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# A STUDY OF CAPITAL STRUCTURE OF INDIAN POWER GENERATION AND SUPPLY FIRMS: UNBALANCED PANEL DATA

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## *ABSTRACT*

This paper reveals the determinants of capital structure of power generation and supply firms (PGSFs) in India for the period 1993-2004 using unbalanced panel data. We try for several estimation methods of panel data, random effects estimation technique is selected after using specification tests. The results are similar with earlier studies relating to traditional determinants of capital structure like tangibility, profitability, however signs of variables: size, growth opportunities, cost of borrowing, and liquidity in the firm effects and firm and time effects are correct but not significant. Among the macro-economic variables, inflation and bank development are significantly related with leverage of PGSFs. The findings from the unbalanced panel data model reveal presence of major theories of finance in the case of Indian PGSFs. Further study suggests, focus should be on designing pro-bank and stock market finance policies to overcome the problems faced by PGSFs. This study proposes to offer special treatment to individual and institutional taxpayers in tax rebate for increasing investment in the equity and bonds of PGSFs.

**Contribution/ Originality:** This study contributes to existing literature by estimating the determinants of capital structure of power generation and supply firms (PGSFs) in India for the period 1993-2004 using unbalanced panel data

## 1. INTRODUCTION

Banking and stock market development in the country creates favorable investment climate for raising finance easily and at minimum transaction cost. It can also offer better access to firms operating in the developing countries, not only that it help in raising funds at overseas level too. Restructuring process of the economy in general and banking sector particular may create conducive climate for new investment and give push for expanding the existing firms. While expanding firms, capital structure decisions are crucial for the owners of the firms. However, it has several implications on the stake holders of the firms. Hence, a decision of designing capital structure is thoughtful process. With this background, present paper attempts to study the determinants of capital structure of power generation and supply firms in India. It is widely believed that this sector is confronting several difficulties in raising finance from the banks, financial institutions, and capital market of domestic as well as

international market. The present study makes sincere efforts in exploring the issues of power sector development by observing determinants capital structure of Indian power generation and supply firms (PGSFs). Present paper is organized as: Section 1 gives introduction. Section 2 is on data and methodology, section 3 deals with literature review, Section 4 discusses the empirical results appeared from the unbalanced panel data model. Section 5 concludes the paper.

## 2. LITERATURE VISITED

Following the pioneering work of Modigliani and Miller (1958) on capital structure, three conflicting theories of capital structure have been developed namely Static Trade off Theory, Pecking Order Hypothesis, and Agency Cost Theory. Further, it as has been established in the literature that market structure and macroeconomic environment of the economy also influences the capital structure of a firm. The Static Trade-off Theory states that optimal capital structure level is obtained where the net tax advantage of debt will be equal to leverage related costs that arise on account of financial distress and bankruptcy. In this condition, issuing equity means moving away from the optimum level of capital structure; which would be bad news for managers of the firms (Myers, 1984). Pecking order theory proposed by Myers and Majluf (1984) states that firms prefer first internally generated funds, then debt, and finally equity capital. Myers argues that an optimal capital structure is difficult to define as equity appears at top and pecking order at bottom. Agency cost theory states that optimal capital structure level is determined by way of minimum costs that arise from the conflicts between the parties involved. As Jensen and Meckling (1976) argue that agency costs play an important role in taking financing decisions due to the conflict exits between shareholders and debt holders.

Corporate control and product market theorists show that firms engaged in manufacturing of durable goods rely more on debt compared to a firm of non-durable goods manufacturing firm. Oligopoly firms maintain high debt-equity ratio compared to other competitive firms in the same industry (Brander & Lewis, 1986). Studies conducted by Harris and Raviv (1988); Stulz (1988) establish that as size of equity capital increases, voting rights of existing shareholders get diluted hence they oppose for equity capital and ask for more debt capital. Also high rate of inflation may create instability in the economy; in such situation, firms avoid to raise debt from outside.

Gallego and Loayza (2000) find that financial liberalization played vital role in easing the constraint for Chilean firms. Ghosh (2006) examines whether financial liberalization has eased the constraints using panel data for 1000 Indian firms. He observed that financial liberalization has significantly eased the financing constraints. Galindo, Schiantarelli, and Weiss (2003) used data for 12 developing countries. They observe significant impact of liberalization in improving the efficiency of investment. Laeven (2003) using firm level panel data methodology on data of 13 developing countries observes that progress of financial liberalization brought down the financing constraints faced by small firms.

