-0.020 (0.099)	-0.264 (0.312)	29.48 p-value=0.00	74.99 p-value=0.00
10	0.046 (0.012)	0.219 (0.097)	0.040 (0.023)	0.024 (0.086)	-0.225 (0.351)	123.46 p-value=0.00	114.15 p-value=0.00
25	0.065 (0.015)	0.253 (0.080)	0.032 (0.020)	-0.023 (0.112)	-0.534 (0.388)	78.84 p-value=0.00	63.30 p-value=0.00
50	0.056 (0.015)	0.252 (0.072)	0.0191 (0.024)	-0.204 (0.122)	-0.299 (0.395)	165.30 p-value=0.00	77.69 p-value=0.00
75	0.024 (0.018)	0.250 (0.135)	0.0003 (0.031)	-0.639 (0.250)	0.402 (0.445)	39.07 p-value=0.00	48.14 p-value=0.00
90	-0.015 (0.027)	0.535 (0.253)	-0.033 (0.060)	-1.827 (0.468)	1.583 (0.876)	76.80 p-value=0.00	45.31 p-value=0.00
95	-0.035 (0.046)	0.733 (0.245)	-0.076 (0.111)	-3.775 (0.870)	1.923 (1.164)	72.94 p-value=0.00	66.03 p-value=0.00

Notes:

1 The dependent variable is the ratio of total debt to total capital employed at time t. Bootstrapped standard errors in parentheses (except for the OLS equation). The bootstrap standard errors were obtained using 1000 replications. The estimation period is 1992-1999.

2 Size denotes the logarithm of total capital employed, NFA denotes the ratio of net fixed assets to total assets, OPM denotes the ratio of operating profits to total sales, GROWTH is the percentage change of sales year over year and CONS is the intercept. All explanatory variables except GROWTH are lagged once.

3 F-test for joint significance of time dummies.

4 F-test for the joint significance of industry dummies.

5 White standard errors for OLS results.

Table 6: Debt-Capital Ratio: Tests for Equality of Coefficients Across Quantiles

	5	**10**	**25**	**50**	**75**	**90**
5						
10	F-test=1.94 *p-val=0.10*					
25	F-test=3.97 *p-val=0.00*	F-test=3.03 *p-val=0.01*				
50	F-test=2.20 *p-val=0.06*	F-test=1.62 *p-val=0.16*	F-test=1.53 p-val=0.19			
75	F-test=3.64 *p-val=0.00*	F-test=3.40 *p-val=0.00*	F-test=9.20 *p-val=0.00*	F-test=6.19 *p-val=0.00*		
90	F-test=7.97 *p-val=0.00*	F-test=6.52 *p-val=0.00*	F-test=8.31 *p-val=0.00*	F-test=8.36 *p-val=0.00*	F-test=4.90 *p-val=0.00*	
95	F-test=9.92 *p-val=0.00*	F-test=8.12 *p-val=0.00*	F-test=11.06 *p-val=0.00*	F-test=11.03 *p-val=0.00*	F-test=8.44 *p-val=0.00*	F-test=2.76 *p-val=0.02*

Notes: This table presents F-tests of equality of the slope coefficients (SIZE, NFA, OPM, and GROWTH) across quantiles, controlling for time and industry dummies and corresponding to table 5. The F-tests for equality of slope coefficients and the corresponding p-values are based on the bootstrap method. All bootstrap simulations are based on 200 replications.

Table 7- Ratio of short-term debt to capital employed: regression results (1992-1997)

	$SIZE_{t-1}$[2]	NFA_{t-1}[2]	$GROWTH_t$[2]	OPM_{t-1}[2]
OLS	-0.020 (0.014)	0.460 (0.083)	-0.025 (0.033)	-0.113 (0.381)
5	0.021 *(0.004)*	0.073 *(0.029)*	-0.001 (0.023)	0.058 *(0.079)*
10	0.018 *(0.005)*	0.120 *(0.030)*	0.035 *(0.022)*	0.103 *(0.097)*
25	0.011 *(0.006)*	0.202 *(0.029)*	0.031 *(0.022)*	0.143 *(0.136)*
50	0.000 *(0.005)*	0.301 *(0.031)*	0.023 *(0.023)*	0.135 *(0.132)*
75	-0.026 *(0.014)*	0.382 *(0.055)*	0.008 *(0.029)*	-0.239 *(0.247)*
90	-0.067 *(0.015)*	0.588 *(0.068)*	-0.022 *(0.056)*	-0.885 *(0.494)*
95	-0.084 *(0.018)*	0.613 *(0.100)*	-0.052 *(0.077)*	-1.54 *(0.514)*

Notes:

1 The dependent variable is the ratio of short-term debt to total capital employed at time t. Bootstrapped standard errors in parentheses (except for the OLS equation). The bootstrap standard errors were obtained using 1000 replications. The estimation period is 1992-1997. Number of observations is 3096.

