Indian Journal of Finance and Economics
Vol. 1, No. 1, **2020** : 1-23

URL : www.arfjournals.com

ARF INDIA
Academic Open Access Publishing
www. arfjournals. com

EFFECT OF MARKET, EXCHANGE RATE AND INTEREST RATE RISKS ON BANKS ACCOUNTING VARIABLES: Evidence from India

Ajay Kumar Mishra[1*] and Trilochan Tripathy[2]

[1] *Assistant Professor of Finance, Vinod Gupta School of Management, Indian Institute of Technology- Kharagpur, Kharagpur 721 302,WB, India*
**Corresponding Author E-mail: akmishra@vgsom.iitkgp.ac.in*
[2] *Professor of Finance, Xaiver School of Management (XLRI), Jamshedpur 831001, JH, India*
E-mail: trilochan@xlri.ac.in

Received : 16 June 2020; Revised : 21 June 2020; Accepted : 27 July 2020; Published : 14 Sept. 2020

Abstract: This study revisitsthe association between the market, exchange rate and interest risk measuresand accounting variables of the 36 major Indian banks. Using data from April, 2001 to March 2015, we investigate such relationships following two step procedure. First, we use multi-index GARCH model to estimate the risk measures of market, interest rate and nominal effective exchange rate (NEER). In the second stage, regression analysis is conducted to find out the relationship between these risks measures with the banking sector specific financial ratios.The first stage analysis results show that market risk measures are consistently significant for entire study period. We also find significant association of these risk measures with the financial ratios for the Indian banks.

Keywords: Banking Sector;Exchange Rate;Interest Rate; Market Risk.

JEL Classification: G12; G21; C52

1. INTRODUCTION

Banks and financial institutions are crucial for smooth functioning of any economy. The global financial crisis 2007-09 shows the importance of banks in stabilizing the financial market and economy (Brunnermeier and Pedersen 2009; Acharya and Mora 2015). Nevertheless, banks are exposed to diverse risks such as - systematic risk, liquidity risk, credit risk, operational risk and performance risks.Market value of the actively traded financial institution declines with increase in interest rate in the economy (Flannery and James, 1984). They also observe that the co movement of

To cite this article:
Ajay Kumar Mishra and Trilochan Tripathy. Effect of Market, Exchange Rate and Interest Rate Risks on Banks Accounting Variables: Evidence from India. *Indian Journal of Finance and Economics*, Vol. 1, No. 1, 2020, pp. 1-23 .

stock returns and interest rate changes is positively related to the size of the maturity difference between the firm's nominal assets and liabilities. The adverse changes in factors associated with market risk negatively affectthe banks financial performance and that risk arises where banks accept financial instruments exposed to market volatility as collateral for loans (Worzala,1995). Several studies show that market, interest rate and exchange rate risk influence banking stock returns (Beaver, Kettler and Scholes 1970; Bae 1990; Flannery and James 1984; Elyasiani and Mansur 2005; Agusman *et al* 2008; Papadamou and Tzivinikos 2013; Agusman *et al*. 2014).

The linkages between accounting variables and market risk measures compel the bank managers and business analysts spend substantial time to understand the association of these factors to better analyze the bank performance and its risk. These variables also have importance for the regulators of different financial institutions. Jahankhani and Lynge (1980) observe significant relationships between market measures of risk and accounting measures of risk barring a very few instances. Hassan (1993) moreover affirmed that banks off balance sheet activities significantly explain the total market risk. The market risk measures and banks accounting ratios are linked because they are involved in lending and currency trading activities at various levels (Elyasiani and Mansur 2005; Agusman *et al*. 2008 & 2014).

