DETERMINANTS OF CAPITAL STRUCTURE: A QUANTILE REGRESSION ANALYSIS

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Abstract:

In this study, we attempted to analyze the determinants of capital structure for Indian firms using a panel framework and to investigate whether the capital structure models derived from Western settings provide convincing explanations for capital structure decisions of the Indian firms. The investigation is performed using balanced panel data procedures for a sample 298 firms (from the BSE 500 firms based on the availability of data) during 2001-2010. We found that for lowest quantile LnSales and TANGIT are significant with positive sign and NDTS and PROFIT are significant with negative sign. However, in case of 0.25th quantile LnSales and LnTA are significant with positive sign and PROFIT is significant with negative sign. For median quantile PROFIT is found to be significant with negative sign and TANGIT is significant with positive sign. For 0.75th quantile, in model one, LnSales and PROFIT are significant with negative sign and TANGIT and GROWTHTA are significant with positive sign whereas, in model two, results of 0.75th quantile are similar to the median quantile of model two. For the highest quantile, in case of model one, results are similar to the case of 0.75th quantile with exception that now GROWTHTA in model one (and GROWTHSA in model two).

Key words: *determinants of capital structure, quantile regression, fixed and random effect models*

1. Introduction

Capital structure refers to the way a firm finances its assets through some combination of equity, debt, or securities. It consists of permanent long-term financing long-term financing of a company, including long-term debt, common stock and preferred stock, and retained earnings. The financial structure is a broad concept which includes permanent long term sources of finance along with short term debt sources and account payables. The capital structure decision is a significant managerial decision, which may substantially affect the share price and market value of the firm. The Modigliani and Miller theorem, proposed by Franco Modigliani and Merton Miller, in 1958 stated that, in a perfect market, how a firm is financed is irrelevant to its value. This result provides the base with which to examine real world reasons why capital structure *is* relevant, that is, a company's value is affected by the capital structure it employs. Some other reasons include bankruptcy costs, agency costs, taxes, and information asymmetry. Some of the fundamental assumptions of the theory were declared unrealistic in the eyes of investors and other economic agents, therefore their subsequent research studies focused on relaxing some of its assumptions like no corporate taxes, in order to develop a more realistic approach. Subsequently, other assumptions were later relaxed to build the trade off theory, which suggests that a firm's target leverage is determined by taxes and costs of financial distress and thus the interest payments tend to be tax deductible making debt less expensive than the use of equity financing.

Myers (1984) worked in the same line and developed the pecking order theory which states that firms prioritize their sources of financing - from internal financing to equity issues according to the law of least effort, or of least resistance, preferring to raise equity as a financing means of last resort. This theory maintains that businesses adhere to a hierarchy of financing sources and prefer internal financing when available, and debt is preferred over equity if external financing is required. Due to insufficient internal sources of funds, in case of using external financing, the firms issue the cheapest security first so they start with debt, and then possibly apply hybrids such as convertible bonds, and going to equity only as a last resort. In contrast to the trade-off theory, there is no well-defined target leverage ratio in the pecking order theory: the debt ratio varies when there is an imbalance between internal funds and real investment opportunities.

In this study, we have attempted to identify the critical factors affecting the capital structure of Indian firms. For the purpose of analysis, a panel model has been estimated for the years 2002 to 2009. Further, for analysis we used quantile regression model which is relatively new in the present context as the regression methodology of this literature has typically been based on standard least panel squares estimators in the form of OLS and/or fixed effect and/or random effect models. This is because by having a complete picture of all quantiles, it is possible to consider several different regression curves that correspond to the various percentage points of the distributions and not only the conditional mean distribution, which neglects the extreme relationship between variables. Quantile regression (Koenker and Bassett 1978; Koenker and Hallock 2001) is a method for fitting a regression line through the conditional quantiles of a distribution. It allows the examination of the relationship between a set of independent variables and the different parts of the distribution of the dependent variable. Quantile regression overcomes some of the disadvantages of the conditional mean framework built upon central tendencies, which tend to lose information on phenomena whose tendencies are toward the tails of a given distribution (Hao and Naiman 2007). The use of quantile regression approach is chosen also because of skewed distribution of GROWTHSA, GROWTHTA, LEV, NDTS, PROFIT, and TANGIT. Since in such case the usual assumption of normally distributed error terms is not warranted and could lead to unreliable estimates. Furthermore, companies analyzed are fundamentally heterogeneous and it may make little sense to use regression estimators that implicitly focus on the 'average effect for the average company' by giving summary point estimates for coefficients. Instead, quantile regression techniques are robust to outliers and are able to describe the influence of the regressors over the entire conditional distribution of GROWTHSA, GROWTHTA, LEV, NDTS, PROFIT, and TANGIT.

The paper is organized as follows. The next section discusses about some possible determinants of the capital structure of the firms and provides empirical evidences. The third section briefly deals with the estimation methodology and data source. The fourth section presents the results, whilst the last section concludes the paper.

2. Literature Review

De-Miguel and Pindado (2001) studied and analyzed the determinants of the capital structure of the selected Spanish firms by using panel data, developed target adjustment model. It is found that the results were consistent with tax and financial distress theories and with the interdependence between investment and financing decisions. The evidences obtained confirmed the relevance of the pecking order and free cash flow theories and the impact of some institutional characteristics on capital structure.