2 Size denotes the logarithm of total capital employed, NFA denotes the ratio of net fixed assets to total assets, OPM denotes the ratio of operating profits to total sales and GROWTH is the percentage change of sales year over year. All explanatory variables except GROWTH are lagged once.

3 F-tests (not reported here) suggest that both the industry dummies and time dummies are significant in explaining the capital structure choice of firms. The results are available upon request.

Fig 1-Ratio of Total Debt to Total Capital Employed

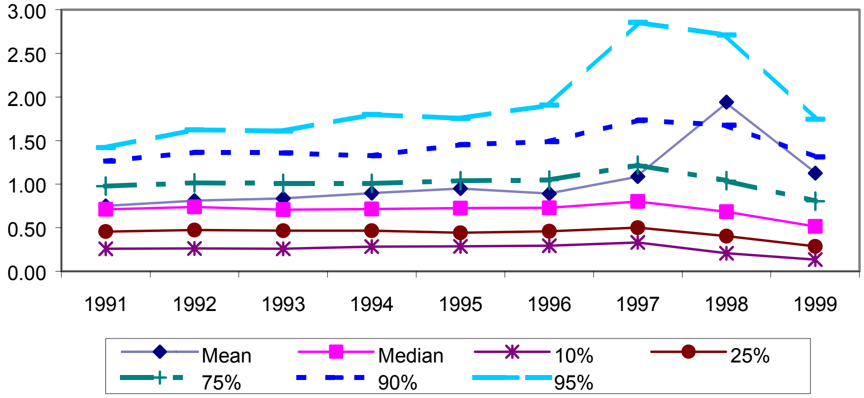


Fig 2-Ratio of Short-Term Debt to Total Capital

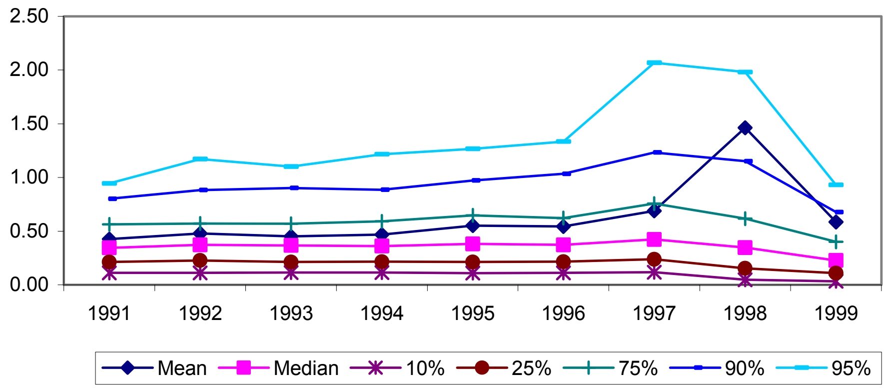


Fig 3- Operating Profit Margin

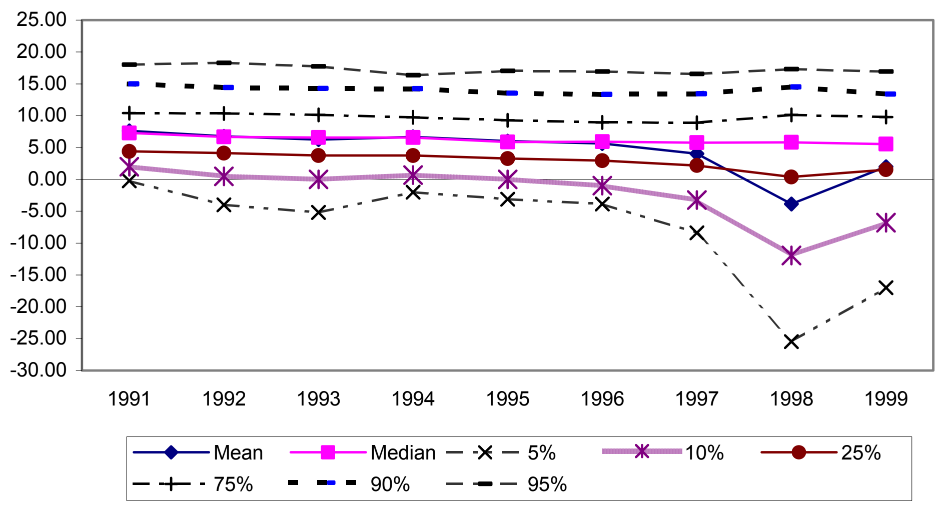


Figure 4a- Short-term debt: estimated coefficient of SIZE

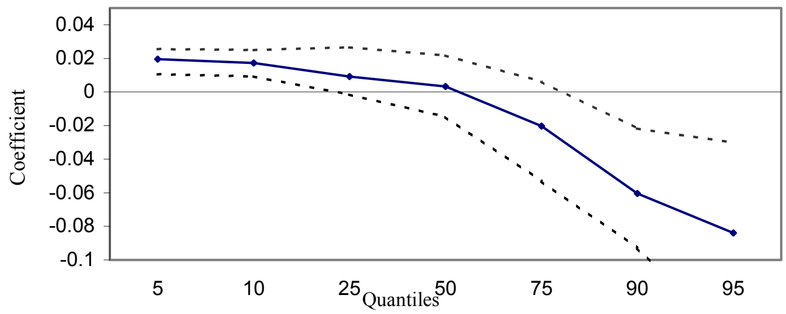


Figure 4b-Short-term debt: estimated coefficient of NFA

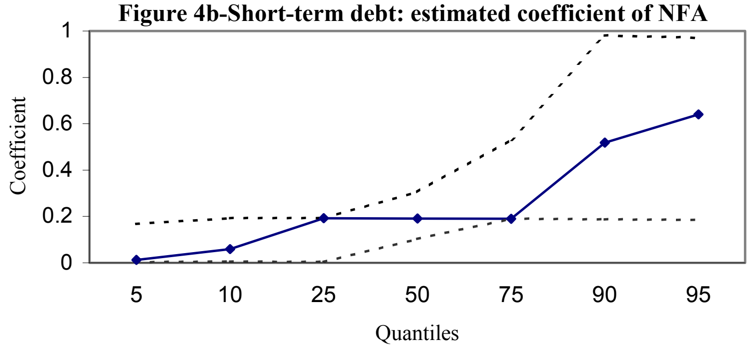


Figure 4c-Short-term debt:estimated coefficient of GROWTH

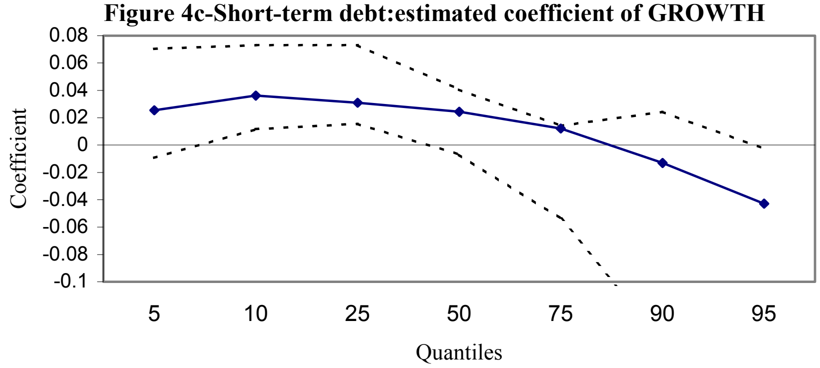


Figure 4d-Short-term debt: estimated coefficient of OPM

