Macroeconomic risk and firms financing decision: An empirical panel data investigation using system GMM

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Abstract

This paper investigates the effect of macroeconomic risk on the capital structure decisions of the non-financial Indian firms over a period of 2002-2014, using a panel robust two-step system-GMM estimator as given in Blundell and Bond (1998) to address the problem of endogeneity. Macroeconomic risk (conditional volatility) is estimated by fitting EGARCH (1, 1) model to India's real exchange rate, and inflation rate. The results indicate that foreign exchange risk and inflation risk have the sizable and statistically significant negative impact on firms' leverage decision. Profitability of firms has negative relation with the leverage decision hence proving pecking order theory in Indian markets. Further, firms are divided into two groups based on their sensitivities to foreign exchange and inflation. It is found that there is significant difference in leverage ratio of the firms that are affected by foreign exchange or inflation risk and those which are not affected by foreign exchange or inflation risk. The firms sensitive to foreign exchange and inflation risk have a lower percentage of total assets financed by debt. This study will be useful to managers in designing their financing strategy and derivative usage strategy.

Keywords: *Inflation risk, foreign exchange risk, capital structure, System GMM*

JEL codes: C23, C26, C58, G32

1. Introduction

Firms in developing economy are highly sensitive to macroeconomic risk since they face high macroeconomic volatility. Therefore, risks associated with macroeconomic conditions are crucial for asset valuation. According to Gertler and Hubbard (1993) "If firms did not have to forgo the tax subsidy for debt, they would opt for a financial structure with greater insulation against aggregate risks". Unlike the firm-specific risk, the existing theories of capital structure do not lay greater stress on how firm capital structure relates to unpredictable variations in macroeconomic conditions. According to Gertler & Hubbard (1993) firms can mitigate the unfavorable effects of idiosyncratic risks but they can't able to overcome systematic macroeconomic risk exposures completely. Therefore, firms prefer equity to debt financing so as to share at least some of the systematic risk with their outside investors when macroeconomic risk is high. While taking the optimal capital structure decision of the firm, it is important to look at both the magnitude and the stability of the firm's cash flows relative to the fixed charges associated with the use of debt. If a firm cash flow is highly sensitive to (highly correlated with macroeconomic volatility) systematic risk, it would not be able to justify higher leverage in its capital structure, as probability of default behaves countercyclical for firms with high response to macroeconomic conditions. According to Chen(2010) if a firm in an economy has low default probability, less idiosyncratic risk but if a firms cash flows are highly correlated with macroeconomic volatility then firms should maintain less debt in their capital structure as firms cash flows will be highly variable during economic downturn and loses will be difficult to bear. There are two types of systematic shocks that a firm faces in an economy (1) random small shocks that follows Brownian motion which affect the cash flows(for e.g Foreign exchange risk, Inflation risk etc) and (2) large shocks or jump risk that change the conditional moments of growth rates of the economy(factors which change the state of the economy). Although a firm has lower default probability, but it is highly sensitive to either form of the risk or both form of the risk. Then investors ask for higher risk premium. Moreover, firms' cash flows as well as expected tax shield due to debt in their capital structure are discounted by higher risk adjusted discount rate. This makes leverage less attractive for firms.

Therefore, in view of the importance of macroeconomic volatility on firms' cash flow and its effect on financing policy, present study aims to investigate the impact of inflation and foreign exchange rate volatility on the capital structure decisions of the firms.

This paper is organized into following sections, Section 2 documents the literature review, section 3 covers data and methodology used. Section 4 presents the empirical results and section 5 concludes the study.