## 3. DATA AND METHODOLOGY

The trends in various sources of finance and determinants of capital structure of power generation and supply firms were analyzed for the period 1993-2004. The firm level data have been collected from Prowess of Center for Monitoring Indian Economy (CMIE) for the period 1993-2004. Prowess is one of data product of CMIE; it contains data on more than 10000 Indian companies starting from the year 1989. Data of CMIE has already been used in the earlier studies on financing patterns and determinants of capital structure by Ganesh-Kumar, Sen, and Vaidya (2002); Mutenheri and Green (2002); Shirai (2004); Mohanty (2000) and Guha-Khasnobis and Kar (2006). All these studies confirm the reliability of CMIE data. Data of CMIE is quite comprehensive and which is updated regularly. We have extracted firm level data from the balance sheet and source-uses statement of the power generation and supply firms for conducting the present study. A study conducted by Mutenheri and Green (2002) also used this type of approach for pursuing study of financing Indian firms. Data on macro variables like GDP of India, bank

development, consumer price index (CPI) and stock market development are taken from the Handbook on Indian Statistics published by Department of Economic Policy Research, Reserve Bank of India (RBI).

Firms whose data were available on all the variables for the period 1993-2004 in the CMIE data base were selected. Data on variables showing extreme values were removed as outlier for smoothing the results. Along with private sector firms, Public sector power generation firms were included in the panel to make the panel appropriate in size. It may be agreed that public sector firms' financing decisions are centralized and are not market driven. However, firms included in the panel are partially privatized and listed on the stock exchanges in India. Therefore, their decisions of financing are partially linked to the market happenings. A firm whose data is available for minimum of four years consistently was included in the panel.

### *3.1. Static Panel Data Model*

We assume a linear relationship between capital structure and its determinants; hence the following static panel data model adopted from the studies (Bhole & Mahakud, 2004; Shuetrim & Lowe, 1993) is specified as follows:

$$\text{Leverage (deq)}_{it} = \alpha + \beta' X_{it} + \rho' W_i + u_{it} \quad \text{Firm Effects Model} \quad (1)$$

$$\text{Leverage (deq)}_{it} = \alpha + \beta' X_{it} + \rho' W_i + \pi' Z_t + u_{it} \quad \text{Firm and Time Effects Model} \quad (2)$$

Where:

Leverage (deq) is dependent variable and subscript $_{it}$ shows firm and year respectively. Leverage is calculated as ratio of total debt to total assets plus equity capital. Both are measured at book value and independent variables shown at the right hand side of the equations are also measured at book value.

$\alpha$, $\beta$, $\rho$, and $\pi$ are vectors of coefficients are constant over time and across the firms.

- $X_{it}$ is a vector of determinants which changes according to firms and time.
- $W_i$ is a vector of determinants that changes only across the firms.
- $Z_t$ is a vector of determinants that vary over time.
- $u_{it}$ is composite residual term consisting of firm-specific components, $\mu_i$, a time specific component, $\lambda_t$, and, $\nu_{it}$ varies over both firms and time.

Hence it can be as:

$$u_{it} = \mu_i + \lambda_t + \nu_{it} \quad (3)$$

Time effect is used along with firm effects to trace the changes that occurred in government policies, regulations and technological factors. These changes make impact on decisions of capital structure of the firms and their performance. To account effects of time on the capital structure of the firms, time dummies are used. Firm dummies are introduced for taking into account an individual character of a firm. A firm level study takes into account individuality of a firm so that it gives better results.

### *3.2. Determinants of Leverage*

On the basis of literature review, this study uses the following variables that determine capital structure of the PGSFs. Variables that vary across the firms and time are ($X_{it}$): Size (SIZ), Tangibility (TAN), Profitability (PRO), Growth opportunities (GRO), Cost of borrowing (COS), Liquidity (LIQ), Non-debt tax shield (NDT), and Age of the firms (AGE). We also used some macro economic variables for analyzing its impact on the capital structure of the power generation and supply firms. These variables are ($Z_t$): Inflation (INF), Banking development (BAN) and Stock market development (STO) and time dummies. To know the individual character of a firm ($W_i$); we used firm dummy that changes according to firm. Considering the above determinants of leverage, present study uses the following static panel data model to understand whether power generation firms faced constraints while raising finance from different sources.

$$\text{Leverage (DEQ)} = \alpha + \beta_1 \text{SIZ} + \beta_2 \text{TAN} + \beta_3 \text{PRO} + \beta_4 \text{GRO} + \beta_5 \text{COS} + \beta_6 \text{LIQ} + \beta_7 \text{AGE} + \beta_8 \text{NDT} + \beta_9 \text{INF} + \beta_{10} \text{BAN} + \beta_{11} \text{STO} + u_{it} \quad (4)$$