Rajan and Zingales (1995) suggested that the level of gearing in UK companies is positively related to size and tangibility, and negatively correlated with profitability and the level of growth opportunities. However, as argued by Harris and Raviv (1991), 'The interpretation of results must be tempered by an awareness of the difficulties involved in measuring both leverage and the explanatory variables of interest' dependent. Further Alan A. Bevan & Jo Danbolt (2002) studied the difficulties of measuring gearing, and the sensitivity of Rajan and Zingales' results to variations in gearing measures. Based on an analysis of the capital structure of 822 UK companies, Rajan and Zingales' where results were found to be highly definitional-dependent. The determinants of gearing appeared to vary significantly, depending upon which component of debt was analyzed. In particular, significant differences found in the determinants of long- and short-term forms of debt. Given that trade credit and equivalent, on average, accounts for more than 62% of total debt, the results are particularly sensitive to whether such debt is included in the gearing measure. Therefore, it was observed that analysis of capital structure is incomplete without a detailed examination of all forms of corporate debt. Aydin Ozkan (2003) conducted study on the determinants of the capital structure of the selected UK firms. He examined the empirical determinants of borrowing decisions of firms and the role of adjustment process. A partial adjustment model was estimated by GMM estimation procedure using data for an unbalanced panel of 390 UK firms over the period of 1984–1996. The results provided positive support for positive impact of size, and negative effects of growth opportunities, liquidity, profitability of firms and non-debt tax shields on the borrowing decisions of the firms.

Huang and Song (2006) studied the determinants of the capital structure of the selected firms in China, by using database containing the market and accounting data (from 1994 to 2003) from more than 1200 Chinese-listed companies to document their capital structure characteristics. As in other countries, leverage in Chinese firms increases with firm size and fixed assets, and decreases with profitability, non-debt tax shields, growth opportunity, managerial shareholdings and correlates with industries. It was found that state ownership or institutional ownership has no significant impact on capital structure and Chinese companies consider tax effect in long-term debt financing. Different from those in other countries, Chinese firms tend to have much lower long-term debt.

Delcoure (2007) investigated, whether capital structure determinants in emerging Central and Eastern European (CEE) countries support the traditional capital structure theory developed to explain western economies. The determinants like Collateral value of assets, size, risk, growth opportunities, profitability and non debt tax shield were studied. The empirical evidence suggested that some traditional capital structure theories are portable to companies in CEE countries. However, neither the trade-off, pecking order, nor agency costs theories explain the capital structure choices. Companies do follow the modified “pecking order.” The factors that influence firms' leverage decisions are the differences and financial constraints of banking systems, disparity in legal systems governing firms' operations, shareholders, and bondholders rights protection, sophistication of equity and bond markets, and corporate governance.

Campello and Giambona (2010) studied the relation between corporate asset structure and capital structure by exploiting variation in the salability of tangible assets. The theory suggests that tangibility increases borrowing capacity because it allows creditors to more easily repossess a firm's assets. Tangible assets, however, are often illiquid. It has been shown that the redeployability of tangible assets is a main determinant of corporate leverage. To establish this link, the analysis used an instrumental variables approach that incorporates measures of supply and demand for various types of tangible assets (e.g., machines, land, and buildings). Consistent with a credit supply-side view of capital structure, they found that asset redeployability is a particularly important driver of leverage for firms that are likely to face credit frictions (small, unrated firms). The tests have also shown that asset redeployability facilitates borrowing the most during periods of tight credit.

Noulas and Genimakis (2011) studied the determinants of the capital structure of the firms listed on the Athens Stock Exchange, using both cross-sectional and nonparametric statistics. The data set is mainly composed of balance sheet data for 259 firms over a 9-year period from 1998 to 2006, excluding firms from the banking, finance, real estate and insurance sectors. The study assessed the extent to which leverage depends upon a broader set of capital structure determinants, got evidences showing that the capital structure varies significantly across a series of firm classifications. The results document empirical regularities with respect to alternative measures of debt that are consistent with existing theories and, in particular, reasonably support the pecking order hypothesis

The empirical literature suggests a number of factors that may influence the capital structure of firms. Bradley et al., (1984), Rajan and Zingales (1995), Kremp et al., (1999) and Frank and Goyal (2002) find leverage to be positively related to the level of tangibility. However, Chittenden et al., (1996) and Bevan and Danbolt (2001) find the relationship between tangibility and leverage to depend on the measure of debt applied. Further, managers of highly levered firms will be less able to consume excessive perquisites, since bondholders more closely monitor such firms. The monitoring costs of this agency relationship are higher for firms with less collateralizable assets. Therefore, firms with less collateralizable assets might voluntarily choose higher debt levels to limit consumption of perquisites (Drobetz and Fix, 2003). Hence, the agency model predicts a negative relationship between tangibility of assets and leverage. Firms with more tangible assets have a greater ability to secure debt. Alternatively, Grossman and Hart (1982) argue that the agency costs of managers consuming more than the optimal level of perquisites is higher for firms with lower levels of assets that can be used as collateral. The monitoring costs of the agency relationship are higher for firms with less collateralizable assets. Consequently, collateral value is found to be a major determinant of the level of debt financing (Omet and Mashharance, 2002). From a pecking order theory perspective, firms with few tangible assets are more sensitive to informational asymmetries. These firms will thus issue debt rather than equity when they need external financing (Harris and Raviv, 1991), leading to an expected negative relation between the importance of intangible assets and leverage.