2. Literature review

Pioneering work in modern theory of capital structure began with the famous proposition of Modigliani & Miller (1958) they postulated that in the perfect financial market the value of a company is not affected by its financing choice. It is based on certain sets of assumptions. Followed by MM's proposition, following theories; Static trade-off, Pecking order, Agency cost and Market timing, postulates that financing decision has an impact on firm value where they have considered some of the market imperfections. All the above mentioned theories (except market timing) of capital structure do not lay much emphasis on the impact of unpredictable variations of macroeconomic conditions on leverage decisions. Later on with the work of Choe & Nanda (1993), Gertler & Gilchrist (1994) importance of macroeconomic conditions on firms financing decisions was highlighted. Gertler & Hubbard (1993) said that firms can mitigate adverse effects of idiosyncratic risk however; they cannot be fully insulated from macroeconomic risk exposures. Therefore, firms prefer equity to debt so as to share at least some of the macroeconomic risk with their outside investors. Bernanke & Gertler, (1995) studied the impact of monetary policy on the cost of borrowing. Leahy & Whited (1996) showed that uncertainty reduces investment. Korajczyk & Levy (2003) finds that financially constrained firms behave differently to uncertainty than unconstrained firms. Hatzinikolaou, Katsimbris & Noulas (2002) studied the impact of inflation risk on firms' debt-equity ratios they find that inflation risk has a significant negative effect on a firm's debt-equity ratio.

However, some of the recent studies, of Hackbarth, Miao, & Morellec (2006), Hennessy, Levy, & Whited (2007), Baum, Stephan, & Talavera (2009) show that for a set of large US non-financial firms an increase in macroeconomic risk leads to a significant decrease in firms' optimal short-term leverage. They used conditional volatility of change in GDP growth rates as an indicator of macroeconomic risk. Bhamra, Kuehn & Strebulaev (2010), put forward that

macroeconomic uncertainty have a significant negative impact on firms' financing decisions. He used dynamic capital structure framework and showed that firms financing decisions were significantly related to macroeconomic conditions. Hackbarth, Miao, & Morellec (2006) documented that debt financing decision of firm's exhibits pro-cyclicity and showed that both the pace and the size of capital structure changes depend on macroeconomic conditions. Levy & Hennessy (2007) examined firms' financing choices in a general equilibrium framework and showed that firms are more likely to reduce their outstanding debt in periods of weak macroeconomic conditions. Baum, Stephan, & Talavera (2009) developed a dynamic partial equilibrium model of a firm's optimal target leverage and predicted a negative relationship between macroeconomic uncertainty and debt/assets ratio. Chen (2010) used a structural model to show that both small Brownian risk and large jump risk in macroeconomic conditions affect leverage decisions of the firms. According to him, firms whose cash flows are highly correlated with macroeconomic factors, their losses are more concentrated in bad times and investors expect higher risk premia therefore, making it imperative for firms to maintain low leverage in their capital structure, even if their idiosyncratic risk is less. From the above studies, it can be inferred that macroeconomic risk has a significant impact on firms' leverage.

The literature discussed above examined the impact of inflation, GDP growth rates on the capital structure of the firms, however, impact of both foreign exchange risk and inflation risk have not been studied in detail. Therefore, the present work is an attempt to investigate the effect of foreign exchange risk and inflation risk caused by small Brownian shocks on capital structure decision of the firms.

3. Data and Methodology

In the present study a sample of firm-year observations is obtained from CMIE Prowess database (Prowess reports the financial performance of Indian firms) over a sample period of 2002-2014. Companies listed on S&P BSE 500 is taken in present study. Consistent with the past literature Fama & French (2002); Frank & Goyal (2003) and Korajczyk & Levy (2003) financial firms have been excluded from the data (as their financing and risk taking strategy differ from non-financial firms). Only those firms were retained whose consistent data is available from 2002 to 2014. 1% Winsorization of the data is done to remove the outliers therefore total sample of 337 firms were included in the study.

In this study, panel system GMM of Blundell & Bond (1998) is used. This methodology is suitable when number of years (considered in the study) is few and number of firms is large. In the dynamic panel data framework lagged dependent variable is highly correlated with panel level effects therefore it makes standard errors estimation highly inconsistent and hence OLS method of estimation cannot be used. Therefore, Arellano and Bond estimator is used which first difference the equation to remove the fixed effects and then use instruments to form moment conditions. According to Blundell & Bond (1998) lagged level instruments used in Arellano and Bond estimator becomes weak if variance in panel level effects to variance in idiosyncratic effect becomes large. System GMM is the augmented version of GMM. According to Blundell & Bond (1998) Lagged levels are often poor instruments for first differences, especially for variables that are close to a random walk. Thus, the original equations in levels can be added to the system, and the additional moment conditions could increase efficiency. In these equations, predetermined and endogenous variables in levels are instrumented with suitable lags of their own first differences. The system GMM estimator improves precision and also reduces the finite sample bias problem.

