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Vodwal, Sandeep and Bansal, Vishakha and Sinha, Pankaj

Faculty of Management Studies, University of Delhi, Delhi, India

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Impact of Financial Crisis on Determinants of Capital Structure of Indian Non-financial Firms: Estimating Dynamic Panel Data Model using Two-Step System GMM

Sandeep Vodwal, Vishakha Bansal and Pankaj Sinha

Faculty of Management Studies, University of Delhi

Abstract:

The sub-prime crisis of 2008 in the US shook the world markets through financial market integration, global trade links, and international banking diversification. The financial crisis led to changes in various policies both at macroeconomic and firm-level around the world. In this scenario, this study is an attempt to identify and uncover the changes in firm and institutional determinants of Debt Financing Ratio in India, before and after the crisis. Micro and macro panel data of 306 non-financial Indian listed firms were used for the period of 2002-2017 to study the factors affecting leverage. Two-step system GMM was employed to study the dynamics of leverage and its determinants during 2002-2008 (pre-crisis period) and 2009-2017 (post-crisis period). Pre and post-crisis analysis are undertaken by employing firm-specific factors represented by Non-debt tax shields, Asset Composition (tangibility), Size, Profitability, Growth Opportunity (Market to Book), and Liquidity in the firms and institutional factors represented by Economic Growth Rate and Inflation. Two models, with different measures of leverage as dependent variables, have been constructed to analyse the impact of the crisis. The results favoured that the Indian firms tend to adjust their capital structure to reach an optimum level of debt (Target Leverage). The study confirms that profitability, and size of the firm are robust determinants of leverage in both pre and post-crisis periods; tangibility is found to be insignificant in the pre-crisis period and statistically significant in the post-crisis period for both measures of leverage. Market to Book (MTB) ratio is consistently a non-significant factor for book measure of leverage, and it holds significant negative relation to the market measure of leverage. Based on the model employing the book measure of leverage as a dependent variable, the factors tangibility and liquidity show different behaviour in pre and post-crisis period. They are not found to be significant during the pre-crisis period but after the crisis, they show significance in the determination of leverage of Indian non-financial firms. Economic indicators show a negative relation of inflation with leverage in the pre-crisis period

and positive relation in the post-crisis period. Economic growth measured through GDP does not show significance during the pre-crisis period but shows a positive influence in the post-crisis period.

Keywords: Corporate Capital Structure, Dynamic Panel Data, GMM.

JEL Classifications: G20, G32.

I. Introduction

The recent financial turmoil of 2008, caused by lending to the subprime borrowers in the USA, has shaken the world and confirmed the phrase “When US sneezes the whole world catches cold.”

The crisis bankrupted major financial and insurance companies in the US. Since the globalization has converted the world economy into a unit, other economies in the world could not remain unaffected leading to rejection of “Decoupling theory” (Subbarao, 2009). During the turmoil, firms faced problems of paying fixed financial obligation as the major part of the financial obligation for a firm is found to be in the form of interest on Debt. World trade declined by 2.8 percent. Further, Indian firms faced problems in raising funds from outside; decrease in foreign consumption led to a reduction in export and downturn of Lehman Brothers led to be cautious, and stringent actions by domestic banks (2 (Subbarao, 2009).

Impact of Sub Prime Crisis on India is also seen indirectly through Capital Market slowdown. Inverse capital inflows by FII’s lead to crash of the Indian Stock Market. The falling equity prices during the onset of crisis further led to increasing market leverage. This financial and macro-economic instability led to decline in GDP growth rate by 2.1 percent, and current account deficit shot up to 2.6 percent of GDP, which is highest since economic reforms in India (Bajpai, 2011).

The Sub Prime Crisis 2008 changed the financing decisions for most of the countries; since during the crisis, risk and uncertainty rise, expected returns decline and long-term financing becomes unattractive [(R. S. Gürkaynak, 2012); (C. D Dick, 2013)]. The crisis induces an economy to experience higher volatility in the performance of firms, inflation, exchange rate, rate of interest, risk etc. This provides

an opportunity to study the relevance of idiosyncratic and institutional factors for financing decisions of the firm (Asli Demirguc-Kunt, 2015).

These macroeconomic instabilities induced by global financial turmoil provided an opportunity to analyse how firms finance their investment needs, before and after the macroeconomy instability caused by the global crisis.

With the same stream of thoughts, this study has attempted to analyse the impact of Sub Prime Crisis on Indian firms' financing decisions. Here, firstly, the major institutional (GDP growth rate and Inflation), as well as firm-specific factors (Last year's leverage, NDTs, Tangibility, Size, Profitability, Growth Opportunities and Liquidity), are identified, based on previous studies [(Sheridan Titman, 1988), (Rajan, 1995), (Laurence Booth, 2001), (Murray Z. Frank, 2003), (Frank & Goyal, 2009), (L. M. Bhole, 2005)].

Secondly, the study has tried to examine whether the determinants are independent for Indian firms' DFR in the light of Sub Prime Crisis employing Dynamic Panel Data Model and applying Two-Step System GMM for estimating the parameters of the model to resolve the problem of endogeneity and unobserved heterogeneity of explanatory variables present in a Dynamic Panel Data framework.

The study is divided into five sections and proceeds as follows. Section II discusses the review of literature, research gaps and rationale for the study. Section III contains data description and descriptive statistics. Section IV consists of data and research methodology, and the last Section V discusses the results and concludes the study.

II. Review of Literature

The prime objective of any business is to maximize the owner's wealth, and this may be achieved by accepting projects that provide excess returns over the cost of borrowing. The Cost of Capital is the weighted average cost of capital for the amount invested from different sources i.e Debt and Equity, in the firm hence cost of capital is the minimum acceptable earning rate for a project. Consequently, while

raising finance a firm must choose an optimal combination of debt and equity that minimizes overall Cost of Capital.

Debt is considered a cheaper source of finance because the cost of debt is generally found to be lower than the cost of equity as interest paid on Debt is tax-deductible. Further, Debt introduction reduces agency costs and brings operating efficiency for firms having free cash flows (Palepu, 1986).

However, Interest and Principal repayments to debt claimants are known in advance and in case the cash flows are not enough to meet the promised debt claimants, it may lead the firm to insolvency – which of course is disastrous for all the stakeholders. Insolvency process leads to the incurrance of direct and indirect bankruptcy costs such as legal fee, loss in the value of assets etc. Further, the managers strive to work for owners neglecting the high risk to bondholders and create agency costs of debt. In such a situation, debt holders' demand for a higher interest rate as risk premium makes debt a fairly unattractive source of funding. [(Myres, 1977), (Jensen, 1986)].