India is one of fastest growing economies and its economic growth is directly tied with the banking sector growth and development. Further, the Indian banking system has undergone regulatory and operational changes to improve the banks stability in India (Sharma 2012;Jayadev 2013). Understandings of the effect of systematic risk, interest rate and exchange rate risk on commercial banks financial performance in the Indian context are scarce in the empirical literature. As the ownership, structure, roles and regulation of banks in India are unique compared to the rest of the world, the existing theories and the empirical evidences may not be sacrosanct for the Indian context, which necessitates a unified study in the aforesaid context. Against this backdrop, first we analyze market, interest rate, and exchange rate risk sensitivities on Indian commercial banks stock returns. Second, examine the degree and direction of relationship between the such risk measures and commercial banks accounting ratios in India. The understanding of this issue at hand is not only crucial for the individual banks strategic policy perspective but also for the regulators point of view.

This study uses data for 14 years spanning from 2001 to 2015 tostudy the association between the three major risk measures and the accounting

variables in two step procedure. In the first step, multi-index GARCH model is used to estimate the sensitivity or beta for the Indian banking institutions.[1] In the second step, the strength of relationship between accounting variables and market measure of risk (betas) are tested. We find a strong evidence of association between bank specific accounting variables and market-risk measures.[2] Our results are unique as we provide new evidences on association across different regulatory regime in the Indian banking sector.

Our study contributes to the banking literature in several ways considering the unique features of Indian banking system. First, this study employs a broader three-index model to extend bank risk analysis to interest and exchange rate risk, as well as the traditional market risk in the emerging market scenario. Second, this paper extends the literature by investigating the determinants of market and exchange rate risks in a second stage within a model incorporating balance sheet activities in the Indian market. Third, by using data on the public and private Indian banking institutions, this study provides a basis for analyzing the systematic risk and exchange rate risk and the strength of the links between the risk measures and the financial variables. Additionally, Indian banking system is unique in its functioning where state owned banks still dominate others. The state-owned public sector banks lead in lending activities (corporate and personal) which has created an inherent risk due to large non-performing assets (NPAs).[3,4] Indian government often rely on bank credits[5] to meet the capital expenditure requirement.[6] The Reserve Bank of India (RBI) helps government in borrowing activities. As RBI is central bank of Indian economy, the risk of government borrows may indirectly transmit to the entire banking system.

The structure of this article is as follows: Section-II presents the review of earlier work by researchers in related field. Section-III discusses the method used in this study and data descriptive. Results and empirical findings are discussed in Section-IV. Conclusion of this study is given in Section-V.

2. REVIEW OF RELATED WORK

Sharpe (1964), Lintner (1965), and Mossin (1966) simplified the Markowitz (1952) portfolio model to a Capital Asset Pricing Model (CAPM), which determines the equilibrium prices for all securities in the market. Since then CAPM has been extensively used to estimate the market risk. This model provides a powerful measure to predict the market risk and the relationship between market risk and expected return. However, due to the restrictive assumptions CAPM fails to model the risk and firm's heteroskedastic return behaviour. Later research studies used multi-index model to incorporate

the heteroskedastic behavior of returns (Bae 1990; Choi at el. 1992; Elyasiani and Mansur 1998 and 2003; Agusman *et al*. 2008 and 2014). Empirical evidence also widely demonstrates the relationship between stock prices, exchange rate and interest rate. Chamberlain *et al*. (1997) argue that a positive and significant relationship exists between volatilities of exchange rate and interest rate with stock prices. Ali *et al*. (2014) suggests that there exists an inverse relationship between interest rate and efficiency of stock market. Muktadir-Al-Mukit (2012) study reveals the result that long run exchange rate has a positive and interest rate has a negative impact on the stock by using the co-integration and Error Correction Model.

However, the association between the market risk and accounting measures are empirically tested both in the context of the non-financial and financial institutions. One of the pioneering studies in this direction is contributed by Beaver *et al*. (1970). Authors using US non-financial firms' data to establish the associative relationship between the market beta and accounting measures. The accounting measure which showed positive association was leverage, asset growth, variability in earning and accounting beta, whereas, dividend payout, current ratio and asset size were negatively related with market beta. The evidence suggests that accounting measures of risk are impounded in the market-price based risk measure. This study concludes that there is a high degree of contemporaneous association between the accounting and market risk measures.