Following models are estimated in the present study:

Model 1

$$BVDTA_{it} = \beta_1 * BVDTA_{it-1} + \beta_2 * fx_{it-1} + \beta_3 * Inf_{it-1} + \beta_3 * Cashtasset_{it-1} + \beta_4 * Tanasset_{it-1} + \beta_4 * Ebitasset_{it-1} + \beta_5 * Ebitasset_{it-1}{}^2 + \beta_5 * Logasset_{it-1} + \beta_6 * Inf * Ebitasset + Rdta_{t-1} + \mu_i + \varepsilon_{it} \quad (1)$$

Model 2

$$LTDNW_{it} = \beta_1 * LTDNW_{it-1} + \beta_2 * fx_{it-1} + \beta_3 * Inf_{it-1} + \beta_3 * Cashtasset_{it-1} + \beta_4 * Tanasset_{it-1} + \beta_4 * Ebitasset_{it-1} + \beta_5 * Ebitasset_{it-1}{}^2 + \beta_5 * Logasset_{it-1} + \beta_6 * Inf * Ebitasset + Rdta_{t-1} + \mu_i + \varepsilon_{it} \quad (2)$$

Model 3

$$STDTA_{it} = \beta_1 * STDTA_{it-1} + \beta_2 * fx_{it-1} + \beta_3 * Inf_{it-1} + \beta_3 * Cashtasset_{it-1} + \beta_4 * Tanasset_{it-1} + \beta_4 * Ebitasset_{it-1} + \beta_5 * Ebitasset_{it-1}{}^2 + \beta_5 * Logasset_{it-1} + \beta_6 * Inf * Ebitasset + Rdta_{t-1} + \mu_i + \varepsilon_{it} \quad (3)$$

Where, $BVDTA$ denote book value of debt to total assets, $LTDNW$ represents long-term debt to net worth and $STDTA$ represents short term debt to total assets, fx denote foreign exchange risk, Inf denote inflation risk, $Cashtasset$ denote total cash and cash equivalents divided by total assets of the firm, $Tanasset$ denote tangible assets divided by the total assets of the firm, $Ebitasset$ denote earnings before interest and taxes divided by total assets. $Logasset$ denote log of total assets held by the firms(a proxy used for size of firm) and $Rdta$ denotes research and development expenses divided by total assets of the firm, μ denote firm fixed effect , ε denote error term, i denotes firms included in the study and t denote time period considered in the study.

$BVDTA$ is used in the present study because as documented by Myers (1977), focus of managers is on book leverage because debt is better supported by assets in place than the growth opportunities. According to him book leverage is also preferred as there is high fluctuation in financial markets and it is believed that market leverage numbers are unreliable as for framing corporate financial policy. Apart from BVDTA, $LTDNW$ long term debt to net worth and STDTA short term debt to total assets is also used in the present study.

3.1 Estimation of inflation risk and foreign exchange risk variable

Inflation risk and foreign exchange risk is estimated by using conditional volatility[1] obtained from Nelson (1991) exponential EGARCH model. 36-currency trade weighted real monthly real effective exchange rate[2] and WPI (whole sale price index) inflation from handbook of statistics

[1] Monthly conditional volatility obtained from the model is annualized.

[2] The real effective exchange rate (REER) is the weighted geometric average of the bilateral real exchange rates of home currency in terms of foreign currencies. Any increase in these indices indicates appreciation of Indian currency against basket of foreign currencies.

on Indian economy published by Reserve bank of India (RBI) is taken for the analysis. Period considered for the analysis is February 1997 to May 2015.

$$R_t = \alpha + \varepsilon_t \quad (4)$$

Where, $\varepsilon_t|\Omega \sim iid(0, h_t)$

$$log(h_t) = \omega + \sum_{j=1}^{q} \alpha_j \left[\left|\frac{\epsilon_{t-j}}{\sqrt{h_{t-j}}} - E\left(\frac{\epsilon_{t-j}}{\sqrt{h_{t-j}}}\right)\right|\right] + \sum_{k=1}^{m} \delta_k \frac{\epsilon_{t-k}}{\sqrt{h_{t-k}}} + \sum_{i=1}^{p} \beta_i h_{t-i} \quad (5)$$

Where, $\omega > 0$, $\alpha_i + \beta_i < 1$, $\delta_k < 0$ if volatility is asymmetric, R_t represents return, ε_t denote error term, δ_k is asymmetric coefficient, α_j represents ARCH term and β_i represents GARCH term and h_t represents volatility.