Equity is another important source of finance. The equity holders are the owners of any firm, take active part in management of the firm, have infinite life and they get the least priority at the time of liquidation. Generally, equity issues are found to be underpriced and Initial Equity Issues might be underpriced up to 10 to 15 percent on an average (Roger G. Ibbotson, 1994).

Therefore, determining the optimum level of Debt Financing Ratio (henceforth DFR) and equity proportion in business is always a matter of interest among the practitioners and academicians. In the following paragraphs, the prominent researches in this area are discussed.

The starting point of financing decision making is the seminal work of (Durand, 1952) advocating that debt is cheaper and an easier source of finance than equity for US firms and increases the value of the firm. “Irrelevance Theory” proposed by (Franco Modigliani, 1958) refuted David Durand's theory and stated that with stiff assumptions, the composition of funds is not related to the value of the firm. In another paper, (Miller, 1963)) suggests that if the earnings are known with certainty and in the presence of taxes, the firm's value is a positive linear function of financial leverage. Subsequent researches violated the stiff assumptions made by Modigliani and Miller (MM) and correlated them with the costs and benefits of debt. Those researchers recommended that an optimum level of debt is possible where “present value of tax benefits of using debt” is more than the “present value of expected financial

distress costs". This got propagated as Trade-Off Theory of capital structure [(Litzenberger, 1973) , (Jensen, 1986) (Myres, 1977), (Myers, 1984)]. Debt creates a tax advantage for a firm and needs to be used cautiously; else, it can lead a firm to bankruptcy too. There is an optimum amount of debt (D^*) that a firm can afford to take and that is established by clearly understanding the trade-offs involved. This D^* is seen to be inversely related to the intangible assets owned by the firm [(Litzenberger, 1973), (Myres, 1977)].

The study now elaborates the firm-specific & institutional factors mentioned in the Tradeoff Theory and related to marginal benefits and the marginal costs mentioned above. It has been observed in the studies that the DFR for firms tends to increase with Tax Rate, Fixed Assets, Size, Profitability and Inflation (Frank & Goyal, 2009). Interest on the payments made towards debt provides tax shield to the firm, by the governments. Fixed Assets serve as collateral and thereby allow easier access to debt financing along with the reduction in agency costs. Large firms tend to diversify their businesses with an objective of spreading the risk thin and as a result are expected to have a lower probability of losses and subsequent default on the debt repayment. This makes such businesses an attractive proposition for the lenders to invest. Profitable firms, since they have free cash flows, tend to have a lower probability of failure and are more inclined to exploit tax benefits that debt financing offers. It is also observed that liquidity is directly correlated with DFR because it is indicative of short term solvency and provide information to a lender for meeting financial obligation (L. M. Bhole, 2005).

During times of high inflation, tax benefits are generally found to be more than the cost associated with debt, therefore the firms increase their DFR [(Harry DeAngelo, 1980); (Jensen, 1986); (Warner, 1977)]. On the other hand, DFR of firms tends to decrease with unpredictability and variation in cash flows as well as when the firms are pursuing high growth opportunities. It is so because a variation in the cash flows essentially arising from the uncertain business conditions, leads to a high probability of financial distress as well as debt agency costs. Also, during the times of volatile cash flows, since the cost of debt tends to be higher, it

would impact the benefits that the firm can get in the form of “Tax Shield”. It was also evident in the literature that debt as an instrument of adding discipline in the business was found to be less utilized in incumbent firms that expect high growth opportunities in the future and creates the problems of asset substitution and underinvestment. Therefore, such firms tend to have lower leverage. Further, during bankruptcy, growth opportunities are more likely to lose liquidation value [(Myres, 1977); (Jensen, 1986); (Myers, 1984); (Frank & Goyal, 2009)].

The study now explores the literature on the Pecking Order Theory, which postulates that due to the presence of adverse selection, information asymmetry and mispricing of seasoned equity, firms follow a hierarchy during the times when funds are required. Internal financing in such times becomes the first choice whereas seasoned equity is at the last in the pecking order of the means of raising funds. Debt in this sort of a situation is treated as safer than equity [(Donaldson, 1961); (S. C. Myers, 1984)]. According to Pecking Order Theory, DFR tends to decline with tangibility, liquidity, firm size and profitability whereas it increases with an increase in growth opportunities because the lower degree of “Information Asymmetry” and “Agency Costs” are associated with a high degree of tangibility in the firms. Therefore, equity is preferable for financing deficit than debt when the firm has high tangibility. Since the large firms are monitored closely by the investors; they release the information in the time leading to a lower degree of information asymmetry and prefer to use seasoned equity instead of debt financing. For profitable firms, it is argued that since they have more retained earnings, therefore they use internal equity as a method of financing and abstain from issuing debt and external equity. However, if the retained earnings or other internal sources of finance are insufficient, not only debt is preferred, but it is also easily available and at better terms. When the firms pursue growth, beyond a stage, their internal financing proves to be insufficient to fund the growth opportunities, therefore leverage increases. [(S. J. Grossman, 1982); (Harris Milton, 1991)]. The support to the Pecking Order Theory was also confirmed in a pronounced survey research (J. R. Graham and C. R. Harvey, 2001) which concluded that the management and owners of the firms prefer to use internal financing more because they want to keep the external finance for the future and maintain

flexibility in terms of the capital needed. In addition to Trade-Off and Pecking order models of capital financing, convincing literature favors that the firms ignore the D^* and hierarchy in case of financing deficit (Marsh, 1982), but take the advantage of mismatched financial markets. They issue more equity when the stock prices rise and vice-versa. This phenomenon is termed as “Market Timing Theory” and is applicable for equity and debt both. Researchers have proven this phenomenon empirically [(Marsh (1982)]. Further, as the market value of the firm increases because of rising equity prices, the leverage declines and to bring the DFR at an optimum level, a firm has to issue more debt (Taggart, 1977), (Malcolm Baker, 2002). Subsequently, researchers nominated some idiosyncratic, systematic and international factors related to the firms, connected those with Trade-Off Theory, Pecking Order Theory or Market Timing Theory and thereafter provided their opinion for the relevance of theory. Thereafter researches evolved for testing the influence of idiosyncratic factors and identifying the relevance of different theories. For instance, some notable studies in this field [(R. Stulz, 1985); (Frank & Goyal, 2009)] favor Trade-Off Theory and partially advocate the applicability of Pecking Order Theory. None of the studies has found evidence for following any theory to explain the variation in DFR. In Indian context one of the major studies was carried out by (Bhaduri, 2002) confirmed the correlation between leverage and growth, cash flows, size, uniqueness and industrial characteristics. (Chakraborty, 2010) explored the applicability of Trade-Off Theory and Pecking Order Theory for Indian firms and observed that, Indian firms tend to follow the views of Pecking Order Theory while making financing decision with respect to DFR.

