CHAPTER – 4

M E T H O D O L O G Y

This chapter is divided into sections. Section one explains the empirical model of the SOA. The variables used in the study are explained in section two. Section three briefs on the various standard tests that were conducted on the data. Section four presents the model specification for the respective objectives and hypotheses of the study.

4.1. Empirical Model

We use the partial adjustment model proposed by Flannery and Rangan (2006) to examine our speed of adjustment hypotheses. We briefly describe the model.

The partial adjustment model for capital structure is based on premise that firms strive towards their target capital structure partially[1]. The partial nature of the adjustment is supported by the argument of market imperfections and adjustment costs. This requires us to calculate the target capital structure. In the partial adjustment model, this target leverage is estimated by regressing leverage on the standard determinants of capital structure. Then we use the estimated coefficients for estimating the target leverage. This estimated target leverage will then be used to estimate the SOA. The process is explained below.

[1] In the presence of adjustment costs, the firms will not be able to meet the target capital structure every year. Rather it will attempt to bridge the gap as much as the market situation allows. This adjustment is known as partial adjustment.

The partial adjustment model:

Target debt ratio,

$$\boldsymbol{Lev^{*}_{i,t+1} = \beta X_{i,t}} \quad \textbf{(3)}$$

Where, $Lev^{*}_{i,t+1}$ is firm *i*'s desired debt ratio at time *t+1*, $X_{i,t}$ is a vector of firm characteristics, β is coefficient vector

Using firm characteristics of the firm, the present market debt ratio is calculated as follows.

$$\boldsymbol{Lev_{i,t} = \frac{D_{i,t}}{D_{i,t}+S_{i,t}P_{i,t}}} \quad \textbf{(4)}$$

Where, $D_{i,t}$ is the book value of debt of the firm *i* and time *t*, $S_{i,t}$ is the number of common shares outstanding, $P_{i,t}$ is the price of the firm's share at time *t*.

In a frictionless world, the firms would be able to maintain their capital structures to the optimal or the target capital structure. In the real world phenomenon, firms have to deal with adjustment costs, which prevent them from adjusting immediately to the firm's target capital structure. This partial adjustment to the target capital structure can be captured by λ in the following equation

$$\boldsymbol{Lev_{i,t+1} - Lev_{i,t} = \lambda\left(Lev^{*}_{i,t+1} - Lev_{i,t}\right) + \delta_{i,t+1}} \quad \textbf{(5)}$$

On further simplification we arrive at the following equation[2]

$$\boldsymbol{Lev_{i,t+1} = \lambda\beta X_{i,t} + (1-\lambda)Lev_{i,t} + \delta_{i,t+1}} \quad \textbf{(6)}$$

[2]Each year the firm covers a gap of λ between the actual and the target capital structure

Substituting (5) into (6)

$$Lev_{i,t+1} - Lev_{i,t} = \lambda\left(\beta X_{i,t} - Lev_{i,t}\right) + \delta_{i,t+1}$$

$$Lev_{i,t+1} = Lev_{i,t} + \lambda\left(\beta X_{i,t} - Lev_{i,t}\right) + \delta_{i,t+1}$$

$$Lev_{i,t+1} = Lev_{i,t} + \lambda\beta X_{i,t} - \lambda\, Lev_{i,t} + \delta_{i,t+1}$$

λ is the Speed of Adjustment, $\mathbf{X_{i,t}}$ is the firm specific variables. By following Rajan and Zingales (1995) we include firm size, performance, growth, tangibility and intangibility and Flannery and Rangan (2006) Industry median leverage as variables in our model. The value of $(1-\lambda)$ is expected to stay between zero to one, zero indicating that the firm has made no adjustment and one indicating that the firm has completely adjusted the capital structure to that of the target or optimal capital structure.

We propose to use, following Flannery and Rangan (2006), Generalized Method of Moments (GMM) procedure to estimate the coefficients. We will test our data for various assumptions of regression analysis using the standard tests.