McDonald and Stehle (1975) found that sensitivity measure (beta) and non-market risk determined 83% of the variation in perceived risk of professional investors. This study added another dimension (i.e. perceived risk) which influences the risk measures. But this study did not explain the investors' perceived risk parameters. This unanswered question was investigated by the Farrelly *et al*. (1985). They provided rationale for incorporation of perceived risk in the risk estimation and also determine the parameter for investor's perceived risk measurement. Selva (1995) reexamined the Beaver *et al*. (1970) work and analyzed the relationship between financial analysts' risk perceptions and accounting and market determined risk measures in Hong Kong. This study tested two things: (a) the significance of the variables determined by Beaver *et al*. (1970) in the estimation of market risk, to the formation of analysts' risk perceptions in the context of Hong Kong, and (b) Earning Growth hypothesis[7]. Authors used Hang Seng stock index return data for this study.

The first work in the commercial bank return relation was conducted by Pettway (1976). In this study author focused to investigate the impact of the bank's capital position on risk premium of the bank's capital notes,

bank's sensitivity measures (beta), and price-earnings ratio (P/E). During this period, 77 capital notes and debenture issues were sold. The study sample included 36 issued capital notes by banks and 41 issues of debentures by bank holding companies. Additionally, the result shows the significance of maturity, marketability, dividend and payout ratios as important factors in the variation in the bank debt, risk measures on large bank stock and P/E ratio of the bank for the study period. Finally, in the P/E model, the most important variables which were significant were payout ratio, dividend yield, earnings growth, dividend per share, and the (capital/risk asset) ratio. Overall, author concludes that the amount of bank equity is significant in the determination of a bank's market beta and price-earning (PE) ratio.

Jahankhani and Lynge (1980) examine the relationship between accounting measures and two market measures of risk: systematic risk (market beta) and total risk (standard deviation of returns). They find that the dividend payout ratio, the coefficient of variation of deposits and the loans to deposits ratio are directly associated with systematic risk. Furthermore, Pettway and Sinkey (1980) use both accounting and market information to develop an alert-system for the bank system. Using market model and discriminant analysis model and the market model, they find that both the accounting and market screens gives signals regarding the banks financial soundness.

Flannery and James (1984) investigate the relation between the interest rate and stock returns of the financial institutions. This study uses US based 67 commercial bank stocks for period of 1976 to 1981. They find a significant association between the interest rate and the bank stock returns. The analysis also shows a co-movement of interest rate and stock returns changes were positively related with the size of maturity difference between the firm's nominal[8] assets and liabilities.

Mansur *et al*. (1993) examine how the financial ratios of banks reproduce the market measure of risk. Authors calculated two market determined risk: systematic risk and total risk (in terms of standard deviation) for 59 banks during the period of January 1986 to September 1990. The study uses bank specific ratios: equity to total deposits, cash to total assets, total loans to total assets, net income to total assets, coefficient of variation of deposits, total loan loss to total loans, and total loans to total deposits. The results show strong linkages between bank specific risk measures and market risk measures.

Moreover, Elyasiani and Mansur (2005) investigate a sample of 52 Japanese banks over the period 1986–1996. Using a multi-factor GARCH model, study shows linkages between banks risk measure with market,

interest rate, and foreign exchange rate sensitivities. They observe that accounting variables contain explains relationship between bank market risk and foreign exchange risk. In particular, under the market beta model, the coefficients pertaining to cash-and-due-from-banks, provisions for credit loss, non-interest expense, assets-held-in-trading-and-dealing accounts, and deposits of customers are all found to be statistically significant, with signs consistent with expectations. Besides, foreign exchange denominated assets and non-interest income, affect the foreign exchange rate beta in a negative and positive direction, respectively.