Apart from the other theories, researchers have identified other micro and macro-economic factors that may affect the financing decisions of the firm. In the literature lagged leverage is found to be positively correlated with the current leverage and states that companies attempt to attain an optimal level of debt in the capital structure (Flannery & Rangan, 2006). It was also argued in the literature that DFR in the firm heavily depends upon the industry’s DFR, individual percentage of leverage in each firm is found to be around the mean value of the industry as a whole because firms follow a leader in the industry (Frank & Goyal, 2009). Some of the researchers also claimed that the DFR of the firms depends upon

the number of rival's incumbent firm. The oligopoly market firms tend to have a higher DFR than that of other forms of the market (Tracy, 1986).

The DFR is highly dependent on the institutional set up of a country too, in which the firms are operating because it is affected by monetary and fiscal policies of the country. The major institutional factors identified in the literature are economic growth rate (generally GDP), expected inflation and long-term rate of interest, with their different proxies and are connected to the existing theories. GDP growth rate has a major impact on the profits and income of firms. During expansion, the profit and income of the firms increase, and they tend to use retained earnings to finance their projects. Hence, a negative relationship is observed between economic growth and DFR. During the times of high inflation, the real value of tax benefits increases and so does the DFR (Taggart, 1977) .

The studies mentioned above are majorly in the context of developed nations like United States, United Kingdom, European and developed markets. In the Indian context, a recent study conducted by (Herwadkar, 2017) examined the impact of various macro factors like volatility in the domestic market, world growth rates, FED shadow rate and found that the DFR has an inverse relation with FED shadow rate.

However, the above cited references applied fixed effect or random effect panel data models and ignored the presence of endogeneity and unobserved heterogeneity of explanatory variables in Panel Data framework which might have caused inefficient and biased estimates of the parameters of the considered models and inconsistent findings

Though a vast literature is available on the financing decisions of firms, but very limited attempts have been made to study the impact of macro-economic factors and almost none of the researches have studied the impact of the Sub Prime crisis on the determinants of capital structure decisions of Indian firms It is evident from previous studies [(Asli Demirguc-Kunt, 2015); (Herwadkar, 2017)] that crisis brings instability in the financial system and whole country may experience recession and slow growth. This leaves a research gap to study the impact of the global financial crisis on determinants of DFR. This study attempts to identify relevant firm specific and institutional factors that may have the power to explain variations in DFR and ascertain the impact of crisis on debt financing decisions of Indian

non-financial firms. A Dynamic Panel Data framework is used by employing Two-Step System GMM for estimating the parameters of the models to resolve the problem of endogeneity and unobserved heterogeneity of explanatory variables.

III. Data and Descriptive Statistics

This study has used annual data for the period 2001-02 to 2016-17, extracted from financial statements of each firm. Micro panel data has been taken from DATASTREAM terminal of “Thomson Reuters” and Bloomberg. The data on Inflation and GDP growth rate has been extracted from the World Bank’s websites. The study includes 306 non-financial companies listed on the Bombay Stock Exchange (BSE).

Based on previous studies and as per the objective of this research, the following model has been adopted:

$$DFR = f(DFR_{t-1}, \text{Non debt tax shield}, \text{Tangibility}, \text{Profit}, \text{Size}, \text{Growth}, \text{Liquidity}, \text{Inflation}, \text{and GDP})$$

The main explanatory variables are NDTs, Asset Composition, Size, Profitability, Growth Opportunity, and Liquidity in the firms. Institutional factors are Economic Growth Rate and Inflation. The formation of these variables is explained in Annexure 1. The selected firms belong to different broad sectors as given in Table 1.

Table 1 Sectoral presentation of firms included in the study.

Sector	Firms	Percentage
Non-Financial Services	56	18.30%
Fuels, Heavy, and Electrical Equipment	46	15.03%
Auto & Ancillary	30	9.80%
Construction, Cement and Steel	48	15.69%
Textile, and Packaging	35	11.44%
Pharmaceutical, Chemical and Fertilisers	53	17.32%
Consumer Durable, Sugar and FMCG	38	12.42%
Total	306	100%

It is evident from Table 1 that the 56 firms belong to the non-financial service industry. It includes Shipping, Telecom, Information Technology and Media. 46 firms are from Industries such as Petrol,

Gas, Electricity, Heavy Goods and Equipment. In the sample, 30 firms are engaged in Auto and its ancillaries. 48 firms belong to construction, cement and steel industry. Textile and packaging industry firms are 35. 53 firms are from Pharmaceutical, Chemical and Fertilizers and lastly. 38 firms belong to Consumer Durable, Sugar Industry and Fast-Moving Consumer Goods.

Table 2 describes the descriptive statistics of the above collected data; it presents the results for the full sample period i.e. 2002 to 2017 of 306 companies and 4366 observations.

Table 2 Descriptive Statistics¹

Statistics	BDFR	MDFR	NDTS	TANGB	PROFIT	SIZE	MTBRATIO	LIQ	INFLATION	GDP
Mean	0.3602	0.2889	0.0341	0.3688	0.123	9.514	2.535	2.052	0.067	0.069
Median	0.3475	0.1965	0.0307	0.3753	0.115	9.436	0.702	1.597	0.058	0.079
Maximum	1.063	0.952	0.1461	0.7873	0.417	14.09	39.11	11.152	0.119	0.086
Minimum	0.00001	0.0001	0.0012	0.0124	-0.10	6.058	0.027	0.286	0.024	0.031
Std. Dev.	0.2483	0.2772	0.0221	0.1913	0.086	1.611	5.650	1.628	0.028	0.016
Skewness	0.366	0.7935	1.901	0.0780	0.472	0.407	4.513	3.030	0.401	-1.180
Kurtosis	2.482	2.4217	9.492	2.156	4.24	3.231	25.83	15.08	1.90	3.094
J/B Stats.	146.3	519.0	10298	133	445	130	109645	33232	336	1018
P-Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Obs.	4366	4366	4366	4366	4366	4366	4366	4366	4366	4366
Levin-Chui	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