Titman and Wessels (1988), in their study mentioned that because of bankruptcy risk, managers would not likely to use debt choice. However, since larger firms have a chance to be more diversified, they have relatively little bankruptcy risk (Titmand and Wessels, 1988). Warner (1977) suggests that bankruptcy costs would be higher for smaller firms. Research evidences for this variable are also ambiguous (Drobetz and Fix, 2003). For example, Friend and Hasbrouck (1988), Crutchley and Hansen (1989) and Berger et al., (1997) report a positive relationship between firm's size and leverage, whilst Feri and Jones (1979) suggest that firm's size has a significant impact on leverage even though the sectoral decisions have been observed to vary among industries. Rajan and Zingales (1995) argued that larger firms tend to be more diversified and fail less often, so size may be an inverse proxy for the probability of bankruptcy. Large firms are also expected to incur lower costs in issuing debt or equity. Thus, large firms are expected to hold more debt in their capital structure than small firms. The measure of size used in this paper is the natural logarithm of net sales similar to the approach followed by Drobetz and Fix (2003). They discuss the logarithm of total assets as an alternate; however, they accept the net sales as a better proxy for the measure of size.

Titman and Wessles (1988) and Barclay and Smith (1996) find a negative relationship between growth opportunities and the level of either long-term or total debt. Similarly, Rajan and Zingales (1995) also find a negative relationship between growth opportunities and leverage. They suggest that this may be due to firms issuing equity when stock prices are high. As mentioned by Hovakimian et al. (2001), large stock price increases are usually associated with improved growth opportunities, leading to a lower debt ratio. However, Bevan and Danbolt (2001) find a negative relationship between growth and long-term debt, but find total leverage to be positively related to the level of growth opportunities. On the other hand, Bevan and Danbolt (2001) find short-term debt to be positively related to growth opportunities.

Toy et al., (1974), Kester (1986), Titman and Wessels (1988), Harris and Raviv (1991), Bennett and Donnelly (1993), Rajan and Zingales (1995), and Michaeles et al. (1999), Booth et al. (2001), Bevan and Danbolt (2001) all find leverage to be negatively related to the level of profitability (supporting the pecking-order theory). Whilst Jensen et al. (1992) find leverage to be positively related to the level of profitability (supporting the trade-off theory).

Based on above analyzed literature on determinants of capital structure we have taken the following elements as the possible determinants of capital structure:

2.1 Tangibility

The nature of a firm's assets impact capital structure. Tangible assets are less subject to informational asymmetries and usually they have a greater value than intangible assets in the event of bankruptcy. In addition, moral hazard risks are reduced when the firm offers tangible assets as collateral, because this constitutes a positive signal to the creditors. Creditors can sell off these assets in the event of default. Hence, the trade off theory predicts a positive relationship between measures of leverage and the proportion of tangible assets. However, empirical evidences relating to this are mixed. In this study we use ratio of fixed assets to total assets as a proxy to measure tangibility.

2.2 Size

The trade-off theory predicts an inverse relationship between size and the probability of bankruptcy, i.e., a positive relationship between size and leverage. However, the pecking order theory of the capital structure predicts a negative relationship between size and leverage that is larger firm exhibits increasing preference for equity relative to debt. We have used natural logarithm of total assets and natural logarithm of sales interchangeably for measuring the size.

2.3 Growth opportunities

The trade-off theory suggests that firms with more investment opportunities have less leverage because they have stronger incentives to avoid under-investment and asset substitution that can arise from stockholder-bondholder agency conflicts

(Drobetz and Fix 2003). Therefore, this theory predicts a negative relationship between leverage and investment opportunities. In the similar line, Jensen’s (1986) free cash flow theory suggests that firms with more investment opportunities have less need for the disciplining effect of debt payments to control free cash flows. Nevertheless, the pecking order theory supports a positive relationship. According to pecking order theory, debt typically grows when investment exceeds retained earnings and falls when investment is less than retained earnings. The empirical evidence regarding the relationship between leverage and growth opportunities are also mixed suggesting the operation of both theories. We have taken two variables for measuring the growth as growth in total assets and growth in sales [(current year-previous year)/ previous year)] interchangeably to test the robustness of the overall results.

2.4 Profitability

Profitability plays an important role in leverage decisions. In the framework of trade-off theory, agency costs, taxes, and bankruptcy costs push more profitable firms toward higher book leverage. This is due to first, decline in the expected bankruptcy costs when profitability increases and Second, the deductibility of corporate interest payments induces more profitable firms to finance with debt. In a tradeoff theory framework, when firms are profitable, they prefer debt to benefit firm the tax shield. In addition, if past profitability is a good proxy for future profitability, profitable firms can borrow more, as the likelihood of paying back the loans is greater. However, in the agency models of Jensen and Meckhing (1976), Easterbook (1984), and Jesen (1986), higher leverage helps control agency problems by forcing managers to pay out more of the firm's excess cash. However, the pecking-order model predicts a negative relationship between book leverage and profitability. Again, the empirical evidence on the issue is mixed. To test the effect of profitability on leverage, we use return on assets (measured by ratio between Operating Income and Total Assets).

2.5 Nondebt tax shield

Although interest is tax deductable due to default risk, firms may tend to use other tax shields. Tax laws allow certain tax deductions to be made from a company’s taxable income. Depreciation on tangibles and intangibles are also tax deductable. The effective tax rate has been used as a possible determinant of the capital structure choice. According to Modigliani and Miller (1958), if interest payments on debt are tax-deductible, firms with positive taxable income have an incentive to issue more debt. That is, the main incentive for borrowing is to take advantage of interest tax shields. Accordingly, in the framework of the trade-off theory, one hypothesizes a negative relationship between leverage and non-debt tax shields. The study has taken depreciation to total assets as a proxy for measuring nondebt tax shield.