Where, DEQ= Leverage or capital structure ratio, SIZ = Size, TAN= Tangibility, PRO= Profitability, GRO = Growth opportunities, COS= Cost of borrowing, LIQ= Liquidity, AGE = Age of the firms, NDT= Non-debt tax shield, INF= Inflation, BAN= banking development and STO= stock market development, $\alpha$ = Intercept term and $u_{it}$= error term and it is expected that:

$$\beta_1 >0, \beta_2 >0, \beta_3 <0, \beta_4>0, \beta_5 <0, \beta_6>0 \text{ or } \beta_6 <0, \beta_7 <0, \beta_8<0 , \beta_9 <0, \beta_{10} >0 \text{ or } \beta_{10}<0, \beta_{11}<0 \quad (5)$$

$\beta_1 >0, \beta_2 >0, \beta_3<0$….. Sign > (greater than) and sign < (smaller than) shows that the value of coefficients may be greater than or less than zero. It also signifies the relationship between independent and dependant variables in the form of either negatively or positively correlated. The dependant variable leverage (Debt-equity ratio) shown in the Equation 4 and its independent variables such as Size of the firm, growth opportunities of the firm, Tangibility, Profit, Cost, Liquidity, Non Debt Tax shield and Macro Economic factors such as Inflation rate, Bank development, and Stock market development may have either positive or negative relation. Linear relationship shown in the Equation 4 explains the determinants of capital structure of power generation and supply firms in India; and it gives an idea about how was the capital structure made by power generation and supply firms for the study period.

### *3.3. Definition of Variables*

In order to find out the probable determinant of leverage or capital structure of the power generation and supply firms in Indian conditions, we propose an accurate dependent variable i.e. financial leverage, which is the ratio of total debt to the sum of total assets and shareholder's equity. This type of definition of leverage is used in the earlier studies conducted by Ranjan and Ziangles (1995). With reference to earlier studies on capital structure and its determinants, present study proposes the following independent or explanatory variables. All these independent variables make an impact on the capital structure decisions of the power generation and supply firms.

**1. Size (SIZ):** Studies pertaining to capital structures by Chung (1993) used size of the firms as one of the determinants, and they find that bankruptcy cost shrinks as value of firm or size increases, generally, large size and diversified firms have easy access to capital market and their fund managers can negotiate effectively with the funds suppliers for securing debt at lower rate of interest. As the size of firm increases, reputation and goodwill are built over a period of time. This increases the chance of securing more debt at easier terms for the firms. With this background, studies conducted by Firth (2006) predict positive relationship between leverage and size. Corresponding to earlier studies, we anticipate the same relationship in the present study. We calculate size of firm by taking natural log of the total assets.

**2. Tangibility (TAN):** There are mixed opinions about the relationship between proportion of fixed assets in the total assets (tangibility) and leverage of the companies. As volume of fixed asset increases, the valve of collateral would increase, that makes easy and less risky for the fund suppliers while financing to such firms because it bring down the risks involved in funding. Studies undertaken by Jensen and Meckling (1976);Thies and Klock (1992); Ranjan and Ziangles (1995) and Mutenheri and Green (2002) support the positive relationship between tangibility and leverage. However, studies of Nivorozhkin (2002) claims negative relationship in Indian condition. Recent study by Bhole and Mahakud (2004) also supports a positive relationship between leverage and tangibility. We have calculated this variable as the ratio of net fixed assets to total assets.

**3. Profitability (PRO**): It is an indicator of soundness of the firms. In the earlier studies conducted on capital structure established negative relationship between leverage and profitability. Among those theories, Myers (1984) and Myers (1984) advocate pecking under hypothesis in which they generalize chronology of preference for selecting finance options as retained earnings first. It followed by debt, and at last, equity capital. Profitable firms never rely more on external finance because debt brings down financial strength of the firms. Tax based models suggest that profitable firms should borrow more due to a provision of interest deductibility while arriving at net income. Studies conducted by Bhole and Mahakud (2004) confirms the negative relationship between leverage and

profitability. However, a study conducted by Schmukler and Vesperoni (2001) use firm level data of East Asian and Latin American firms for panel data analysis. Study made by Mohanty (2000) on Indian firms rejected the negative relationship between leverage and profitability. We have measured profitability variable as ratio of profit before interest and taxes and depreciation (PBIID) to total assets.