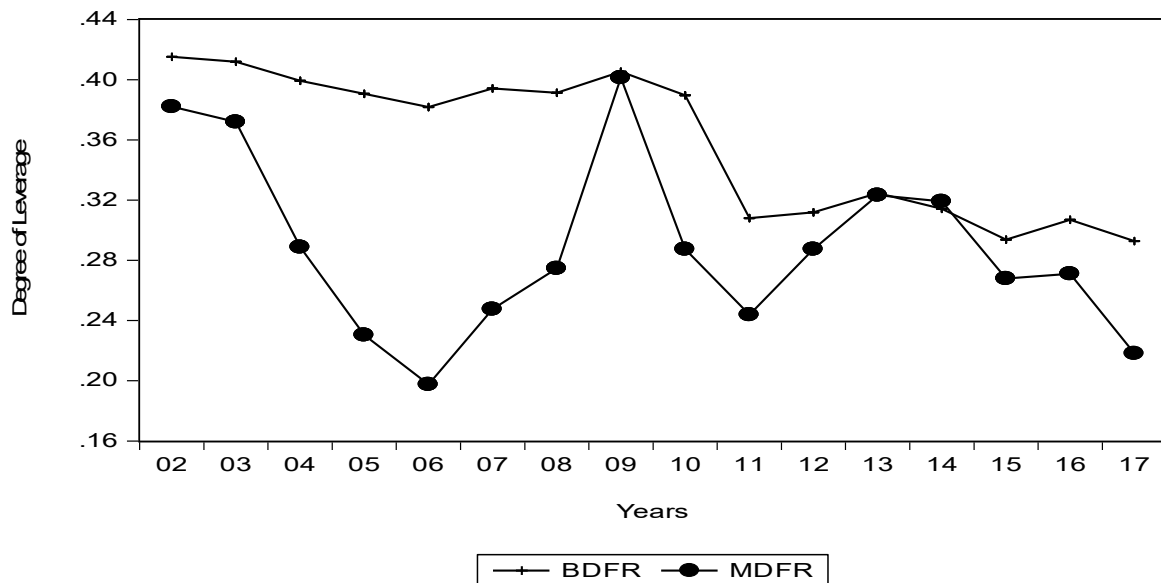
Table 2 exhibits that the data used in the study is highly volatile as the mean values of all dependent and independent variables are deviated from the mean of the observations. All variables are non-normally distributed as the p-values of Jarque-Bera statistics reject the null hypothesis of normality for all variables. For the possibility of any long-run association, study checked the stationarity using two methods namely “Levin-Lin-Chu” and “PP - Fisher”², and found that data considered in the study is stationary for all variables at the level and first difference.

It is visible from the table that only GDP growth rates are having negative skewness while all other variables are positively skewed. It is also evident from the table that market-based debt finance ratio (henceforth MDFR) and book-based debt financing ratio (henceforth BDFR) are non-negative.

¹ Abbreviations: BDFR: Book Debt Financing Ratio, MDFR: Market Debt Financing Ratio, NDTS: Non-Debt Tax Shield, Tangb: Tangibility of assets, MTB Ratio: Market Value to Book Value Ratio, LIQ: Liquidity, GDP: Gross domestic product, Std. Dev.: standard Deviation and rest of the words used are self-explanatory. ** Stationary after removing time trend.

² The results are given in appendix 2.

Based on the data it may be inferred that Indian companies carried around 36 percent of their assets as fixed assets, the NDTs is 3 percent of assets in place and firms earned around 12 percent rate of returns on the amount invested, carried twice of their current liabilities as current assets. India experienced growth at 6.9 percent and inflation during this period was approximately 6.7 percent. For the sake of clarity and to examine the behaviour of dependent variables during the study period, the mean value of the dependent variable is also presented year-wise graphically.



It is evident from the graph that mean BDFRs show substantial instability over time. Mean value of BDFR is more stable than mean MDFR. Further, the mean values of BDFR and MDFR have been declining over time, but MDFR was more volatile than the BDFR. The only difference between these two measures is the inclusion of the market value of equity. Consequently, MDFR skyrocketed during the 2008-09, while BDFR did not respond as much as MDFR. It is further noted that amid of financial crisis and unstable market environment. The low market value of equities led to a sharp increase in the leverage during 2008-09. This is the reason that some people prefer to use the Book leverage as a representation for the measurement of leverage (J. R. Graham and C. R. Harvey, 2001) . In this study, both measures of leverage have been used to identify the impact on both book and market measures. It is further evident that after the crisis, Indian companies have reduced the proportion of debt in their DFR irrespective of their proxies. The possible reasons may be, that during and after the crisis, financial

intermediaries increase their term premium as the probability of default rises. Also during the crisis firms value their financial flexibility that leads to decrease in long term debt [(R. S. Gürkaynak, 2012); (C. D Dick, 2013), (Zhiguo, 2014)]. These reasons make long term debt less lucrative.

Subsequently, study has presented the results of the coefficient of correlation to ensure the association of variables. The next table 3 exhibits the pairwise correlation of all included variables in the study.

Table 3 Coefficients of Correlation:

Variables	NDTS	TANGB	SIZE	PROFIT	MBRATIO	LIQ	INFLATION	GDP
NDTS	1.000	0.419	-0.039	0.239	0.051	-0.091	-0.068	0.010
TANGB	0.419	1.000	0.029	0.057	-0.072	-0.178	-0.036	-0.006
SIZE	-0.039	0.029	1.000	0.110	0.045	-0.254	0.141	0.027
PROFIT	0.239	0.057	0.110	1.000	0.375	0.074	-0.031	0.000
MBRATIO	0.051	-0.072	0.045	0.375	1.000	0.047	-0.099	0.046
LIQ	-0.091	-0.178	-0.254	0.074	0.047	1.000	-0.035	0.005
INFLATION	-0.068	-0.036	0.141	-0.031	-0.099	-0.035	1.000	-0.127
GDP	0.010	-0.006	0.027	0.000	0.046	0.005	-0.127	1.000

The matrix shows that none of the independent variables is highly correlated. The highest correlation is observed between NDTS and Tangibility i.e. 41.9%. This shows that the assumption of no multicollinearity is satisfied. In the next section, the research methodology is discussed in detail.

IV Research Methodology

To study the effects of idiosyncratic and institutional factors on DFR, the standard approach is to use multiple regression and OLS along with its standard assumptions. In the literature, it has been used extensively by the researchers [(Rajan, 1995); (Murray Z. Frank, 2003) (Frank & Goyal, 2009)]

Following the same pattern, Equation 1 below models this study:

$$DFR_{it} = \alpha + \lambda DFR_{it-1} + \beta_1 NDTS_{it} + \beta_2 Tangb_{it} + \beta_3 Profit_{it} + \beta_4 Size_{it} + \beta_5 MTB_{it} + \beta_6 Liquidity_{it} + \beta_7 Inflation_{it} + \beta_8 GDP_{it} + e_{it} \dots \dots \dots (1)$$