3. Data and Methodology

For the analysis, we have taken 298 firms (from the BSE 500 firms based on the availability of data) during the period 2001-2010, comprising of a panel model. Data of selected variables (discussed below for the 298 firms) was obtained from CMIE (Centre for Monitoring Indian Economy) data base of India. In estimations process, firstly, we introduce estimation technique of quantile regression in brief, and then apply it to our dataset. Standard least squares regression techniques provide summary point estimates that calculate the average effect of the independent variables on the 'average company'. However, this focus on the average company may hide important features of the underlying relationship. As Mosteller and Tukey (1977, pp.266) correctly argued, "What the regression curve does is give a grand summary for the averages of the distributions corresponding to the set of *x*'s. We could go further and compute several regression curves corresponding to the various percentage points of the distributions and thus get a more complete picture of the set. Ordinarily this is not done, and so regression often gives a rather incomplete picture. Just as the mean gives an incomplete picture of a single distribution, so the regression curve gives a correspondingly incomplete picture for a set of distributions". Quantile regression techniques can therefore help us obtain a more complete picture of the underlying relationship between Liquid ratios and its determinants. In our case, estimation of linear models by quantile regression may be preferable to the usual regression methods for a number of reasons. First of all, we know that the standard least-squares assumption of normally distributed errors does not hold for our database because the values for all variables in our case are non-normal and Size (growth of total assets or growth of total sales) LEV(total debt to equity) , NDTS (ratio between Depreciations and Total Assets), PROFIT (ratio between Operating Income and Total Assets), and TANGIT(ratio between Fixed Assets and Total Assets) follow a skewed distribution (see the evidence in Table 1). While the optimal properties of standard regression estimators are not robust to modest departures from normality, quantile regression results are characteristically robust to outliers and heavy tailed distributions. In fact, the quantile regression solution $\hat{\beta}_0$ is invariant to outliers of the dependent variable that tend to $\pm\infty$ (Buchinsky, 1994). Another advantage is that, while conventional regressions focus on the mean, quantile regressions are able to describe the entire conditional distribution of the dependent variable. In the context of this study, all determinants of LEV are of interest in their own right, we don't want to dismiss them as outliers, but on the contrary we believe it would be worthwhile to study them in detail. This can be done by calculating coefficient estimates at various quantiles of the conditional distribution. Finally, a quantile regression approach avoids the restrictive assumption that the error terms are identically distributed at all points of the conditional distribution. Relaxing this assumption allows us to acknowledge company heterogeneity and consider the possibility that estimated slope parameters vary at different quantiles of the conditional distribution of all determents of LEV.

The quantile regression model, first introduced by Koenker and Bassett (1978), can be written as:

$$y_{it} = x_{it}^{'}\beta_0 + \varepsilon_{\theta it} \quad \text{with} \quad Quant_\theta(y_{it} \mid x_{it}) = x_{it}^{'}\beta_0 \quad (1)$$

where *i* denotes company, *t* denotes time, y_{it} is the dependent variable, x_{it} is a vector of regressors, β is the vector of parameters to be estimated, and ε is a vector of residuals. $Quant_\theta(y_{it} \mid x_{it})$ denotes the θ^{th} conditional quantile of y_{it} given x_{it}. The θ^{th} regression quantile $0<\theta<1$, solves the following problem:

$$\min_\beta \frac{1}{n}\left\{ \sum_{i,t:y_{it}\geq x_{it}^{'}\beta} \theta \mid y_{it} - x_{it}^{'}\beta \mid + \sum_{i,t:y_{it}<x_{it}^{'}\beta} (1-\theta) \mid y_{it} - x_{it}^{'}\beta \mid \right\} = \min_\beta \frac{1}{n}\sum_{i=1}^{n} \rho_\theta \varepsilon_{\theta it} \quad (2)$$

where $\rho_\theta(\cdot)$, which is known as the ‘check function', is defined as”:

$$\rho_\theta(\varepsilon_{\theta it}) = \begin{cases} \theta\varepsilon_{\theta it} & if\ \theta\varepsilon_{\theta it} \geq 0 \\ (\theta-1)\varepsilon_{\theta it} & if\ \theta\varepsilon_{\theta it} < 0 \end{cases} \quad (3)$$

Equation (2) is then solved by linear programming methods. As one increases θ continuously from 0 to 1, one traces the entire conditional distribution of y_{it}, conditional on x_{it} (Buchinsky 1998).

Here we assume that LEV is the function of GROWTHSA/GROWTHTA, NDTS, TANGIT, PROFIT, and LNSALES/LNTA, which can be, in linear equation form, written as:

$$LEV_{it} = \alpha + \beta_1 \ln(Sales)_{it} + \beta_2 \Pr ofit_{it} + \beta_3 NDTS_{it} + \beta_4 TNGIT_{it} + \beta_5 GrowthTA_{it} + \varepsilon_{it} \quad (4)$$

and

$$LEV_{it} = \alpha + \beta_1 \ln(TA)_{it} + \beta_2 \Pr ofit_{it} + \beta_3 NDTS_{it} + \beta_4 TNGIT_{it} + \beta_5 GrowthSA_{it} + \varepsilon_{it} \quad (5)$$

However, in this model company and time effects are ignored therefore, by incorporating unobserved company effect in the equation (4) we get following equation:

$$LEV_{it} = \alpha + \beta_1 \ln(Sales)_{it} + \beta_2 \Pr ofit_{it} + \beta_3 NDTS_{it} + \beta_4 TNGIT_{it} + \beta_5 GrowthTA_{it} + u_{it} \quad (6)$$

and

$$LEV_{it} = \alpha + \beta_1 \ln(TA)_{it} + \beta_2 \Pr ofit_{it} + \beta_3 NDTS_{it} + \beta_4 TNGIT_{it} + \beta_5 GrowthSA_{it} + u_{it} \quad (7)$$

where $u_{it} = \mu_i + \varepsilon_{it}$, with μ_i being companies' unobservable individual effects. The difference between a polled OLS regression and a model considering unobservable individual effects lies precisely in μ_i. When we consider the random effect model the equations 6 and 7 will be same however in that case μ_i is presumed to be having the property of zero mean, independent of individual observation error term ε_{it}, has constant variances σ_ε^2, and independent of the explanatory variables.