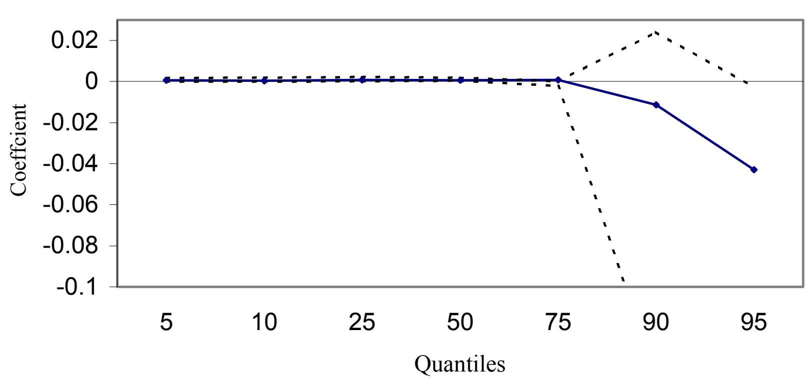


Figure 5a- Total debt: estimated coefficients of SIZE

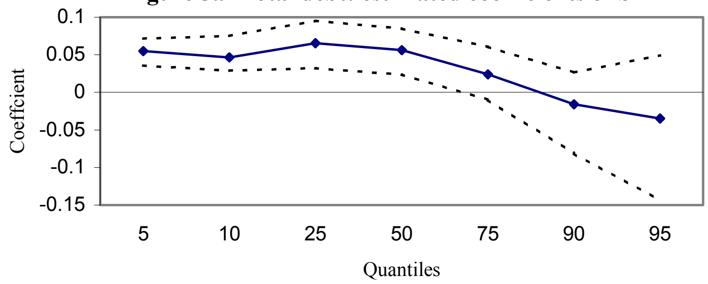


Figure 5b-Total debt: estimated coefficient of NFA

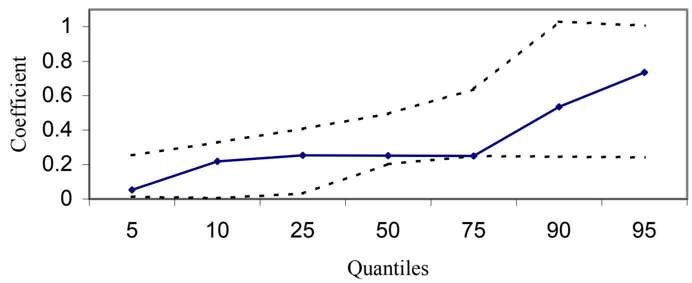
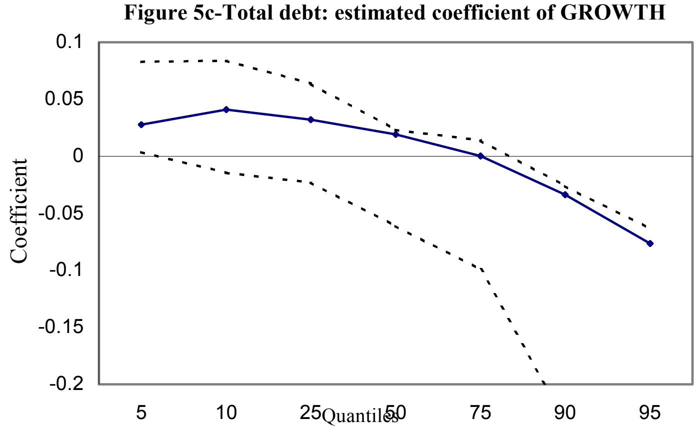


Figure 5c-Total debt: estimated coefficient of GROWTH



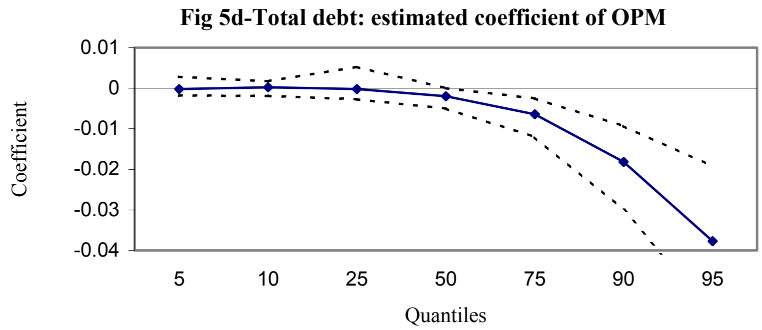


Fig 5d-Total debt: estimated coefficient of OPM
0.01
0
-0.01
-0.02
-0.03
-0.04
Coefficient
5
10
25
50
75
90
95
Quantiles

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