**4. Growth opportunity (GRO):** The studies made by Bhole and Mahakud (2004) used variable growth of firm as one of the determinant of capital structure. They find that more the growth opportunities more would be the requirement of debt. Empirical studies of Ranjan and Ziangles (1995) and Wald (1999) support theoretical prediction. Power generation and supply firms have bright prospect to grow in near future in India and also in other developing countries. Hence, we include this variable for finding out the possible relationship between growth opportunity and leverage. Growth opportunity variable is a proxy variable that represents growth in sales and it is percentage change in sales over the sales of the preceding year.

**5. Cost of Borrowing (COS):** A borrowing cost owing to external debt has an implication on capital structure of the companies. The expected relationship between cost of borrowing and leverage would be negative. Interest paid on debt is treated as expenditure hence it brings down tax liability of the firms is proved by several studies. In this regard, Myers and Majluf (1984) and Bhole and Mahakud (2004) establish the hypothetical relationship. With their theoretical and empirical findings, we introduce this variable to explore the impact of cost of borrowing on leverage of PGSFs. It is total interest payment made as percentage of total borrowing of the firm.

**6. Liquidity (LIQ):** Liquidity ratio is used to confirm paying capacity of the firms or to judge the potential of firms in meeting the short term liabilities. Firm that meets obligations satisfactorily is known as efficient firm. In the capital structure decisions, liquidity ratio plays an important role while shaping the design of capital structure; high liquidity ratio firms can meet debt liability easily. In that case, leverage and liquidity will be positively correlated. On the contrary, firm having more liquid assets may prefer to use its liquid assets for financing; in such circumstances leverage would be negatively related with liquidity. In the present study we calculate liquidity as the ratio of current assets to current liability.

**7. Age (AGE):** Aged firms remain in operations for a long period Hence age is considered as factor for raising finance from the managers of the financial institutions. Higher the age more would be the total assets and size. It is found that age increases the reputation and goodwill of a firm. It reduces the risk involved in advancing fund for the creditors and gives incentives to the borrowers. Age-old firm replaces debt as result of profit earned over a period (Diamond, 1989) Study conducted by Guha-Khasnobis and Kar (2006) empirically establishes the negative relationship between age of firm and leverage. This variable is calculated as age of the firm is difference between current year (2004) in the present study and year of incorporation of a firm.

**8. Non-Debt Tax Shield (NDT):** Capital structure of a firm is also influenced by debt taxes such as depreciation, investment tax credit etc. A study conducted by (DeAngelo & Masulis, 1980) note the positive impact of non- debt tax shield (NDT) on the capital structure of the firms. Empirical studies conducted in this respect not reached to conclusive results. More the tax shield less would be the use of debt and vice versa. The possible relationship between leverage and non-debt tax shield will be negative on account of more cash flows from tax shield. Tax saving capacity of a firm brings down the reliance on debt. This variable is Non-debt tax shield (NDT) = profit after tax -depreciation / total assets.

**9. Banking Development (BAN):** It has been argued in several studies that firms in the developing countries rely more on external finance. The reliance of the firms on bank finance is empirically proved in the studies made by Mutenheri and Green (2002); Agarwal and Mohtadi (2004) and Saggar (2005). Banking penetration increases availability of funds and velocity of credit money. Banking development is underway in India since 1950. In 1991, comprehensive banking reforms were introduced to make banking industry more competitive and profitable. With this backdrop, it is essential to observe the impact of banking development on capital structure decisions of the PGSFs. This variable is ratio of M2 (coins in circulation+ all types of deposits of the commercial banks in the

country + non-institutional market funds) to gross domestic product (GDP) as a proxy for banking development in India.

**10. Stock Market Development (STO):** Earlier studies investigated the impact of stock market development on financing pattern of the firms. Studies conducted by Demirguc and Maksimovic (1996) found negative relationship between stock market development and leverage. However, since 1991 stock market reforms are underway for promoting the equity culture and overall stock market development in India. We introduce this variable as proxy for stock market development to understand its likely impact on the capital structure of PGSFs. It is computed as ratio of stock market capitalization to gross domestic product (GDP). We expect negative or positive relationship between stock market development and leverage.

**11. Inflation (INF):** Inflation is a macroeconomic variable that shows the level of macroeconomic stability present in the economy. Though it is external to the firms but it makes difference with the project cost of a new firm and financing cost of the existing firms. Mutenheri and Green (2002) used this variable for knowing its impact on Zimbabwean firms' leverage. We propose this variable in the present study to trace the impact of inflation on the capital structure of PGSFs. The possible outcome would be the negative or positive relationship between inflation and leverage. This variable is percentage change in consumer price index (CPI) over the last years' CPI.