4.2. Measures of Leverage:

Different measures of leverage have been suggested in the literature, most relevant measure depends upon the objective of the study (Rajan and Zingales, 1995). There are two important issues that a researcher faces with regard to measurement of leverage first, which leverage ratio to use - book leverage or market leverage and second, how to calculate the ratio.

In our study, we use market leverage to study objective 1 and since the other objectives are to study both listed and unlisted firms, we use book leverage. Market leverage is the ratio of the book value of total debt to the sum of the market value of equity and book value of debt. We compute book leverage as the ratio of the book value of debt to book value of equity and debt.

4.3. Determinants of leverage:

There are five important firm specific variables, different combinations of which have been used in most of the prior studies as determinants of target capital structure (Banerjee et al, 2000; Hovakimian et al, 2001; Fama and French, 2002; Frank and Goyal, 2003; Korajczyk and Levy,

2003; Loof, 2004; Flannery and Rangan, 2006; Drobetz and Wanzenried, 2006; Byoun, 2008; Lemmon et al, 2008;Qian et al, 2009; Cook and Tang, 2010; Faulkender et al, 2012; Getzmann et al, 2014). These are size, profitability, tangibility, Research and development expenditure, Non-debt tax shield (NDTS) and growth opportunities.

In our study, we use all of these six variables along with the industry median leverage ratio (MED) to capture the industry specific characteristics which are not captured by the other variables (Byoun, 2008; Cook and Tang, 2010; Faulkender et al. 2012).

4.4. Variables and Impact on Leverage: (Refer Table – 1)

Size: The size of a firm affects the bankruptcy risk of the firm. Larger the firm, lesser is the bankruptcy risk of the firm and hence the firm would have a higher leverage. Also, smaller companies have higher asymmetry of information and would have less access to credit facilities, thereby effecting the leverage of the firm. We use the sales of the firm as a proxy for size as used in Rajan and Zingales (1995). We compute the size of the firm as the log of sales.

Profitability: It is a proxy for performance of the firm. Higher the performance of the company, the higher is the free cash available to the firm. This higher free cash would help firms in buying more assets or retire some debt from the capital. We use Return on Assets as the proxy for profitability and we compute it as the ratio as profit before interest and taxes to total assets of the firm.

Tangibility: higher the amount of tangible assets a firm owns, the lower is the bankruptcy risk of the firm. This leads to firm using more debt. Further, tangible assets can be used as collateral for

term loans leading to higher leverage. We compute tangibility as the ratio of net fixed assets to total assets.

Intangible assets: Intangible assets proxies' innovation and modernization of the firm. Higher intangible assets indicate better quality products and services in tune to the requirement of the customers. This would lead to higher profitability of the firms. Further, certain intangible assets like patents and trademarks can be used as collateral for a loan. These reasons increases the debt, taking capacity of the firm. We compute intangibility as the ratio of Research and Development expenditure to that of total assets of the firm. As most firms in India do not have expenditure in research and development, we create a dummy variable for R and D with it taking one if the firm incurs Research and Development expenditure and zero otherwise.

Non Debt Tax Shield: The advantage of debt is the tax benefit that the firm can claim. In reality, there are avenues other than debt that provide the same tax benefits such avenues are broadly classified as NDTS. Higher the presence of NDTS in a firm, the lower is the intent to take risky debt into the capital. We compute NDTS as the ratio of the sum of depreciation and amortization to total assets of the firm.

Growth Opportunity: A firm with growth opportunities would have high cash flows and would be investing in its assets to manage such growth. A growing firm would be an ideal investment opportunity for equity investors. Also the uncertainty of future growth opportunity increases the risk of bankruptcy of the firm. This would compel the firm to use equity financing into its capital. We use two measures to compute growth opportunities: Market to Book ratio, computed as the ratio of the market value of the firm to the book value of the firm. The objective of the

study is to analyze both listed and unlisted firms growth in total assets would provide as a better measure of growth opportunity.