Further, due to the advantages (as stated above) of quantile regression estimation technique over OLS, fixed and random effect models in the study, we examined at the 5th, 25th, 50th, 75th and 95th quantiles as shown here for first and second specifications respectively:

Model One

$$Q_{.05}(LEV_{it}) = \alpha_{.05} + \beta_{.05,1} \ln(Sales) + \beta_{.05,2} \Pr ofit + \beta_{.05,3} NDTS + \beta_{.05,4} TNGIT + \beta_{.05,5} GrowthTA + \varepsilon_{.5it}$$

$$Q_{.25}(LEV_{it}) = \alpha_{.25} + \beta_{.25,1} \ln(Sales) + \beta_{.25,2} \Pr ofit + \beta_{.25,3} NDTS + \beta_{.25,4} TNGIT + \beta_{.25,5} GrowthTA + \varepsilon_{.5it}$$

$$Q_{.5}(LEV_{it}) = \alpha_{.5} + \beta_{.5,1} \ln(Sales) + \beta_{.5,2} \Pr ofit + \beta_{.5,3} NDTS + \beta_{.5,4} TNGIT + \beta_{.5,5} GrowthTA + \varepsilon_{.5it}$$

$$Q_{.75}(LEV_{it}) = \alpha_{.75} + \beta_{.75,1} \ln(Sales) + \beta_{.75,2} \Pr ofit + \beta_{.75,3} NDTS + \beta_{.75,4} TNGIT + \beta_{.75,5} GrowthTA + \varepsilon_{.5it}$$

$$Q_{.95}(LEV_{it}) = \alpha_{.95} + \beta_{.95,1} \ln(Sales) + \beta_{.95,2} \Pr ofit + \beta_{.95,3} NDTS + \beta_{.95,4} TNGIT + \beta_{.95,5} GrowthTA + \varepsilon_{.5it}$$

Model Two

$$Q_{.05}(LEV_{it}) = \alpha_{.05} + \beta_{.05,1} \ln(TA) + \beta_{.05,2} \Pr ofit + \beta_{.05,3} NDTS + \beta_{.05,4} TNGIT + \beta_{.05,5} GrowthSA + \varepsilon_{.5it}$$

$$Q_{.25}(LEV_{it}) = \alpha_{.25} + \beta_{.25,1} \ln(TA) + \beta_{.25,2} \Pr ofit + \beta_{.25,3} NDTS + \beta_{.25,4} TNGIT + \beta_{.25,5} GrowthSA + \varepsilon_{.5it}$$

$$Q_{.5}(LEV_{it}) = \alpha_{.5} + \beta_{.5,1} \ln(TA) + \beta_{.5,2} \Pr ofit + \beta_{.5,3} NDTS + \beta_{.5,4} TNGIT + \beta_{.5,5} GrowthSA + \varepsilon_{.5it}$$

$$Q_{.75}(LEV_{it}) = \alpha_{.75} + \beta_{.75,1}\ln(TA) + \beta_{.75,2}\Pr ofit + \beta_{.75,3}NDTS + \beta_{.75,4}TNGIT + \beta_{.75,5}GrowthSA + \varepsilon_{.5it}$$

$$Q_{.95}(LEV_{it}) = \alpha_{.95} + \beta_{.95,1}\ln(TA) + \beta_{.95,2}\Pr ofit + \beta_{.95,3}NDTS + \beta_{.95,4}TNGIT + \beta_{.95,5}GrowthSA + \varepsilon_{.5it}$$

We used *sqreg* module of STATA 11 for simultaneous quantile regression estimation and obtain an estimate of the entire variance-covariance of the estimators by bootstrapping with 100 bootstrap replications. Simultaneous quantile regression is a robust regression technique that accounts for the non-normal distribution of error terms and heteroskedasticity (Koenker and Bassett 1978; Koenker and Hallock 2001). Unlike traditional linear models, such as OLS regression, that assume that estimates have a constant effect, simultaneous quantile regression can illustrate if independent variables have non-constant or variable effects across the full distribution of the dependent variable. To examine this, baseline OLS regression models were also executed. See appendix for data source their measurement and name of the companies analyzed in balanced panel.

4. Results of Analysis

We analyzed two models in order to avoid problem of multicollinearity in the estimation. First, we present descriptive statistics of our all variables analyzed in Table 1.

Table 1: Descriptive statistics for variables analyzed

	GROWTHSA	GROWTHTA	LEV	LnSales	LnTA	NDTS	PROFIT	TANGIT
Mean	0.318249	0.299187	0.951473	6.87281	7.11261	0.086266	0.397010	1.143070
Median	0.160440	0.162741	0.550000	6.85053	7.05939	0.025972	0.114999	0.321730
Maximum	81.42857	17.85714	109.4700	12.7069	12.4342	38.24590	183.6557	521.0656
Minimum	-0.811293	-0.741935	-328.170	-1.60944	-2.5257	0.000000	-0.43471	0.00000
Std. Dev.	1.933418	0.842026	7.231952	1.64159	1.64323	1.287751	6.002297	17.50037
Skewness	29.93169	13.29768	-29.4495	-0.02865	-0.2975	24.42389	24.53995	23.94180
Kurtosis	1116.695	235.4595	1466.571	4.69239	5.15886	625.8729	632.7614	599.5233
Jarque-Bera	1.54E+08	6797469	2.66E+08	356.0446	622.662	4846929	4954352	4446816
Probability	0.000000	0.000000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