Equation 1 states that DFR of the firm ‘i’ for time ‘t’ depends upon the previous DFR, Non-Debt Tax Shield, the proportion of fixed assets in the business, earning capacity, size, market to book ratio and liquidity of the firm. The DFR at the institutional level depends upon the inflation and growth rate of

the country, presented by the growth rate in GDP. Since this study investigates the role of financial variables of the firms and institutional factors in determining DFR, this may lead to time series and cross-sectional heterogeneity. Therefore, the model is re-written in panel data format also known as the Fixed Effect Model, given in Equation 2 below by introducing α_i

$$DFR_{it} = \alpha_i + \lambda DFR_{it-1} + \beta_1 NDT S_{it} + \beta_2 Tangb_{it} + \beta_3 Profit_{it} + \beta_4 Size_{it} + \beta_5 MTB_{it} + \beta_6 Liquidity_{it} + \beta_7 Inflation_{it} + \beta_8 Rate_{it} + \beta_9 GDP_{it} + e_{it} \dots \dots \dots (2)$$

Equation 2 represents the panel data where $i = 1$ to 305 and $t = 2002$ to 2017, Now coefficients in equation (2) may be computed using OLS if the error term satisfies all the standard assumptions. The number of coefficients to be estimated in equation 2 will be individual for 305 firms along with 10 coefficients of explanatory variables, therefore computing more estimates with the help of limited information would not lead to precise estimates. Now coming to the further development of the model, Re-writing the equation (2) in a concise format in equation (3) below with an assumption that the individual effect ‘ α_i ’ is a random variable and is included in the error term. This is also known as Random Effect Model.

$$Y_{it} = \alpha + \lambda Y_{i,t-1} + \beta X_{it} + v_{it} \dots \dots \dots \text{Equation 3}$$

In equation 3, Y_{it} is a vector specifying leverage of the firm ‘ i ’ for time ‘ t ’, Y_{t-1} is a vector of immediate past leverage of the firm, β denotes 8×1 vector of coefficients, X_{it} represents 1×8 vector of explanatory regressors and v_{it} is the composite error term.

It is further stated that $v_{it} = \alpha_i + e_{it}$. In equation 3 it is evident that Y_{it} and Y_{it-1} are function of α_i , because α_i is time-invariant. Therefore, $Y_{it-1} = \alpha + \delta Y_{i,t-2} + \beta X_{it-1} + v_{it-1}$ and the resulting error term cannot be independent. It is further noticed using Hausman Test, that the individual effects “ α_i ” are not random variable and further, $E(X_{it} e_{it}) \neq 0$, variables such as NDT S, Tangibility, Size, Profitability and Liquidity are endogenous and they are correlated with the error term. Under such conditions standard OLS estimates will be biased and inconsistent, which further leads to the invalid point and interval estimates.

Using the first difference operator study transforms the equation 3 as below

$$Y_{it-1} = \lambda Y_{i,t-2} + \beta X_{it-1} + v_{it-1} \dots \dots \dots \text{Equation 4}$$

Subtracting equation 4 from 3 we get the following

$$Y_{it} - Y_{it-1} = \lambda (Y_{i,t-1} - Y_{i,t-2}) + \beta (X_{it} - X_{it-1}) + v_{it} + e_{it} - v_{i-1} - e_{it-1} \dots \dots \dots \text{Equation 5}$$

$$\Delta Y_{it} = \lambda \Delta Y_{i,t-1} + \beta \Delta X_{it} + \Delta e_{it} \dots \dots \dots \text{Equation 6}$$

In equation 6, time-invariant effect has been eliminated, (Arellano Manuel, 1991) proposed the GMM to the estimation of coefficients of equation 6. Here in equation 6, it is also stated that the differenced variables will be instruments for main regression equation 1, and will eliminate all time-invariant and constant effects. This would solve the problem of endogeneity and the resulting error terms will be uncorrelated. To test the validity of the instrument in equation 6, ‘Sargan’s Test’ has been adopted (Arellano Manuel, 1991).

The hypothesis of overidentification is rejected and p-value of Sargan test is close to zero which validates that the instruments used in (Arellano Manuel, 1991) estimators may not be efficient.

It is stated in the literature [(Bover, 1995); (Bond, 1998); (Roodman, 2009)] that if the first differences of instruments are uncorrelated with individual effects. If the dependent variable is persistent then differenced GMM may yield biased and inefficient estimates. This inefficiency may rise when time span is small. This provides an opportunity to introduce more instruments to improve the efficiency of the estimates. Consequently, “Two-Step System GMM” advocated by (Bond, 1998) model has been used with the assumption of stationarity in the level form. This approach works through a set of equations i.e. level equation and transformed equation (First Difference) with two-moment condition i.e. covariance between the composite error term and lagged difference of X_{it-1} and Y_{it-1} should be zero. This supports the use of the lagged difference of Y_{it} as instruments of the level equation in addition to the lagged levels of Y_{it} as instruments of first differenced equations (Baltagi, 2014). This method increases the instruments used to estimate the parameter that further improves the efficiency of the model.

For the validity of the model, the study further tested the autocorrelation of the model up-to two lags and found that none of the models rejects the hypothesis of “there is no autocorrelation” for second lag which is a pre-requirement of applying, System GMM³. Hence the results may be taken as ‘good’ estimates. The results of Arellano Bond Autocorrelation for lag (1) and lag (2) are given in Table 4 in Appendix 3.

Since “no autocorrelation hypothesis” is not rejected in the lag (2) it means that the model does not suffer from autocorrelation, and the estimates are efficient. The study has also documented that standard errors of estimates⁴ are dramatically reduced when it used Two-Step System GMM as compared to Differenced GMM, One-Step System GMM along with Fixed Effect Method and Random Effect Model. Thus, the methodology of Two-Step System GMM used for estimating parameters in a dynamic panel data framework is best suited.

V. Discussion of Results

The results of this study are presented in Table 5, Table 6 and Table 7 for whole sample period [2001-02 to 2016-17], Pre-Crisis Period [20001-02 to 2007-08], and Post Crisis Period [2009-10 to 2016-17] separately for Book Leverage and Market Leverage, respectively. Table 8 summarizes the significant factors determining the DFR in all three periods and for both measures of DFR.

Table 5 Two-Step System GMM results.