Industry Median Leverage: Literature as found that the median industry leverage has a significant impact on the leverage of the firm. It acts a proxy for the ex-firm variables impacting leverage of the firm. A change in the industry median leverage would directly impact the leverage a firm in that industry. We compute the median leverage of all firms in the industry year wise.

Table 1: Determinants of leverage used and their expected relationship with the leverage ratio

Sl.No.	Variable	Measurement	Source	Expected Sign
1	Size	Natural Log of Sales	Rajan and Zingales (1995)	Positive
2	Tangibility	Fixed Assets/ Total Assets	Rajan and Zingales (1995)	Positive
3	Profitability	EBIT/Total Assets	Rajan and Zingales (1995)	Negative
4	Non Debt Tax Shield	(Depreciation + Amortization)/Total Assets	Graham (2000)	Negative
5	Growth Opportunities	Market to Book ratio; $(TA_{t+1}-TA_t)/TA_t$	Rajan and Zingales (1995)	Negative
6	Industry Median Leverage	Median of leverage of all firms in the industry	Fama and French (1997)	Positive
7	Intangibility	Research and Development expenditure to Total Asset ratio	Graham (2000)	Negative

8	Rand D Dummy	One if Research and Development exp is present or zero otherwise	Flannery and Rangan (2006)	Positive

4.5. Normality, heteroscedasticity and multicollinearity assumptions

The inferences from the multivariate regression are made with the assumptions that the errors of the model have a constant variance and the error terms are normally distributed. Also, the independent variables are assumed to be uncorrelated with each other and with the error terms.

Heteroscedasticity: In the presence of heteroscedasticity and non-normal error distribution, though the parameters are consistent the standard errors was larger and thus will lead to misleading results. We adopt Newey- west robustness estimation procedure to adjust for possible heteroscedasticity; this procedure will yield robust standard errors in the presence of heteroscedasticity.

Normality test: The Jarque-bera statistic of all the variables used in our study is presented in the data section. The Null hypothesis of the test is that the Skewness and excess kurtosis of the sample is zero (the sample is normally distributed). As observed from the values the all variables show statistical evidence by which you reject the hypothesis and conclude that the variables are not normally distributed. This problem is encountered in most corporate finance empirical research as we use ratios as variables where the values invariably lie between zero to one. We further conduct the S-wilkies test to check whether the residuals are normally distributed for our base equation. The null hypothesis of the test is that the residuals are normally distributed. The test rejects the null hypothesis, indicating that the residuals are not normally distributed. Hence, the results of our analysis have to be interpreted with caution.

Multicollinearity test: our analysis is based on the interpretations of different multivariate regression models which are estimated under the assumption that the independent variables are neither correlated with each other nor correlated with the residuals. If multicollinearity is prevalent in the model than the estimated standard errors will not be robust and cannot be relied upon. We use the Variance Inflated Factor (VIF) on the models used. We find that the VIF values for all variables are above 1.7 and multicollinearity problem is not posing a serious obstacle.

4.6. Model Specification

Objective I: To examine whether firms consider a target capital structure

Hypothesis: H1: Indian firms partially adjust their capital structure towards their target leverage

$$\boldsymbol{Lev_{i,t+1} = \lambda\beta X_{i,t} + (1-\lambda) Lev_{i,t} + \delta_{i,t+1}} \qquad \textit{(7)}$$

The variable of interest in the above model is the Leverage Ratio ($Lev_{i,t}$). A significant coefficient (1-λ) indicates that the firms consider target leverage and the sign of (1-λ) coefficient indicates the direction of the adjustment that the firm is trying to bridge the gap in the leverage. Flannery and Rangan (2006) report a positive and significant SOA coefficient which indicates that the firms consider a target leverage ratio and they reduce the gap every year. It is expected that the value of λ lies between zero to one. Due to various adjustment costs the firms will not be

able to completely match the target capital structure and consequently λ is not expected to be equal to one. We also expect a positive and significant SOA coefficient.