3.2 Importance of risk variables used in the study

Inflation affects the earning volatility of the firm. It affects the firm's price and cost structures, it also affects firm's sales structure due to change of consumption pattern in the economy and hence it makes firms earning volatile. Inflation uncertainty increases the volatility of the firm's operating income and the probability of insolvency. When managers of a firm is deciding optimal capital structure of the firm, it is important for them to look at both the magnitude and the stability of the firm's cash flows relative to the fixed charges associated with the use of debt. The greater the inflation uncertainty, the higher the firm's risk and it should have lower debt-to-equity ratio. Therefore, it will be suitable for a firm which has high correlation to inflation volatility to maintain flexibility and preserve some unused debt capacity for the future. If a firms cash flows are highly correlated with change in inflation conditions in the economy then inflation uncertainty also makes the tax shield due to debt in capital structure more uncertain, as more debt is used, beyond some point, the tax savings associated with the use of debt will become highly uncertain. There is also a pervasive effect of inflation risk on capital budgeting decisions. Inflation risk makes the expected cash flows from investment projects more uncertain hence

projects will be evaluated at high discount rates as a result taking up projects will become costlier hence fewer projects are undertaken, and growth of the firm will be affected.

3.3 Foreign exchange risk and its impact on leverage decisions

It is evident from structural model of Chen(2010) that both jump risk[3] and Brownian risk[4] are important for determination of leverage ratio of the firm. Where, volatility in exchange rate constitutes the jump risk component. Theoretical risk management literature emphasizes the impact of exchange rate risk on corporate cash flows motivating corporate risk management in the presence of capital market imperfections such as bankruptcy costs, a convex tax schedule Smith & Stulz (1985), or underinvestment problems Bessembinder (1991), Froot, Scharfstein, & Stein (1993) Some of the important work related to impact of exchange rates exposure on cash flow is of Shapiro (1975) Hodder (1982) Adler & Dumas (1984) Flood & Lessard, (1986). The structural models of the foreign exchange rate exposure of firms as in Bodnar & Marston (2002) typically assume the following relationship:

$$\frac{d\ ln\ V}{d \ln S} = \frac{d \ln CF}{d \ln S}$$

Where, V is firm value, S is the exchange rate, and CF is a cash flow measure of the firm Hence, high foreign exchange risk volatility affects firm cash flow volatility (which constitutes the Brownian risk component) and hence it affects firms leverage decisions. If firm cash flows, are highly volatile, that will affect firm's bankruptcy risk and hence leverage decisions. Therefore, foreign exchange risk component is used in the present study.

[3] Jump risk is large shocks in the economy that change the conditional moments of growth rates over the business business cycle.

[4] Brownian risk is the small random shocks that affect the cash flows of the firm.