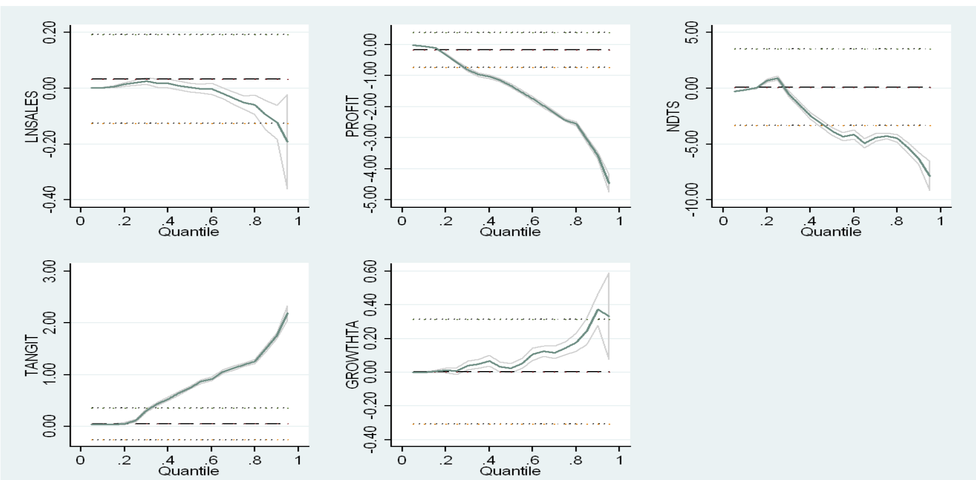
Table 1 shows one measures of tails i.e., the kurtosis among other descriptive statistics. It is well known that whenever this quantity exceeds 3, we say that the data feature excess kurtosis, or that their distribution is leptokurtic, that is, it has heavy tails. It is evident from Table 1 that except for LnSales and LnTA distribution of all variables is leptokurtic. This shows that data is not normal which is also proved with the JB test statistic. JB test statistics shows, in particular, that no variables follow feature of normality. Therefore, estimation technique (like OLS) based linear Gaussian models will be biased hence, use of quantile regression estimation is more appropriate.

Therefore, we applied quantile regression estimation technique and report result of quantiles $\theta \in \{0.05, 0.25, 0.50, 0.75, 0.95\}$ in Table 2 below. However, for comparison purpose we presented results of OLS estimates of fixed and random effect models in Table 1 of appendix.

Table 2: Results of a quantile regression of balanced panel data Model one: LEV

Quintile	0.05	0.25	0.50	0.75	0.95
Intercept	-.0049865 (-1.48)	.0157567 (0.31)	.53984*** (6.82)	1.431045*** (12.01)	3.945647*** (6.05)
LnSales	.0012723** (2.09)	.0208817*** (3.18)	.0036439 (0.33)	-.051426*** (-3.45)	-.19112*** (-2.26)
PROFIT	-.0233478* (-1.77)	-.56322*** (-2.65)	-1.3203*** (-3.68)	-2.425001*** (-5.57)	-4.46305*** (-6.82)
Ndts	-.258195*** (-2.74)	.9230109 (0.70)	-3.833444 (-1.36)	-4.250916 (-1.25)	-7.834883 (-1.49)
TANGIT	.0272698*** (3.47)	.1133776 (0.87)	.747834*** (3.42)	1.19217*** (4.45)	2.19167*** (5.57)
GROWTHTA	.000576 (0.50)	.0069795 (0.25)	.0238283 (0.44)	.142307*** (1.46)	.332952 (1.29)
Model summary					
Pseudo R2	0.0005	0.0112	0.0236	0.0296	0.0287
Notes: 1. ***, **, and *denote significance at 1, 5 and 10 % level of significance respectively.					
Source: Authors' calculation					

Figure 1: Variation in the 'PS, GE, GDP, and FC' coefficient over the conditional quantiles.



Note: Confidence intervals extend to 95% confidence intervals in either direction (for computational manageability, we use the Stata default setting of 20 replications for the bootstrapped standard errors). Horizontal lines represent OLS estimates with 95% confidence intervals. Graphs made using the '*grqreg*' Stata module (Azevedo 2004).

Figure 1 shows the marginal effects of LnSales, PROFIT, NDTS, TANGIT, and GROWTHTA for all quantiles within the (0, 1) range of the Lev. The red line refers to the OLS coefficient and the difference between the OLS and the marginal effects of LnSales, PROFIT, NDTS, TANGIT, and GROWTHTA for all percentage points of the quantiles in the Lev tell us that one cannot just consider the relationship between Lev and LnSales, PROFIT, NDTS, TANGIT, and GROWTHTA in the conditional mean model.