### *3.4. Unbalanced Panel Data Analysis*

In this panel, we estimate a static panel data model to explore the determinants of leverage using unbalanced panel consisting of 26 firms for the period 1993-2004. Data used in this panel is drawn from Prowess; a data product of CMIE, Mumbai. In this panel, total 231 observations remained for estimation after removing the outliers and firms that have merged during the study period.

**Table-1.** Descriptive statistics of variables used in unbalanced panel.

| Variables | Observations | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| DEQ | 231 | 1.3896 | 1.4533 | 0.0173 | 8.2293 |
| SIZ | 230 | 6.9035 | 2.2773 | 1.3838 | 11.0968 |
| TAN | 230 | 0.6371 | 0.1753 | 0.1003 | 0.9669 |
| PRO | 230 | 0.1166 | 0.0743 | -0.2966 | 0.2849 |
| COS | 222 | 9.1298 | 6.4369 | 0.0000 | 35.8165 |
| LIQ | 231 | 4.2632 | 8.0904 | 0.0098 | 94.6667 |
| NDT | 227 | 0.0327 | 0.0558 | -0.3016 | 0.2417 |
| EAR | 217 | 4.4122 | 2.3336 | -3.9120 | 8.9004 |
| AGE | 231 | 31.5195 | 29.1079 | 1.0000 | 91.0000 |
| INF | 231 | 6.6970 | 3.2233 | 3.3800 | 13.1100 |
| BAN | 231 | 0.1866 | 0.0100 | 0.1722 | 0.2115 |
| STO | 231 | 0.0710 | 0.0301 | 0.0400 | 0.1474 |

**Source:** Prowess a data product of CMIE, Mumbai.

Data points on few firms and for a few years were missing hence the present study sample becomes unbalanced panel. The following points justify the use of unbalanced data panel model in the present study:

1. Power generation business was the monopoly of state and central governments until the year 1992 except a few licensed firms in the country.

The power sector reforms, 1992 opened up this sector for private sector investment in the areas of power generation and distribution. The number of business houses and NRI entered into this sector considering lucrative opportunity of business. As a result, the number of power generation firms increased after each subsequent year during the study period.

**Table-2.** Correlation matrix of variables used in unbalanced panel.

| Variables | SIZ | TAN | PRO | COS | LIQ | AGE | GRO | NDT | EAR | INF | BAN | STO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZ | 1 | | | | | | | | | | | |
| TAN | 0.3511* | 1 | | | | | | | | | | |
| PRO | 0.0576 | -0.0436 | 1 | | | | | | | | | |
| COS | -0.2906* | -0.0663 | 0.3324* | 1 | | | | | | | | |
| LIQ | -0.2233* | -0.0953 | 0.0481 | 0.0462 | 1 | | | | | | | |
| AGE | 0.1304* | -0.4085* | 0.1638* | 0.0636 | -0.2002* | 1 | | | | | | |
| GRO | 0.0274 | 0.1111 | -0.02 | -0.0047 | -0.028 | -0.0626 | 1 | | | | | |
| NDT | 0.1530* | -0.023 | 0.8209* | 0.0182 | 0.0778 | 0.1183 | -0.0338 | 1 | | | | |
| EAR | 0.9219* | 0.1977* | 0.1899* | -0.1626* | -0.1544* | 0.1717* | 0.0216 | 0.1930* | 1 | | | |
| INF | 0.0051 | 0.1278 | -0.032 | -0.0371 | -0.084 | 0.052 | 0.0054 | 0.0924 | -0.048 | 1 | | |
| BAN | 0.0639 | -0.1628* | 0.071 | 0.0439 | 0.1711* | 0.008 | -0.0488 | 0.0013 | 0.101 | -0.3922 | 1 | |
| STO | 0.028 | 0.1750* | -0.024 | 0.029 | -0.104 | 0.0971 | 0.0041 | 0.1301 | -0.063 | 0..5960* | -0.4701* | 1 |

**Note:** sign * represents significant at 5% level.

In unbalanced panel, we use several traditional variables as explanatory variables such as size, tangibility, profitability, cost, liquidity, and age for which maximum observations were available in the panel data set. Further, we add macroeconomic variables such as inflation, banking development and stock market development. We could not use variables GRO (growth opportunities) NDT (Non-debt tax shield), and EAR (earning potential) because of the data points on these variables were insufficient, few variables were showing high value of coefficient of correlation and some of them were exhibiting extreme values thus all those variables were removed before estimating a model.