Full Sample Period 2002-2017		
Dep. Variable	BDFR	MDFR
Lag (1)	0.808 ^{***}	0.576 ^{***}
	(0.000)	(0.000)
NDTS	-0.521 ^{***}	-0.629 ^{***}
	(0.002)	(0.000)
TANGB	0.0886 ^{***}	0.182 ^{***}
	(0.000)	(0.000)
Profitability	-0.559 ^{***}	-0.793 ^{***}
	(0.000)	(0.000)
Size	-0.00361	0.0000681
	(0.249)	(0.986)

³ Results The results of Arellano Bond Autocorrelation for lag (1) and lag (2) given in Annexure 3

⁴ Results are provided in Appendix 4(a) and 4(b)

MTB Ratio	-0.000347	-0.00303 ^{***}
	(0.497)	(0.000)
LIQ	0.0212 ^{***}	0.0194 ^{***}
	(0.000)	(0.000)
Inflation	0.00439	0.271 ^{**}
	(0.911)	(0.000)
GDP	0.296 ^{***}	-0.561 ^{***}
	(0.000)	(0.000)
Intercept	0.0840 ^{**}	0.147 ^{**}
	(0.019)	(0.000)
Observations	3983	3983
<i>FE</i>	Present	Present
<i>Wald Stats</i>	7537.32	7264.06
<i>p-value</i>	0.000	0.000
<i>AB test AC(1)</i>	0.000	0.000
<i>AC(2)</i>	0.1794	0.9147

p-values in parentheses, *, **, *** at 10, 5, and 1 percent level of significance respectively.

Table 6 Two-Step System GMM results

Pre-Crisis Period (2002-2008)		
Dep. Variable	BDFR	MDFR
Lag (1)	0.722 ^{***}	0.729 ^{***}
	(0.000)	(0.000)
NDS	-0.927 ^{**}	-1.026 ^{**}
	(0.037)	(0.032)
TANGB	-0.0118	0.0208
	(0.805)	(0.729)
Profitability	-1.012 ^{***}	-0.744 ^{***}
	(0.000)	(0.000)
Size	0.0495 ^{***}	0.0230 ^{**}
	(0.001)	(0.024)
MTB Ratio	0.000263	-0.00151 ^{**}
	(0.762)	(0.022)
LIQ	-0.00352	0.00341
	(0.421)	(0.427)
Inflation	-1.028 ^{***}	0.774 ^{**}
	(0.005)	(0.014)
GDP	-0.0706	-0.130
	(0.722)	(0.479)
Intercept	-0.0913	-0.0524
	(0.432)	(0.561)
<i>Obs.</i>	1653	1653
<i>Fixed Effect</i>	Present	Present
<i>Wald Stats</i>	583.92	1141.77
<i>p-value</i>	0.000	0.000
<i>AC(1)</i>	0.0000	0.000
<i>AC(2)</i>	0.0477	0.6588

p-values in Brackets, *, **, *** at 10, 5, and 1 percent level of significance respectively.

Table 7 Two-Step System GMM results

Post Crisis 2009-17		
Dep Variable	BDFR	MDFR
Lag(1)	0.673***	0.481***
	(0.000)	(0.000)
NDTS	-1.193**	-0.239
	(0.030)	(0.550)
TANGB	0.148***	0.137***
	(0.008)	(0.004)
Profitability	-0.518***	-0.939***
	(0.000)	(0.000)
Size	0.0654***	0.115***
	(0.000)	(0.000)
MTB Ratio	0.000367	-0.00910***
	(0.839)	(0.007)
LIQ	0.0271***	0.00701
	(0.000)	(0.277)
Inflation	0.475***	0.798***
	(0.000)	(0.000)
GDP	0.881***	-0.319
	(0.000)	(0.134)
Intercept	-0.674***	-1.020***
	(0.000)	(0.000)
<i>Observations</i>	2047	2047
<i>Fixed Effect</i>	Present	Present
<i>Wald Stats</i>	1972.28	805.63
<i>p-value</i>	0.0000	0.0000
<i>AC(1)</i>	0.0000	0.0000
<i>AC(2)</i>	0.0998	0.1925

p-values in Brackets, *, **, *** at 10, 5, and 1 percent level of significance respectively.

Table 8 Summarized results of the analysis: The table exhibits the comparative description of the significant factors for both the measures of DFR in all the study periods.

	Full Sample			Pre-Crisis			Post Crisis		
	Variables	Sign	Significance	Variables	Sign	Significance	Variables	Sign	Significance
BDFR	BDFR(-1)	Positive	1%	BDFR(-1)	Positive	1%	BDFR(-1)	Positive	1%
	NDTS	Negative	1%	NDTS	Negative	5%	NDTS	Negative	5%
	Tangibility	Positive	1%	Profit	Negative	1%	Tangibility	Positive	1%
	Profit	Negative	1%	Size	Positive	1%	Profit	Negative	1%
	Liquidity	Positive	1%	Inflation	Negative	1%	Size	Positive	1%
	GDP	Positive	1%				Liquidity	Positive	1%
							Inflation	Positive	1%
							GDP	Positive	1%
MDFR	Full Sample			Pre-Crisis			Post Crisis		
	Variables	Sign	Significance	Variables	Sign	Significance	Variables	Sign	Significance
	MDFR(-1)	Positive	1%	MDFR(-1)	Positive	1%	MDFR(-1)	Positive	1%
	NDTS	Negative	1%	NDTS	Negative	5%	Tangibility	Positive	1%
	Tangibility	Positive	1%	Profit	Negative	1%	Profit	Negative	1%
	Profit	Negative	1%	Size	Positive	5%	Size	Positive	1%
	Growth	Negative	1%	Growth	Negative	5%	Growth	Negative	1%
	Liquidity	Positive	1%	Inflation	Positive	5%	Inflation	Positive	1%
	Inflation	Positive	1%						
GDP	Negative	1%							

When the study compared the factors affecting DFR based on Book and Market value of the firm, some difference is observed, consistent with the argument by (Frank and Goyal (2009)). The author mentions in his study that, until now, no theory could explain the reasons for such difference. Therefore, in this study, the results have been discussed in four sections. Section V. (a) describes the results for the full sample for both BDFR and MDFR. Section V. (b). It compares the results for pre and post-crisis for BDFR. Section V. (c) compares the results for MDFR for pre and post crisis.

V(a). Results for 2002-2017:

The results suggest that NDTS, tangibility, profitability and liquidity are consistent determinants of leverage irrespective of the measure of leverage. Growth as defined by MTB ratio and inflation are significant for MDFR, the results are consistent with the theory. GDP, an indicator of economic growth shows a positive relation with BDFR and negative with MDFR. Whereas the positive relation with BDFR is consistent with the theory, the negative relation seems to be mechanical due to the definition

of MDFR since the denominator of MDFR is Market Value of the firm that is found to be high during expansion. As existing research (Frank & Goyal, 2009) suggests that during expansion bankruptcy costs declines and taxable income increases. Further share prices have a positive relationship with GDP. The study confers that leverage of Indian firms increases with tangibility, liquidity and GDP, whereas decrease with NDTS, Profitability and Growth Opportunities. These results are consistent with major previous theories in India and abroad [(Sheridan Titman, 1988); (Rajan, 1995); (Laurence Booth, 2001); (Bhaduri, 2002); (L. M. Bhole, 2005); (Chakraborty, 2010); (Sulagna Mukherjee, 2012); (Basu, 2015).