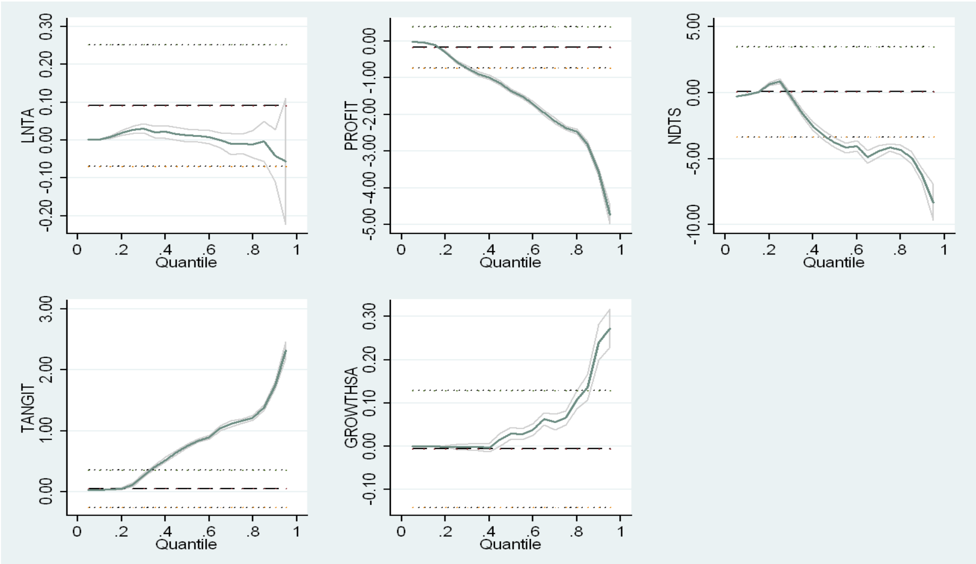
It is evident from Table 2 that for lowest quantile (i.e., 0.05) LnSales and TANGIT are significant with positive sign and NDTS and PROFIT are significant with negative sign. However, in case of 0.25th quantile only LnSales is significant with positive sign and PROFIT is significant with negative sign. For median quantile (i.e., 0.5) PROFIT is found to be significant with negative sign and TANGIT is significant with positive sign. For 0.75th quantile LnSales and PROFIT are significant with negative sign and TANGIT and GROWTHTA are significant with positive sign. For highest quantile (i.e., 0.95) results are similar to the case of 0.75th quantile with exception that now GROWTHTA is insignificant.

Now if we see results of fixed and random effect models we find that Hausman test show that random effect model (that either random effect is assumed in cross-section or time) is appropriate way to carry out analysis and in case of random effect, none of the analyzed variables are significant. However, JB test shows that both effects model are not satisfying assumption of normality. Therefore, quantile results are well suited in our case.

Table 3: Results of a quantile regression of balanced panel data

Quintile	0.05	0.25	0.50	0.75	0.95
Intercept	-.0031655 (-0.81)	-.0212629 (-0.29)	.47623*** (4.13)	1.1642*** (5.50)	3.0815*** (4.82)
LnTA	.000977 (1.54)	.02689*** (3.72)	.012646 (0.93)	-.0103409 (-0.39)	-.0572498 (-0.79)
PROFIT	-.0237203* (-1.80)	-.5721044** (-2.56)	-1.3609*** (-3.23)	-2.36501*** (-4.59)	-4.7260*** (-5.42)
NDTS	-.26942*** (-2.74)	.8867336 (0.66)	-3.768192 (-1.30)	-4.140177 (-1.05)	-8.306115 (-1.30)
TANGIT	.0281757*** (3.36)	.1195229 (0.91)	.757544** (3.14)	1.1619*** (3.47)	2.32049*** (4.13)
GROWTHSA	.000068 (0.09)	-.0012701 (-0.05)	.0303833 (0.72)	.0650303 (0.86)	.272919* (1.69)
Model summary					
Pseudo R2	0.0005	0.0120	0.0234	0.0269	0.0269
Notes: 1. ***, **, and *denote significance at 1, 5 and 10 % level of significance respectively.					
Source: Authors' calculation					

Figure 2: Variation in the 'LNTA, PROFIT, NDTS, TANGIT and GROWTHSA' coefficient over the conditional quantiles.



Note: Confidence intervals extend to 95% confidence intervals in either direction (for computational manageability, we use the Stata default setting of 20 replications for the bootstrapped standard errors). Horizontal lines represent OLS estimates with 95% confidence intervals. Graphs made using the '*grqreg*' Stata module (Azevedo 2004).

Figure 2 shows the marginal effects of LnTA, PROFIT, NDTS, TANGIT, and GROWTHSA for all quantiles within the (0, 1) range of the Lev. The red line refers to the OLS coefficient and the difference between the OLS and the marginal effects of LnTA, PROFIT, NDTS, TANGIT, and GROWTHSA for all percentage points of the quantiles in the Lev tell us that one cannot just consider the relationship between Lev and LnTA, PROFIT, NDTS, TANGIT, and GROWTHSA in the conditional mean model.

It is evident from Table 2 that for lowest quantile (i.e., 0.05) TANGIT is significant with positive sign and NDTS and PROFIT are significant with negative sign. However, in case of 0.25^{th} quantile only LnTA is significant with positive sign and PROFIT is significant with negative sign. For median quantile (i.e., 0.5) PROFIT is found to be significant with negative sign and TANGIT is significant with positive sign. Results of 0.75^{th} quantile are similar to the median quantile. For highest quantile (i.e., 0.95) results are similar to the case of 0.05^{th} and 0.75^{th} quantiles with exception that now GROWTHSA is significant.

Now if we see results of fixed and random effect models we find that Hausman test show that random effect model (that either random effect is assumed in cross-section or time) is appropriate way to carry out analysis in this case also and in case of random effect, none of the analyzed variables is significant. However, JB test shows that both effects model are not satisfying assumption of normality. Therefore, quantile results are well suited in this specification also.

5. Conclusions

The study was intended to identify the determinants of capital structure for Indian firms using a panel framework. For the analysis, we have taken 298 firms (from the BSE 500 firms based on the availability of data) during the period 2001-2010, comprising of a panel model with fixed and random effects. However, most of the variables show skewed distribution and therefore, we relied upon quantile regression analysis as an appropriate tool and quantiles used for our case are $\theta \in \{0.05, 0.25, 0.50, 0.75, 0.95\}$. Further, we tested sensitivity of our model by two independent variables in the regression.