In the literature of financial accounting, extensive studies have been done on analyzing the factors which determine the performance of banking failures or success. The performance of banks or financial institutions is affected by both industries specific (macro-factors) and the factors related with the firm. Lane *et al*. (1986) studied the bank failure for 464 US banks during the period of 1979-83 in Cyprus.[9] In this study, Lane *et al*. identified 21 financial ratios. They further classified these ratios into five different categories. These categories are Capital adequacy, asset quality, management style, firm earning and bank liquidity (CAMEL). The bank specific variables used in this study are capital/asset ratio, loan/assets, liquid/asset and net income. Real exchange rate and real interest rate is used as an external variable. The survival analysis and results show that the low assets and low liquidity (liquid asset/ total assets) are bank specific factors that give explanation for survival time of North Cyprus banks. The study by Whalen (1991) also employed the hazard approach to model the time-to-failure as a function of bank specific various characteristics.

The link between micro and macro-economic variables make the bank performance fragile (Gunsel 2008). Author investigate the bank fragility using multivariate logit model for the period of 1984-2002. The model relates the bank specific factors and macro-economic variable with the probability of problems banks in Cyprus. The findings reveal that besides the bank specific variables in context to CAMEL criteria, credit expansion plan in public and private sectors, increase in real exchange rate and ratio of M2 to Forex (Foreign reserve) are important variables in explaining the banking distress in North Cyprus.

Goddard *et al*. (2004), Demirguc-Kunt and Huizinga (2000) and Bourke (1989) studies use linear estimation model test the impact of various factors that are important in explaining profits of banks. The results of these studies show that bank profitability can be determined using the bank specific variables. Goddard *et al*. (2004) study used a cross sectional data for six European countries Denmark, UK, Italy, Spain Germany, and the France,

for the period 1992–98. From the finding of this study, it is evident that there exists a positive relationship between Off-balance-sheet business in a bank's portfolio and the profitability for the UK based banks. Further, the relationship between the profitability and the capital to assets ratio is positive. The roles of bank specific expenses also have an impact on the profitability and are closely related with the efficiency of portfolio manager. Therefore, the efficiency is another dimension which determines the earning and profitability of banks/financial institutions (Molyneux and Thornton 1992).

3. DATA AND METHODOLOGY

3.1. Data and Sample

The study is based on secondary data, which are obtained from the three diverse sources and the study period lies in between 2001 and 2015. Our sample constitutes all the commercial banks in India. We obtain all the commercial bank stock specific data and broad equity market benchmark index daily data from the Prowess database of the Centre of Monitoring Indian Economy (CMIE). We use Nifty CNX 500 as a market portfolio benchmark as it accounts for more than 85 percent of market capitalization in India. Monthly Data for nominal effective exchange rate (NEER) and interest rate is obtained from the Economic and Political Weekly Research Foundation (EPWRF) database and RBI websites respectively. In our entire study period, Indian banking systems has witnessed rounds of consolidation among the banks. To control for influence of consolidation and merger of banks, we dropped banks that are merged in the sample period.We also removed those observations for which data is not available in a particular period. There are total around 36 banks (including public and private) across the sample period.

We prepare two set of datasets. First dataset includes daily observations of bank stock returns, interest rate, NEER and market return. We use this dataset for the estimation of risk betas using GARCH model.Second dataset is based on annual observations on bank related variables. This dataset is used in regression estimation with risk betas obtained from the first stage of GARCH analysis.

Table 1 present data descriptive for all the variables used in our study. Details of variable construction and definition is given in Table A1 in Appendix. Panel A in table 1, presents descriptive for macro-variables and stock specific variables. Observations for Interest rate and NEER are available on monthly basis. Bank interest rate during the study period range