Objective II: To examine the speed of adjustment of the capital structure of group affiliated firms vs. Standalone firms

Hypothesis: H2: The Speed of Adjustment of group affiliated firms is greater than that of Standalone firms

$$\boldsymbol{Lev_{i,t+1} = \lambda\beta X_{i,t} + (1-\lambda) Lev_{i,t} + \eta\,(GroupDum_i * Lev_{i,t}) + \delta_{i,t+1}} \quad \textbf{(8)}$$

To classify the firms into group and standalone firms, we use the classification used by CMIE. Based on this classification a group dummy is created with firms affiliated with a group having the value one and standalone firms zero. If these coefficients η and (1-λ) are significant then it means that group affiliated firms have a SOA different than that of the standalone firms. The λ value would be the SOA of standalone firms and the SOA of group affiliated firms is given by (1-((1-λ) + η)). We expect both η and (1-λ) coefficients to be significant and positive.

Objective III: To examine whether the speed of adjustment of group affiliated firms varies with the level of diversification

Hypothesis: H3: The Speed of Adjustment of high diversified group affiliated firms is greater than that of a less diversified group affiliated firms

$$\boldsymbol{Lev_{i,t+1} = \lambda\beta X_{i,t} + (1-\lambda) Lev_{i,t} + \eta\,(DivDum_i * Lev_{i,t}) + \delta_{i,t+1}} \quad \textbf{(9)}$$

Diversification is defined as the number of industries in which a particular group has its presence. This information is collected from CMIE database. Based on the median value of diversification, we divide the sample into highly diversified (one) and lowly diversified groups (zero). A significant η and (1-λ) coefficient values indicate that SOA of high and low diversified firms are significantly different. λ would the value of SOA of low diversified firms and (1-(1-λ) + η) is that of high diversified firms. Khanna and Palepu (2000) report a positive and significant impact of diversification on group performance. This high performance gives better access to funds and accordingly we expect diversified groups will have higher SOA compared to less diversified firms.

Objective IV: To investigate whether macroeconomic conditions of the economy affect the speed of adjustment of the capital structure of firms

Hypothesis: H4: The Speed of Adjustment of the capital structure of Indian firms in a good macroeconomic condition is greater than that of firms in bad macroeconomic condition

$$\boldsymbol{Lev_{i,t+1} = \lambda\beta X_{i,t} + (1-\lambda) Lev_{i,t} + \eta\left(MacroVar_t * Lev_{i,t}\right) + \gamma(MacroVar_t) + \delta_{i,t+1}} \quad \textbf{(10)}$$

The variable of interest in this model is macroeconomic variable in our case it is the GDP growth rate. The GDP growth rate data of India will be collected from the International Monetary Fund (IMF) database for the study period i.e. from 1997 to 2013. If the coefficients η and (1-λ) are significant then it means that the macroeconomic conditions have an impact on the SOA of the firms in India. Based on the previous study by Cook and Tang (2010) we expect a

positive and significant impact of macroeconomic variable on SOA. i.e. η and (1-λ) are positive and significant.

Objective V: To examine whether the speed of adjustment of capital structure varies with firm specific characteristics of Indian firms

I. **Hypothesis: $H5_{A1}$**: The Speed of Adjustment of high profitable firms is greater than that of a low profitable firms

$$\boldsymbol{Lev_{i,t+1} = \lambda\beta X_{i,t} + (1-\lambda)Lev_{i,t} + \eta\,(Profit\ Dum_i * Lev_{i,t}) + \delta_{i,t+1}} \quad \textbf{(11)}$$

Here we measure profitability as the ratio of EBIT to Total Assets. We classify firms into high performing firms if they have above median performance and these firms take value one in the dummy variable. The most important variable in the above equation is the interaction variable of profitability dummy and market debt ratio (Profit Dum *$Lev_{i,t}$). If these coefficients are significant then it means that high profitable firms have an SOA different than that of the standalone firm. λ would be the SOA of low profitable firms and the SOA of high profitable firms is given by (1-((1-λ) + η)). We expect both η and (1-λ) to be significant and positive. We propose to use model (11) to estimate coefficients for $H5_{A2}$ and $H5_{A3}$ separately for group and standalone firms.