4 Results

Table 1

Summary Statistic												
Variable	**Fx risk**	**Inflation risk**	**Cashtasset**	**Bvdta**	**Tanasset**	**Ebitasset**	**Logasset**	**Rdta**	**Ndtsta**	**Pb**	**De**	**Stdta**
Mean	0.05	0.39	0.08	0.23	0.27	0.26	9.71	0	0.03	4.11	2.2	0.27
Std. Dev.	0.01	0.13	0.11	0.23	0.18	4.59	1.65	0.01	0.02	6.29	6.72	0.17
Min	0.04	0.29	0	0	0	-3.48	-0.22	0	0	-48.13	0	0
Max	0.07	0.79	0.91	8.56	0.92	276.5	13.93	0.16	0.27	121.96	43	1.01
LLC Test	-48.73***	-6.56***	-24.68***	-29.00***	-40.61***	-17.07***	-35.15***	-27.00***	-40.05***	-18.73***	-13.00***	-19.79***
IPS	-29.62***	-2.42***	-10.97***	-36.00***	-13.49***	-7.07***	-8.90***	-30.00***	-16.81***	-5.91***	-20.00***	-6.93***
2002	0.052	0.544	0.061	0.266	0.333	1.350	8.417	0.005	0.036	2.528	14.381	0.252
2003	0.051	0.574	0.071	0.252	0.324	0.171	8.636	0.004	0.036	3.392	4.304	0.265
2004	0.052	0.540	0.083	0.238	0.305	0.174	8.839	0.005	0.033	4.089	1.105	0.281
2005	0.046	0.536	0.098	0.235	0.284	0.176	9.129	0.005	0.030	5.659	0.901	0.276
2006	0.053	0.568	0.094	0.235	0.274	0.187	9.424	0.004	0.027	5.101	1.349	0.271
2007	0.044	0.672	0.080	0.221	0.260	0.184	9.711	0.004	0.025	4.850	0.759	0.273
2008	0.066	0.605	0.092	0.235	0.262	0.172	9.877	0.004	0.024	2.548	0.915	0.267
2009	0.062	0.704	0.091	0.239	0.256	0.156	10.029	0.005	0.025	4.596	0.762	0.267
2010	0.043	0.614	0.086	0.212	0.251	0.157	10.208	0.005	0.024	4.308	0.763	0.271
2011	0.051	0.891	0.078	0.218	0.248	0.157	10.355	0.005	0.024	3.940	0.795	0.275
2012	0.073	0.545	0.073	0.212	0.249	0.152	10.461	0.006	0.025	3.562	0.818	0.277
2013	0.066	0.633	0.065	0.205	0.252	0.161	10.552	0.006	0.025	4.267	0.871	0.280
2014	0.052	0.564	0.067	0.204	0.252	0.162	10.559	0.006	0.025	4.549	0.871	0.280

- ***, **, * denote significance at 1%, 5% and 10% respectively.
- LLC denote Levin-Lin-Chu unit-root test, which has null hypothesis that panel contain unit roots.
- IPS denotes Im-Pesaran-Shin unit-root test, which has null hypothesis that all panels contain unit roots.
- Where, Fx denote foreign exchange risk, Inf denote inflation risk, Cashasset denote total cash and cash equivalents divided by total assets of the firm, Tanseet denote tangible assets divided by the total assets of the firm, Ebitasset denote earnings before interest and taxes divided by total assets. Logasset denotes log of total assets held by the firms and Rdta denotes research and development expenses divided by total assets of the firm

Descriptive statistics for various variables are presented in Table 1. The mean foreign exchange risk is 0.05 and inflation risk is 0.39, where inflation risk has higher level of variation as compared to foreign exchange risk. Average debt –equity (DE) ratio is 2.20 over the span of 13 years. And it is observed that DE ratio is decreasing over the sample period considered.

Table 2

Variation between and within data			
Variables	**Overall**	**Between**	**Within**
Fx	0.008	-	0.008
Inf	0.133	-	0.133
Cashtasset	0.114	0.092	0.067
Bvdta	0.231	0.167	0.160
Tanasset	0.178	0.153	0.090
Ebitasset	4.59	1.27	4.412
Logasset	1.65	1.414	0.861
Rdta	0.011	0.010	0.005

It is observed from above Table 2 that there is enough variation in all control variables both within and between hence pooled methodologies of panel data estimation cannot be used in the present study.

Table 3

Correlation Table										
Varibles	**FX**	**Inf**	**Cashtasset**	**Tanasset**	**Ebitasset**	**Logasset**	**Rdta**	**Ndtsta**	**Quick**	**Pb**
FX	1									
Inf	-0.071	1.000								
Cashtasset	-0.017	0.004	1							
Tanasset	-0.045	-0.070	-0.267	1.000						
Ebitasset	-0.007	-0.014	0.067	-0.029	1					
Logasset	0.171	0.180	0.034	-0.023	-0.108	1.000				
Rdta	0.020	-0.002	-0.030	0.018	-0.006	-0.049	1			
Ndtsta	-0.045	-0.089	-0.123	0.565	-0.021	-0.171	0.022	1.000		
Quick	-0.010	-0.017	0.416	-0.102	0.008	-0.113	-0.002	-0.001	1	
Pb	-0.058	0.005	0.120	-0.146	0.002	-0.077	0.020	-0.048	-0.050	1