### *3.5. Descriptive Statistics and Correlation Matrix of Unbalanced Panel*

We estimate descriptive statistics and correlation matrix for all explanatory variables is given here. The results of descriptive statistics and correlation matrix are shown in the Table 1 and Table 2 respectively. If correlation coefficient value between any two variables is observed above 0.5 %, all those variables are not included for estimating the regression. Thereby we avoid multicollinearity problem of model estimation. We calculate Variance-Inflation Factor (VIF) for each variable entering into regression and their values observed less than 2 (Zou & Xiao, 2006). This implies that multicollinearity is not a problem in the present study.

### *3.6. Specification Tests for Unbalanced Panel Data*

The specification tests conducted for the unbalanced panel data-set are reported in the Table 3 Lagrange multiplier test (LM) is used to examine relative efficiency of random effects against the OLS method. The results of Chi-square ($X^2$) statistics are significant at 0.01% and 0.03% levels for fixed effects firm and random effects firm and time respectively.

**Table-3.** Results of specification tests for unbalanced panel.

| Tests | Period | Hypothesis | Test results | Decisions |
|---|---|---|---|---|
| Incremental F test | 1993-2004 | OLS vs. Fixed effects firm $H_0^1$; $\sigma\mu^2=0$ | 14.72 [ 26,186] | Rejected |
| Incremental F test | 1993-2004 | OLS vs. Fixed effects firm & time $H_0^2$; $\sigma\mu^2=0$ | 11.17 [36,175 ] | Rejected |
| Lagrange multiplier test | 1993-2004 | OLS vs. Random effects firm | $Chi^2(1)$ (10.80) Prob >1(0.01) | Random effects preferred |
| Lagrange multiplier test | 1993-2004 | OLS vs. Random effects firm & time | $Chi^2(1)$ (10.77) Prob>1(0.03) | Random effects preferred |
| Hausman specification | 1993-2004 | Fixed vs. Random effects firm | $Chi^2(10)$ (19.02) Prob>Chi2(0.04) | Fixed effects efficient |
| Hausman specification | 1993-2004 | Fixed vs. Random effects firm & time | $Chi^2(1)$ (10.77) Porb>Chi $^2$(0.34) | Random effects efficient |

**Note:** Prob. means probability.

We also use incremental F test to know the presence firm and firm and time effects. F Test confirms the presence of both the effects. For better understanding of the panel data models results and check the equivalence of three estimating methods (OLS, LSDV and Random effects) is checked. Ultimately, estimate the multivariate regression with two effects covering firm and firm and time effects. In the present unbalanced panel data model (LSDV and Random effects model), we add three macroeconomic variables i.e., age (AGE), inflation (INF), banking development (BAN) and stock market development (STO) with traditional variables in the unbalanced panel in line with the earlier theoretical and empirical studies conducted on firm financing in the different countries. This may

possible us to understand their impacts on leverage of the PGSFs and to examine the constraints, if any faced by these firms in raising finance from the various sources of finance.

The impact of liberalization and financial deregulations on the decisions of leverage of the power generation firms can be assessed with some macro economic variables: inflation (INF), banking development (BAN) and stock market development (STO). These variables were used in the earlier empirical studies by Demirguc-Kunt and Levine (1999); Mutenheri and Green (2002) for knowing its influence on capital structure of the non-financial firms in the different countries. The first variable (Inflation) captures the cost aspect of debt, macroeconomic stability and last two variables assess the financial liberalizations process in India. These three variables are calculated by assuming 1993 as a base year. The common understating about the financial development is that more the developments; more would be the use of debt and equity capital. Financial development also represents by the volume of bank deposit mobilize by the commercial banks in India.

### *3.7. Empirical Results from the Unbalanced Panel Data Model*

The results obtained after running unbalanced panel data model using LSDV, fixed effects and random effects methods are presented in the Table 4. We estimate firm effects and firm and time effects with (Least Square Dummy variable) LSDV method and random effects respectively on the basis of model selection hypotheses tests. For the unbalanced panel dataset in the present case, fixed effects method is appropriate for firm effects, whereas for the random effects model, both firm and time effects are found suitable. This has been decided by acceptance or the rejection of the null hypothesis using *Hausman Specification Test.* In the Table 4 column I to IV and V to VII are reporting of the variables to be estimated, coefficient values, std. errors, significance values, model F test, Adjusted $R^2$, and total observations used are reported.