II. **Hypothesis: $H5_{B1}$**: The Speed of Adjustment of larger firms is greater than that of Smaller firms

$$\boldsymbol{Lev_{i,t+1} = \lambda\beta X_{i,t} + (1-\lambda) Lev_{i,t} + \eta\,(\text{Size Dum}_i * Lev_{i,t}) + \delta_{i,t+1}} \qquad \textbf{(12)}$$

We use natural logarithm of sales as a measure of firm size. Based on the median firm size, we create a size dummy with firms whose size is greater than that of the median is indicated as 1 and 0 for the rest of the firms. The most important variable in the above equation is the interaction variable which is a product of firm size dummy and market debt ratio (Size Dum *$Lev_{i,t}$). If these coefficients are significant, then it means that large firms have an SOA different than that of smaller firms. λ would be the SOA of smaller firms and the SOA of large firms is given by (1-(1-λ) + η)). We expect both η and (1-λ) to be significant and positive. We propose to use model (12) to estimate coefficients for $H5_{B2}$ and $H5_{B3}$ separately for group and standalone firms.

III. Hypothesis: $H5c_1$: The Speed of Adjustment of a listed firms is greater than that of unlisted firms

$$\boldsymbol{Lev_{i,t+1} = \lambda\beta X_{i,t} + (1-\lambda) Lev_{i,t} + \eta\,(\text{List Dum}_i * Lev_{i,t}) + \delta_{i,t+1}} \qquad \textbf{(13)}$$

We create a dummy variable to indicate the listing status of a firm. A listed firm is indicated by 1 and 0 otherwise. The listing status of firms is accessed through the CMIE database. The most important variable in the model is the interaction variable of listed status dummy and market debt ratio (List Dum *$Lev_{i,t}$) If these coefficients η and (1-λ) are significant then it means that listed firms have an SOA different than that of unlisted firms. The coefficient λ would be the SOA of unlisted firms and the SOA of listed firms is given by [1-{(1-λ) + η}].We expect both η and (1- λ) to be significant and positive. We propose to use model (13) to estimate coefficients for $H5_{C2}$ and $H5_{C3}$ separately for group and standalone firms.

IV. Hypothesis: $H5_{D1}$: The Speed of Adjustment of firms with higher growth opportunities is greater than that of a firm with a lower growth opportunity

$$\boldsymbol{Lev_{i,t+1} = \lambda\beta X_{i,t} + (1-\lambda) Lev_{i,t} + \eta\left(\text{Growth Dum}_i * Lev_{i,t}\right) + \delta_{i,t+1}} \quad \textbf{(14)}$$

Firms with higher growth opportunities in the future would have higher earnings and as a result lower bankruptcy risk. Due to this low bankruptcy risk the firm would have a relatively lower adjustment costs and thus the firms would be able to adjust to its target capital structure faster. We use Market to book ratio as a proxy future growth opportunities. Based on the median market to book ratio we create a dummy variable high growth firms as one and low growth firms as zero. The most important variable in the model is the interaction variable of growth dummy and market debt ratio (Growth Dum_i *$Lev_{i,t}$). If the η and (1-λ) coefficients are significant then it means that high growth has an SOA different than that of unlisted firms. λ would be the SOA of unlisted firms and the SOA of listed firms is given by [1-{(1-λ) + η}]. We expect both η and (1-λ) coefficients to be significant and positive. We propose to use model (14) to estimate coefficients for $H5_{D2}$ and $H5_{D3}$ separately for group and standalone firms.