It is observed from Table 3, that foreign exchange risk has negative correlation with cash, tangibility, profitability measure, price to book value (Pb) and non debt tax shield (Ndtsta). But both inflation risk and foreign exchange risk are positively related to size (proxy used for size of the firm logasset). Therefore it can be inferred that large size firm tend to be more exposed to foreign exchange risk and inflation risk. Inflation risk is negatively related to asset tangibility

(Tanasset), profitability (Ebitasset), measure of uniqueness (Rdta), non debt tax shield(Ndtsta) and liquidity(quick). However, it is positively related to growth of the firm(Pb).

Table 4

Estimation Results			
Variables	**BVDTA**	**LTDNW**	**STDTA**
Lagged dependent variable	0.122** [0.057]	0.174** [0.088]	0.898*** [0.025]
FX_{t-1}	(0.970)*** [0.269]	(4.29) [2.928]	0.316*** [0.099]
Inf_{t-1}	(0.119)*** [0.015]	(0.337)*** [.097]	(0.003) [0.007]
$Cashtasset_{t-1}$	(0.151)*** [0.044]	(0.827) [0.478]	0.048*** [0.016]
$Tanasset_{t-1}$	0.353*** [0.055]	1.030*** [0.415]	(0.027)** [0.016]
$Ebitasset_{t-1}$	(0.002)*** [0.0005]	(0.006)*** [0.002]	(0.0004)*** [0.0001]
$Logasset_{t-1}$	0.027*** [0.002]	0.088*** [0.022]	0.0007 [0.0008]
Ebitassett*Ebitasset	0.487*** [0.017]	0.006 [.148]	(0.029)*** [0.007]
Inf*Ebitasset	(1.165)*** [0.088]	(0.758) [1.412]	(0.017) [0.036]
$Rdta_{t-1}$	(0.801)*** [0.453]	(5.366)*** [2.35]	0.118 [0.085]
Model Diagnostic Tests			
Wald Test	860.60***	266.32***	530***
AR(1)	(3.98)***	(1.963)**	(9.01)***
AR(2)	-0.99	0.309	-0.379
Sargan test statistic	67.5	62.2	45

- *** , **denote significance at 1% and 5% respectively.
- () denote negative values, vales in [] denote standard errors.
- Where, Fx denote foreign exchange risk, Inf denote inflation risk, Cashasset denote total cash and cash equivalents divided by total assets of the firm, Tanseet denote tangible assets divided by the total assets of the firm, Ebitasset denote earnings before interest and taxes divided by total assets. Logasset denotes log of total assets held by the firms and Rdta denotes research and development expenses divided by total assets of the firm.
- Wald test is used to check the null hypothesis that all the coefficients estimated in the model is equal to 0. Wald test statistic follows chi-square distribution.
- AR(2) test denote the Arelleno and Bond second order correlation in the residuals.
- Sargan test statistics check the instruments validity.

Table 4 reports the results of the dynamic model estimated with panel System GMM methodology. It is observed from above table that total debt, long-term debt and short-term debt levels are persistent. Where, persistence in short-term debt usage is very high. This means, a firm that uses high level of short term debt in the past continues to use high levels in the future also and vice-versa. The study finds that foreign exchange risk is negatively affects total debt and positively affects the short-term debt levels. Therefore, it can be inferred that firms that face high foreign exchange risk, they tend to take lower total debt in their capital structure, however, favor short-term debt. High level of inflation risk is negatively related to all the three measure of debt considered in the study. Therefore, it can be inferred that firms that are highly sensitive to the inflationary environment tend to have lower debt in their capital structure. It vindicates trade-off theory, which postulates that firms that have more volatile cash flows; their tax shield will not be fully utilized. They face higher cost of financial distress and therefore, should use less debt. The current results are in accordance with the following studies; Chung (1989) showed negative relation between capital structure and the beta (measure of risk) and Chen(2010) who documented the negative relation between both large shocks faced by firms in the economy and the small Brownian shocks faced by the firm due to the random movements in foreign exchange rate volatility and inflation volatility.