**Table-4.** Results of static unbalanced panel data model.

| Variables | Fixed Effects: Firms | | | Random Effects: Firms and Time | | |
|---|---|---|---|---|---|---|
| I | II | III | IV | V | VI | VII |
| DEQ | Coef. | Std. Err. | t | Coef. | Std. Err. | z |
| SIZ | 0.144 | 0.176 | 0.82 | 0.136 | 0.176 | 0.77 |
| TAN | 2.097 | 0.731 | 2.87* | 2.095 | 0.743 | 2.82* |
| PRO | -3.225 | 0.896 | -3.60* | -3.037 | 0.930 | -3.27* |
| COS | -0.005 | 0.009 | -0.59 | -0.011 | 0.011 | -1.05 |
| LIQ | 0.004 | 0.008 | 0.55 | 0.003 | 0.008 | 0.38 |
| AGE | 0.064 | 0.080 | 0.80 | 0.035 | 0.033 | 1.06 |
| INF | -0.016 | 0.023 | -0.70 | 0.068 | 0.036 | 1.89** |
| BAN | -20.444 | 7.432 | -2.75* | | | |
| STO | 6.772 | 6.987 | 0.97 | | | |
| Constant | 1.058 | 2.277 | 0.46 | -2.734 | 2.232 | -1.23 |
| Observations | 221 | | | 221 | | |
| Adjusted $R^2$ | 0.7611 | | | 0.8027 | | |
| F- Statistics | (34,186)= 21.61; Prob.> F (0.000) | | | Wald $Chi^2$ (41)= 728.14; Prob>$chi^2$(0.000) | | |

**Note:** 1. DEQ – Dependant variable. 2. Sign * and ** show the 1% and 5% significance value. Coef. means coefficient.

For both the effects, the F- statistics and Wald $Chi^2$ show that models are correctly specified, the adjusted $R^2$ is quite high. The results drawn by LSDV model (fixed effects: firms), Columns V, VI and VII show the results appeared using Random effects estimation method with firm and time effects. The results appeared from both the effects in the present study are consistent with earlier studies conducted by scholars and to our expectations. The estimated coefficients of tangibility (TAN), profitability (PRO), banking development (BAN) and inflation (INF) are significant at 1 % and 5 % level respectively with the fixed effects firm and random effects firms and time. However, the sign of other variables such as size (SIZ), cost (COS), liquidity (LIQ), age (AGE) and stock market development

(STO) are correct and none of them is significant in determining the leverage of power generation firms in India. The positive and significant relationship of leverage with size and tangibility empirically established by Myers (1977); Jensen and Meckling (1976); Firth (2006). In the present study, we find that power generation firms hold more collateral as shown by tangibility (TAN) and leverage (DEQ) relationship hence these firms can raise finance easily. This finding proves that firms with high quality collateral can obtain debt at lower premium because the collateral gives security and minimize risks weight involved in advancing funds for the financial institutions.

The agency costs and financial distress costs of the external fund are generally high but it can be minimized by holding more collateral assets by firm. Since these firms are in infrastructure business, naturally these firms hold assets in big size, therefore, the relationship of leverage of PGSFs with the variables size and tangibility appears to be positive. The findings obtain on tangibility and its relationship with leverage in the present study is in line with earlier studies pursued by Jensen and Meckling (1976); Bhole and Mahakud (2004).

The sign of coefficients for the variables; size and tangibility supports the Static Trade-Off Model in the present study. However, the results which appear on the coefficient of profitability are negative at 1 % level of significance in both the effects. It advocates Pecking Order Hypothesis and predicts that power generation firms prefer internal finance first over the other sources of finance. The negative relationship between profit and leverage predicts that power generation firms do not entirely depend upon debt from outside or the other meaning of this relationship can be concluded as profit generated by them is used for self-financing. Our finding on profitability is consistent with studies conducted by Titman and Wessels (1988); Jensen and Meckling (1976); Bhole and Mahakud (2004).

The coefficient value of cost of borrowing (COS) shows negative relationship with leverage but it is not significant in both the effects. This shows that power generation firms follow cost conscious approach while they raise loans from the external sources. The coefficient on liquidity is positive but it is not significant determinant of leverage in the present case. In this regard, we presume that if the firms hold more short term assets over current liabilities, in such a situation firms do not raise debt or remain reluctant to raise external finance. Age of a firm is also considered as one of determinant of leverage of the firm. More the age of the firm, more would be the size of assets and goodwill. As a result, the firm may persuade creditors in securing more debt at reasonable cost of borrowing. Therefore, age and debt of the firms find positively related but not significant in the present findings.

The role of macroeconomic factors in determining the capital structure of the firms are captured in the unbalanced panel by using variables like inflation, banking development and stock market development in India especially after the introduction of economic reform and power sector reforms. The coefficient value of inflation is negative in the firm effects but not significant. However, it is positive and significant in the random effects with firm and time at 5% significance level. This relationship establishes that power generation firms respond positively during the reform era with the falling of rate of inflation from its peak 13% to minimum 3%. This fall has given confidence to the firms for raising more funds. We also expect this type of relationship because the falling rate of inflation brings stability in the economy and minimize the costs of borrowing. The finding appears between the inflation and leverage in the present study is consistent with the earlier study made by Mutenheri and Green (2002).