Table 1: Descriptive statistics for the variables used

Panel A: Macro factor and Stock Specific variables

Variable	*N*	*Minimum*	*25th Pctl*	*Mean*	*Median*	*75th Pctl*	*95th Pctl*	*Maximum*
Bank Interest Rate (%)	168	5.105	6.292	7.036	7.198	7.737	8.281	9.350
NEER (%)	168	0.926	0.982	1.014	1.004	1.018	1.157	1.169
Nifty 500 (%)	3556	-12.885	-0.638	0.086	0.230	0.947	2.356	15.034
Stock Return (%)	1,28,016	-29.451	-1.471	0.121	0.040	1.617	5.031	41.910
Panel B: Accounting Variables								
Net fixed assets (INR bn)	504	0.167	1.525	7.788	7.805	8.109	29.169	47.493
Total Assets (INR bn)	504	12.752	169.832	807.201	411.547	946.642	2783.167	10534.137
Lending to sensitive sectors (INR bn)	504	0.01	4.872	76.410	22.724	88.846	309.788	950.205
PAT (INR bn)	504	5-20.760	1.363	7.429	4.030	8.422	30.583	91.661
RONW (%)	504	-47.65	11.34	15.82807	17.125	20.675	28.59	39.28
ROCE (%)	504	-19.13	6.715	10.16385	10.04	14.02	20.3	27.94
Current ratio	504	0.09	2.2	3.255152	3.06	4	6.32	12.05
No# of employees	504	140	3550	20781.19	11330	24834	57859	209462
Outstanding shares (Mn)	504	0.01	98.189	306.912	309.295	446.700	724.354	1114.845
Loans_advances (INR bn)	504	7.331	89.998	448.387	221.004	527.391	1579.335	6319.142
Loan &Adv to Fixed assets (Ratio)	504	10.415	39.423	65.262	58.493	83.234	136.689	218.497
Investment by banks (INR bn)	504	8.480	472.345	719.289	875.013	1626.160	3675.106	4950.274
ROE (%)	504	-51.9	11.6	15.0	15.9	19.60	25.3	36.10
ROA (%)	504	-3.10	0.7	0.9	1.00	1.20	1.60	3.70
EPS (Ratio)	504	-31.800	8.537	26.605	17.412	34.196	84.542	180.852
Branches	504	71	373	1,453	910	1,951	4,043	12,638

from minimum of 5.1 percent to maximum of 9.3 percent. Minimum and maximum value of NEER is 0.926 percent to 1.169 percent. During the study period minimum and maximum variation in bank stock return is -29.45 percent and 41.941 percent respectively. Daily observations are used for Nifty 500 index and bank stocks returns. Panel B shows descriptive for annual accounting variables used in analysis.Observations are removed for banks that were either merged or data was inconsistent. In final sample, there are 36 banks including private and state-owned. Mean and median of net fixed assets of banks is INR 7.78 billion and INR 7.81 billion respectively. Minimum and maximum lending to sensitive sectors is INR 0.01 billion and INR 950.20 billion respectively-. Sample includes small and large banks where number of branches in India range from minimum of 71to maximum of 12,638.

3.2. Methodology

We deploy a variant of Elyasiani and Mansur (2005) two stage methodology to examine the relationship between market and accounting based risk measures. In the first stage, we estimate the sensitivity of themarket, interest rate and exchange rate risks for Indian banking institution by using multi-index GARCH model (refer to following section). This provides the sensitivity measures (beta) for market, interest rate and exchange rate for banking sector. - In the second stage, these beta estimates are regressed on the accounting risk measures following OLS estimation technique. Thus, the estimated results in the second stage provide the degree and direction of the effect of the banking institutions accounting based financial ratios on the market risk measures.

3.2.1. GARCH model for market beta estimation

The ARCH model was first introduced by Engle (1982) and it was further extended and generalized under the name of GARCH by Bollerslev (1986). Theuse of GARCH model relaxes the classical assumption of CAPM model which assumes that the variables are homoskedastic in nature. We have used multi-index GARCH model to estimates the beta coefficients for systematic markets risk, interest rate risk and foreign exchange risk in relation to bank stock returns. The GARCH (1,1) process constitutes the mean equation, variance equation and the information criterion, which is presented below:

$$R_{it} = \beta_0 + \beta_i^m R_{m,t} + \beta_i^I I_t + \beta_i^F F_t + \varepsilon_{it} \quad (1)$$

$$h_{it} = \alpha_0 + \alpha_1 \varepsilon_{i,t-1}^2 + \alpha_2 h_{i,t-1} \quad (2)$$

$$\varepsilon_{it} \mid \Omega_{t-1} \sim N(0, h_{it}) \quad (3)$$

Where, '*i*' varies from 1 to 36 and *t* varies from 1 to 14; R_{it} is the sample banking institution returns; $R_{m,t}$ is the Indian stock market portfolio return (CNX 500). β_i^m, β_i^I and β_i^F are the beta coefficients for the market return, interest rate and nominal effect exchange rate (NEER) respectively. In the equation 2, h_{it} represent the conditional variance of the bank returns and t shows the time index.