The current study finds that firms that maintain high level of liquidity tend to have lower total and long-term leverage in their capital structure. However, the relation between short-term debt and liquidity is positive. Relation between tangibility and leverage is positive this means firms that have large tangible assets they tend to gear-up their capital structure more. As the level of information asymmetry and bankruptcy cost are less since tangible assets makes firms suffer a smaller loss of value when firms go into distress. This finding is in agreement with the studies undertaken by Rajan & Zingales (1995), and Titman & Wessels (1988). Hence, vindicating the trade-off hypothesis that tangible assets act as collateral and provide security to lenders in the event of financial distress. Thus, firms with higher tangible assets are expected to have a high level of debt in their capital structure and relation is stronger in case of long term leverage considered. It is also observed that short-term debt and tangibility have negative relation. Profitability measure is negatively related to leveraging in the capital structure hence vindicating

Pecking order theory in Indian context. However, profitability square has positive sign representing that firms that have high profitability, they tend to take more debt to overcome the agency problem. Stulz (1990) postulates that debt mitigates shareholder manager conflicts therefore, as level of profitability increases chances of shareholder manager conflict is expected to increase, but debt can act as a discipline for the managers. Jensen & Meckling (1976) argue that choosing the debt instead of equity allows keeping the insiders' fraction of equity high and thus improves their incentive to work in the interests of shareholders. Following, studies documented negative relation between profitability and debt level; Titman & Wessels (1988), Rajan & Zingales (1995), Fama & French (2002) , Kester (1986), Booth, Aivazian, Demirguc-Kunt, & Maksimovic (2001) and Wiwattanakantang (1999). The present study finds that size of the firm is positively related to leverage of the firms. According to Rajan & Zingales (1995) large-sized firms should have more debt since larger firms are more diversified and have lower default risk. They are also expected to incur lower costs in issuing debt. Following studies supports the above finding; Lasfer (1995), Rajan & Zingales (1995), and Rajan & Zingales (1995) according to them, size can act as a proxy for the information that outside investors have, as large firms disclose more transparent information than small firms, hence the firms can have easy access to debt financing at lower cost. It is observed that, R&D expenses are negatively related to both total leverage and long term leverage in the capital structure of the firms. Therefore, it can be inferred that R&D expenses a proxy for uniqueness of the firm contributes negatively to total-debt and long-term debt in the capital structure. These results can be supported by following studies; Titman (1984) argues that firms making unique products will lose customers if they appear likely to fail therefore; they take less debt in their capital structure. Maksimovic and Titman (1991) consider how leverage affects a firm's incentives to offer a high-quality product.

If we differentiate the interaction term (it will help in analyzing the effect of inflation risk on leverage conditional on profitability) in equation1 with respect to inflation risk, we get the following result;

$$\frac{\partial BVDTA_{i,t}}{\partial Inf_{i,t}^{firm}} = \beta_6 * Ebitasset_{i,t-1} \quad (6)$$

It is observed from Table 4, and equation 6 that as the profitability of the firm increases the adverse effect of inflation uncertainty on firms leverage decreases.

Table 5

Estimation results (2007-2012)	
Variables	**BVDTA**
Lagged dependent variable	0.5414558*** [.1530512]
FX_{t-1}	(3.628808)*** [.1001149]
Inf_{t-1}	(.0022409) [.0012]
$Cashtasset_{t-1}$	(.3314629) [.3045293]
$Tanasset_{t-1}$	(0.001238) [.00856343]
$Ebitasset_{t-1}$	(0.2322967)* [.4718958]
$Logasset_{t-1}$	.0540545*** [.020311]
Model Diagnostic Tests	
Wald Test	860.60***
AR(2)	0.22502
Sargan test statistic	67.5

***, **, * denote significance at 1%, 5% and 10% respectively.

To analyze the robustness of the results, sample period of 2007 to 2012 is considered (this time period also a recession time).It is observed from Table 5 that during recession, sensitivity of leverage to foreign exchange risk is increased. Rest of the variables except tangibility has the same sign in the whole sample period considered.