We found that our results are non-sensitive to the changing of the independent variable. Fixed and random effect model are not found to performing well. We found that for lowest quantile (i.e., 0.05) LnSales and TANGIT are significant with positive sign and NDTS and PROFIT are significant with negative sign. That means the companies which are keeping very low (i.e., 0.05 quantile) level of debt is determined by its high sales, high tangible assets, charging high amount of depreciation and having very high profit.

However, in case of 0.25^{th} quantile LnSales and LnTA are significant with positive sign and PROFIT is significant with negative sign. It indicates that the companies which are having low (0.25^{th} quantile) level of debt in the capital structure are determined by high sales and significant growth with high profit. For median quantile (i.e., 0.5) PROFIT is found to be significant with negative sign and TANGIT is significant with positive sign. That means the companies are keeping average (0.05 quantile) debt in its capital structure will be determined by minimum profit and having high amount of tangible assets.

For 0.75^{th} quantile, in model one, LnSales and PROFIT are significant with negative sign and TANGIT and GROWTHTA are significant with positive sign whereas, in model two, results of 0.75^{th} quantile are similar to the median quantile of model two. For the highest quantile (i.e., 0.95), in case of model one, results are similar to the case of 0.75^{th} quantile with exception that now GROWTHTA in model one (and GROWTHSA in model two). The companies are having high and very high (0.75^{th},0.95^{th}quantile) debt in the capital structure is determined by low sales, low profit with large amount of fixed assets and with high growth opportunity.

6. References

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Appendix

Table 1: Regression results of Static Panel data models

Panel data Models: Dependent variable is $LEV_{i,t}$; standard error in parenthesis				
Independent variables	Model 1	Model 2	Model 3	Model 4
	CS-FE	CS-RE	PE-FE	PE-RE
LNSALES	-0.042077*** (-11.38772)	0.028819 (0.328211)	0.025373 (1.163043)	0.040734 (0.496008)
PROFIT	-0.051376*** (-4.036421)	-0.153611 (-0.538969)	-0.874594*** (-5.999362)	-0.175629 (-0.615991)
NDTS	-0.094677 (-1.128483)	0.130818 (0.074664)	-3.384095*** (-4.205330)	0.117403 (0.067205)
TANGIT	0.024383*** (3.767398)	0.042868 (0.268772)	0.547850*** (6.503195)	0.051300 (0.325794)
GROWTHTA	0.006020 (1.342835)	0.003750 (0.023521)	0.055947 (1.591185)	0.004339 (0.027290)
C	1.239550*** (48.89229)	0.752981 (1.201200)	0.773272*** (4.986336)	0.671178 (1.137153)
Model summary				
R^2	0.838375	0.000134	0.023516	0.000212
F-test	45.98020***	0.079952	5.100388***	0.125960
Hausman test		1.831438		4.910874
Fixed effect (F-test)	40.633796***	-----	2.016642**	
JB test	180.96***	2.66e+08***	869060.4***	2.66e+08***
Firms included				
Total observations				
Notes: 1. The Hausman test has χ2 distribution and tests the null hypothesis that unobservable individual effects are not correlated with the explanatory variables, against the null hypothesis of correlation between unobservable individual effects and the explanatory variables. 2. The F test has normal distribution N(0,1) and tests the null hypothesis of insignificance as a whole of the estimated parameters, against the alternative hypothesis of significance as a whole of the estimated parameters. 3. ***, **, and *denote significance at 1, 5 and 10 % level of significance respectively. 4. EF, CS, denotes fixed-effect, cross-section. 5. [----] denotes results are not computed.				
Source: Author's calculation				

Table 2: Regression results of Static Panel data models

Panel data Models: Dependent variable is $LEV_{i,t}$; standard error in parenthesis				
Independent variables	Model 1	Model 2	Model 3	Model 4
	CS-FE	CS-RE	PE-FE	PE-RE
LNTA	-0.000445 (-0.143771)	0.089019 (1.003155)	0.091394*** (3.889502)	0.102507 (1.222531)
PROFIT	-0.065491*** (-4.960149)	-0.157784 (-0.553570)	-0.834539*** (-5.709743)	-0.177435 (-0.622557)
NDTS	-0.036927 (-0.418040)	0.099435 (0.056886)	-3.337456*** (-4.165369)	0.078227 (0.044925)
TANGIT	0.024948*** (3.448773)	0.048222 (0.302878)	0.532829*** (6.339864)	0.056707 (0.361238)
GROWTHSA	0.001668 (0.838899)	-0.003591 (-0.052269)	0.012062 (0.424116)	-0.006628 (-0.096388)
C	0.954778*** (42.97223)	0.318404 (0.488647)	0.307754* (1.793235)	0.223369 (0.361350)
Model summary				
R^2	0.840135	0.000442	0.027503	0.000642
F-test	46.58420***	0.262816	5.989542***	0.382104
Hausman test		1.521947		5.839495
Fixed effect (F-test)	40.647754***	-----	2.533828***	
JB test	199.7253***	2.66e+08***	866378.4***	2.66e+08***
Firms included				
Total observations				

Notes: 1. The Hausman test has χ2 distribution and tests the null hypothesis that unobservable individual effects are not correlated with the explanatory variables, against the null hypothesis of correlation between unobservable individual effects and the explanatory variables. 2. The F test has normal distribution N(0,1) and tests the null hypothesis of insignificance as a whole of the estimated parameters, against the alternative hypothesis of significance as a whole of the estimated parameters. 3. ***, **, and *denote significance at 1, 5 and 10 % level of significance respectively. 4. EF, CS, denotes fixed-effect, cross-section. 5. [----] denotes results are not computed.

Source: Author's calculation