The positive and high significance of lagged leverage variable, irrespective of measure of leverage in GMM, implies that Indian firms tend to adjust their capital structure to optimum level of debt or ‘Target Leverage’. This is consistent with the results of (G (Basudeb Guha-Khasnobis, 2002), (Bhaduri, 2002) and (Basu, 2015) . This is confirmed in the whole sample and sub sample periods. An interesting observation is that the coefficient on lagged leverage variable is less after the crisis in comparison to the pre-crisis period, suggesting that though crisis did not impact the adjustment process by the firms but it did impact the speed of adjustment and it lowered the speed of adjustment by Indian non-financial firms.

V. (b) Pre and Post-crisis impact on BDFR

With the book measure of leverage, as the dependent variable, it is found that NDTS, profitability and size are significant determinants of leverage during both the periods. NDTS and profitability are negatively related with BDFR suggesting that with high-tax shields, companies do not prefer taking debt as they are not able to reap tax advantage and with high profitability the need for debt reduces. The factors tangibility and liquidity, however, show variation as they are not significant during the pre-crisis period but show significance after the crisis, in the determination of leverage; in confirmation with the theory, both the variables are positively related to leverage. This has an important implication, since, it throws light on the role of institutions and their processes in lending funds to firms. It implies that

NDTS and profitability influence leverage choices made by firms and are unaffected by the crisis. Similarly, size may give some advantage to firms and give large firms easy access to the debt market and hence may be categorized as one influencing firms' choice. In line with the theoretical explanations, high tangibility opens prospects for taking higher debt as it can be kept as collateral with lenders, also liquidity ensures timely payment of interest and principal to lending authorities. These factors can be categorized as ones influencing the institution's decision towards lending. It further implies that the crisis may have caused learning for lenders and their improved processes. Tangibility and liquidity seem to influence lenders' decisions in post-crisis analysis leading to higher leverage for firms with high tangibility and liquidity. The results reveal important information which can also explain the current economic situation of non-performing assets of financial institutions.

Economic indicators show a negative relation of inflation with leverage in the pre-crisis period and positive relation in the post-crisis period. Economic growth measured through GDP does not show significance during the pre-crisis period but shows a positive influence in the post-crisis period.

IV. (c). Pre and Post-crisis impact on determinants of MDFR

Firm's profitability and size remain significant determinants of market leverage in both pre and post-crisis. NDTS is found to be significant in the pre-crisis period and turns insignificant in the post-crisis period. Growth, as measured by MTB ratio, is negatively related to market leverage, inflation is positively related to MDFR and GDP is not significant during both the periods.

V. Summary and Conclusion:

This study tries to seek the answer of two questions viz. "What are important determinants of Debt Financing Ratio (DFR) for Indian non financial listed firms?" "How has sub prime crisis impacted the above-identified determinants?" For this objective, the study identifies significant and consistent firm-specific (NDTS, Tangibility, Size, Profitability, Growth Opportunities and Liquidity) and institutional

specific (Inflation and GDP growth rate) determinants of DFR. DFR has been defined in terms of book and market value of firms. The study collected micro and macro panel data for 306 Indian non financial firms for the period of 2002-2017 and divided the time frame in three-period, i.e. full sample period (2002-2017), Pre-Crisis Period (2002-2008) and Post-Crisis Period (2009-2017). Dynamic Panel Data modeling has been adopted and empirical estimation was done using Two-Step System GMM to estimate the coefficients of the models and their statistical significance. For full sample period, the results show that DFR (for both book and market measures of leverage) of the sample Indian firms increases with increase tangibility and liquidity whereas it decreases with increase in non-debt tax shield and profitability. The positive and high significance of lagged leverage variable, irrespective of measure of leverage implies that Indian firms tend to adjust their capital structure to a 'Target Leverage'. Size is not a significant factor in the full sample period. Growth opportunities (MTB) for the firm, inflation and GDP show inconsistent results with different measures of leverage, partially explained by existing theory.

Profitability and size are robust determinants of leverage in both pre and post-crisis periods. Profitability is found negatively related whereas the size is positively related to leverage. Tangibility is found not relevant in the pre-crisis period whereas it is found statistically significant in the post-crisis period for both measures of leverage. Other factors show inconsistent results for both the measures in full and sub sample periods.

The study has an important finding based on the analysis of Book measure-based model of leverage. The factors tangibility and liquidity show different behavior in pre and post-crisis period. They are not found to be significant during the pre-crisis period but after the crisis, they show significance in the determination of leverage. These findings throw light on the process of financial institutions in lending funds to firms. In line with the theoretical explanations, high tangibility increases prospects for firms for taking higher debt as it can be kept as collateral with lenders and liquidity ensures timely payment of interest and principal amount to lending authorities. These factors can be categorized as influencing the institution's decision towards lending to firms. It further implies that the crisis may have caused a learning for lenders and their improved processes by implementing laid down policies after the crisis.

Tangibility and liquidity seem to influence lending decisions in the post crisis period; leading to higher leverage for firms with high tangibility and liquidity. The results also indicate that it is more appropriate to model liquidity and tangibility as institutional factors rather than firm specific factors affecting capital structure of Indian firms. The results suggest to investigate further the role of tangibility and liquidity on non-performing assets of financial institutions in India.

Annexure 1: Definitions of variables and their proxies:

Dependent Variable: This study has used two measures of leverage one is book and second is the market-based definition. Book Debt Financing Ratio (BDFR) is the ratio of total debt and sum of Total Long-Term Debt and Book Value of Equity. Market Debt Financing Ratio (MDFR) is the ratio of Total Long-Term Debt and the sum of total debt and market value of equity. Long-Term Debt excludes the short term liabilities of the firms.

Immediate past leverage: The proxy for lagged leverage is the leverage at the time (t-1).

Non-Debt Tax Shield (NDTS): The study has taken the ratio of Depreciation to Total Assets.

Tangibility (TANGB): The ratio of Fixed Asset with respect to fixed and non-fixed assets available in the firm, as an attribute for tangibility.

Profitability (PROFIT): The ratio of Earning Before Interest, Tax, Dividend and Amortization of capital expenditure and Total Assets. It is the overall measure of returns on Assets (EBITDA / Total Assets).

Size: Study has used the proxy for Size as a natural logarithmic value of sales after-sales returns.

Market to Book Value (MTB Ratio): In this study market-to-book asset ratio has been used as a proxy for future growth prospect of the firm and it is computed using formula $MTB\ Ratio = (\text{No. of Outstanding shares} \times \text{closing price of share}) / \text{Book Value of Assets}$.