Banking development in India is represented by ratio of commercial bank deposit to gross domestic product (GDP). More the value of ratio; more would be the development of banking in the country. As a result, corporate firms find it easy while raising funds from the bank if the banking development is adequate. The coefficient value of banking development is negative and significant in the firm effects. This can be interpreted as power generation firms may not be raising short term finance from the banks. On the other hand, banks might be reluctant to provide finance to these firms on account of uncertainty in the cash flow of PGSFs. The sign of coefficient of liquidity and banking development are mutually explanatory. More the liquid funds with a firm less would be the reliance on banks for short term credit. The earlier studies on Indian firm financing made by Saggar (2005) and Samuel (1996)

find that banks play dominant role in financing corporate firms. However, findings of these studies drawn about the bank finance and leverage relationship does not suit to PGSFs firms because leverage and banking development relationship is negatively related in the present study.

The Stock market development is represented by the ratio of stock market capitalization to the gross domestic product (GDP) of India in the present study. Country in which stock market development is quite satisfactory, firms of that county prefer more finance from the capital market in the form of equity and debt. In the present study, coefficient value of STO (stock market development) is positive but not significant in the fixed firm effects. It means power generation firms do raise the equity finance from the capital market but not significantly. The other side of this meaning can be concluded as power generation firms may not find it easy in raising the finance by equity issue in Indian condition. As stated earlier, the cash flow of PGSFs is uncertain. In the random firm and time effects, the macro economic variables such as banking development and stock market development have been dropped due the multicollinearity problems except the variable inflation.

Results appeared from the fixed effects firms and random effects firms and time methods of unbalanced panel can be summarized as; the power generation firms do not prefer debt from outside as shown by the negative relationship between profitability with leverage. The Information Asymmetry Theory predicts negative relationship of profit and tangibility with leverage of the firms. We also find the same kind of significant relation of leverage with profit and tangibility at 1 % level of significance. We therefore, conclude that results on these two variables are consistent with prediction of Information Asymmetry Theory. The sign of other traditional variables are appropriate but they are not significant. Banking development and leverage relationship is negative and significant in the fixed effects which predict that power generation firms are either poorly financed by the banks or PGSFs must have not raised finance from them. The positive relationship between inflation and leverage is and significant which predict that economic stability increases the confidence of firms as well as reduces the cost of funds.

The findings from the unbalanced panel indicate that Pecking order hypothesis is present in the case of power generation and supply firms. The findings of the variables: Size, Tangibility, Profitability, Banking development, and Inflation are consistent with the studies conducted earlier by Titman and Wessels (1988); Ranjan and Ziangles (1995); Shuetrim and Lowe (1993) on the firms of developed countries and the findings of Pandey (2001); Um (2001); Guha-Khasnobis and Kar (2006); Mutenheri and Green (2002); Huang and Song (2002); Zou and Xiao (2006); Bhole and Mahakud (2004) on the firms from the developing countries.

## 4. CONCLUSIONS

The findings of this study contributes towards a better understanding of the determinants of capital structure of the power generation and supply firms along with the applicability of the theories of corporate finance to PGSFs. This exercise also helps in identifying the constraints faced by these firms in raising finance from different sources of finance. On the basis of results, this study concludes that these firms used both types (internal and external) of funds. However, these firms face constraints while raising the finance from banks and capital markets are shown by the coefficient value and sign of BAN and STO in the firm effects of unbalanced panel data model. These findings confirm that banks and financial institutions are hesitant while giving finance to PGSFs.

The coefficient values of variables such as size, tangibility supports The Static Trade off Theory and results on profitability and liquidity show the applicability of Pecking Order Theory. The results obtained on Cost of borrowing and Liquidity support the presence of Agency Cost Theory. The results of macroeconomic variables such as inflation; banking development and stock market capitalization suggest that these firms face constraints while raising finance from banks and stock market. The findings from the unbalanced panel data model in present study suggests that focus should be on designing pro-bank and stock market finance policies to overcome the problems faced by PGSFs. This study proposes that there is a need to offer special treatment to individual and institutional

taxpayers in tax rebate for increasing investment in the equity and bonds of power generation and supply firms. The results on the determinants of capital structure of power generation and supply firms are consistent with the earlier studies conducted by Indian and international researchers on financing of corporate firms.

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