4.1 In order to check the difference in financing pattern of firms, according to sensitivity of firm's total risk to foreign exchange rate and inflation rate. Following GARCH model is estimated:

$$R_t = \mu_t + \varepsilon_t \quad (7)$$

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i \epsilon_{t-1}^2 + \sum_{j=1}^{p} \beta_i \sigma_{t-j}^2 + \gamma_1 * fx + \gamma_2 * \text{Inf} \quad (8)$$

Where, R_t represents returns of asset under consideration, μ_t represents mean return, ε_t represents error term, σ_t^2 represents volatility at time t, α_0 represents constant term, α_i represents coefficient of ARCH term, q represents lags of innovation term used in the model , β_i represents coefficient of GARCH term and p represents lags of volatility taken in model, fx denotes foreign exchange rate and Inf represents inflation rate(where Fx and Inf is taken as exogenous variables in volatility equation 8). Equation 7 and 8 are estimated for the sample of the firms considered in the study. Firms are divided into two groups according to their sensitivity to foreign exchange risk(group 1-firms that show significant foreign exchange sensitivity and group 2- firms that are insignificant to foreign exchange) . Similarly firms are divided into two groups according to their sensitivity to inflation rate. Student t-test statistic estimated using bootstrap methodology as the TDTA is not normally distributed. The significance level was determined using the confidence interval obtained from the bootstrapping distributions to test following hypothesis:

H_0: There is no significant difference between BVDTA[5] in group[6]1 and group 2[7] firms.

H_1: There is significant difference between BVDTA in group1 and group 2 firms.

[5] Book value of debt to total assets
[6] Group 1- firms sensitive to foreign exchange rate
[7] Group2- firms that show insignificance to foreign exchange rate.

Table 6

Test Used(using Bootstrap)	Variable	Test statistic	Degree of freedom	P-value
T-Test	BVDTA	-6.998	4297	0.00

Table 6 depicts that null hypothesis is rejected and alternate is accepted hence we can say that there is significant difference between leverage levels of group 1 and group 2 firms.

Difference in leverage decisions of group 1[8] and group 2[9] firms is also analyzed with the Non-parametric Mann-Whitney U test and Kolmogorov-Smirnov test are also used.

Table 7

S.no	Null Hypothesis	Test	Sig.	Decision
1	The distribution of BVDTA is across categories of group 1 and group 2	Independent-Samples Mann-Whitney U test	**0**	Reject the null
2	The distribution of BVDTA is across categories of group 1 and group 2	Independent-Samples Kolmogorov-Smirnov Test	**0**	Reject the null

Asymptomatic significances are displayed. The significance level is .05. Group 1 represents firms sensitive to foreign exchange rate and Group 2 represents firms that show insignificance to foreign exchange rate.

Table 7 reports the results of Mann-Whitney U test and Kolmogorov- Smirnov Test estimated using SPSS version 20. Results in Table 7 also reject the null hypothesis of no significant

[8] Group 1- firms sensitive to foreign exchange rate

[9] Group2- firms that show insignificance to foreign exchange rate.

difference between BVDTA[10] in group1 and group 2 firms. Hence, accepting the alternate hypothesis that there exist significant difference between BVDTA in group1 and group 2 firms.

5. Conclusion

This paper studies the impact of foreign exchange risk and inflation risk, caused by small Brownian shocks, on the capital structure decision of Indian firms. The study covers a time span of 13 years from 2002 to 2014. 337 non-financial Indian firms listed on S&P BSE 500 have been studied. It is observed that both inflation risk and foreign exchange risk negatively affect the firms' leverage decisions. The control variables used in the study indicate that profitability of firms negatively affects leverage decision, the results are in accordance with following studies; Titman & Wessels (1988), Rajan & Zingales (1995), Fama & French (2002) and Titman & Wessels (1988). However, squared profitability positively affects the leverage decision of the firms. It also finds that in order to maintain a high level of liquidity, the firms try to keep lower total and long-term leverage in their capital structure. Firms maintaining high liquidity use short-term financing options. Higher tangible assets in a firm, allow use of more debt in their capital structure. Firms incurring high investments in R&D take less debt. It is also observed that adverse effect of inflation risk mitigates with the increase in the level of profitability. Therefore, it is inferred that foreign exchange risk and inflation risk affect the leverage decisions of the firms.

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