Liquidity (LIQ): Liquidity refers to the convertibility of assets into cash without losing value and delaying in time. The standard measurement of liquidity as the ratio of Current Asset to Current Liabilities, hence, this study considered the standard measure of liquidity for this attribute.

Inflation: Study has taken the change in consumer price index as a proxy for inflation.

Domestic GDP growth rate (GDP): This study has considered this factor to account the business cycle and included GDP as a proxy for the state of the business cycle in the economy.

Annexure 2: Unit root test for stationarity

Null Hypothesis: The series contains unit root Alternate Hypothesis: Series does not contain unit root				
Variables	Method	T-Stat.	P-Value	Description
BDFR	Levin, Lin & Chu	-640.972	0.00	At Level with intercept
	PP - Fisher Chi-square	746.524	0.00	
MDFR	Levin, Lin & Chu	-1936.01	0.00	At Level with intercept
	PP - Fisher Chi-square	966.736	0.00	
NDTS	Levin, Lin & Chu	-18.3853	0.00	At Level with intercept
	PP - Fisher Chi-square	983.898	0.00	
TANGB	Levin, Lin & Chu	-23.8669	0.00	At Level with intercept
	PP - Fisher Chi-square	903.542	0.00	
Profit	Levin, Lin & Chu	-6.36784	0.00	At Level with intercept
	PP - Fisher Chi-square	1047.75	0.00	
Size	Levin, Lin & Chu	-17.5225	0.00	At Level with intercept
	PP - Fisher Chi-square	935.153	0.00	
MTB	Levin, Lin & Chu	-67.3682	0.00	At Level with intercept
	PP - Fisher Chi-square	976.017	0.00	
GDP	Levin, Lin & Chu	-41.1177	0.00	At Level with intercept
	PP - Fisher Chi-square	3356.94	0.00	
Inflation	Levin, Lin & Chu	-8.60108	0.00	At Level with no intercept and trend
	PP - Fisher Chi-square	451.14	0.00	

Annexure 3: The results of Arellano Bond Autocorrelation for lag (1) and lag (2).

H₀: No autocorrelation in first or second differenced errors.

H_a: Autocorrelation in first or second differenced errors.

Table 4 Arellano Bond Autocorrelation for lag (1) and lag (2).

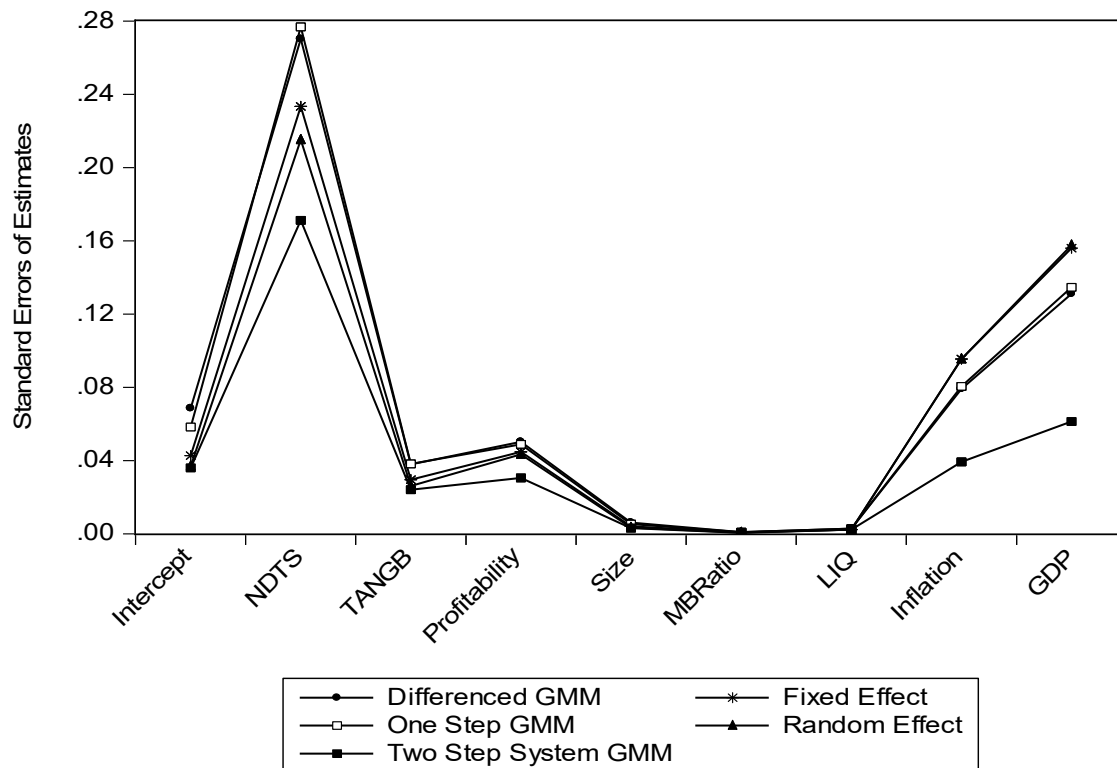
Variables		Full sample period (2002-2017)		Pre- Crisis (2002-2008)		Post -Crisis(2009-2017)	
(criterion)		Z – Statistics	Prob > z (Prob.-value)	Z – Statistics	Prob > z (Prob.-value)	Z – Statistics	Prob > z (Prob.-value)
Book value measure of leverage	Lag(1)	-8.4658	0.0000***	5.1393	0.0000***	4.8113	0.0000***
	Lag(2)	-1.3425	0.1794	1.9804	0.0477	1.6459	0.0998
Market value measure of leverage	Lag(1)	-11.047	0.0000***	-6.7923	0.0000***	-6.4636	0.0000***
	Lag(2)	0.1071	0.9147	0.44158	0.6588	-1.3032	0.1925

*** represents rejection of null hypothesis at 1 percent level of significance.

Annexure 4(a): Standard Errors with Pooled, GMM and Two-Step System GMM

Variables	Fixed Effect	Random Effect	Differenced GMM	One Step GMM	Two-Step System GMM
Intercept	0.043	0.037	0.069	0.058	0.036
NDTS	0.233	0.215	0.270	0.277	0.171
TANGB	0.030	0.026	0.038	0.038	0.024
Profit	0.045	0.043	0.050	0.049	0.031
Size	0.004	0.003	0.006	0.005	0.003
MB Ratio	0.001	0.001	0.001	0.001	0.001
LIQ	0.002	0.002	0.003	0.003	0.002
Inflation	0.095	0.095	0.079	0.080	0.039
GDP	0.156	0.158	0.131	0.135	0.061

Annexure 4(b) Comparisons of Standard Errors



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