It is important to note that a GARCH process requires to meet certain constraints so as to be a *stable* one else the model is *explosive* and running a GARCH model on it does not make much sense. Thus, to attain the stability of the GARCH process, parameters in variance equation (2) α_0, α_1, and α_2 must take positive values and sum of the coefficient values of α_1 and α_2 must be less than or equal to unity(Engle and Bollerslev 1986).

3.2.2. Multivariate regression Model

In the second stage, we have used regression analysis to find out the determinant of risk measures (beta) which are estimated in the first stage GRACH model. The regression model relates the -market measure of risk $\left(\beta_i^m, \beta_i^I \text{ and } \beta_i^F\right)$ with the banking institutions accounting risk measures. The selection of regression analysis is based on the prior literature following the CAMEL framework (Elyasiani and Mansur, 2005). The regression model for market, NEER and interest ratebeta are represented by following equation-

$$\beta^m = \beta_0 + \beta_1 CapAdq_i + \beta_4(TD_i/TA_i) + \beta_5 Log(Investment_i) + \beta_6 ShrtBrrw_i + \beta_9 \log(adv_i/fxAsst_i) + \beta_8 \log(LoanAdvs_i) + \beta_{10} \log(Sensall) + + \beta_{11} \log(Brnch)_i + \beta_{12} IntCvr_i + \beta_{12} \log(TA_i) + \beta_3 EPS_i + \beta_2 RONW_i + \varepsilon_i \quad (4)$$

$$\beta^F = \beta_0 + \beta_1 CapAdq_i + \beta_4(TD_i/TA_i) + \beta_5 Log\ (Investment_i) + \beta_6 ShrtBrrw_i + \beta_9 \log(adv_i/fxAsst_i) + \beta_8 \log\ (LoanAdvs_i) + \beta_{10} \log\ (Sensall) + + \beta_{11} \log\ (Brnch)_i + \beta_{12} IntCvr_i + \beta_{12} \log(TA_i) + \beta_2 RONW_i + \beta_{12} \log(ECB_i) + \beta_{13} ROA_i + \varepsilon_i \quad \mathbf{(5)}$$

$$\beta^I = \beta_0 + \beta_1 CapAdq_i + \beta_4(TD_i/TA_i) + \beta_5 Log(Investment_i) + \beta_6 ShrtBrrw_i + \beta_9 \log(adv_i/fxAsst_i) + \beta_8 \log(LoanAdvs_i) + \beta_{10} \log(Sensall) + + \beta_{11} \log(Brnch)_i + \beta_{12} IntCvr_i + \beta_{12} \log(TA_i) + \beta_{12} \log(ECB_i) + \beta_{13} ROA_i + \varepsilon_i \quad \mathbf{(6)}$$

In the above regression model, "i" represents i^{th} bank. The other variables are capital adequacy (CapAdq), total debt to total assets (TD/TA), total

book value of bank's investment (Investment), short term bank borrowings (ShrtBorrw), ratio of total advance to fixed assets (adv/fxAsst), total loan & advances (LoanAdvs), lending to sensitive sectors (Sensall), number of branches (Brnch), interest coverage ratio (IntCvr), total assets (TA), earning per share (EPS), return on net worth (RONW), and external commercial borrowings (ECB) and return on assets (ROA).

4. EMPIRICAL FINDINGS

4.1. Estimation of beta coefficients (GARCH Model)

For our first stage beta estimation, we divided our study period into three parts. The three periods are 2002-2005, 2006-2008, and 2009-2015 is different regulatory norms[10] across these periods (Jayadev, 2013). The reason behind this classification is to analyze the changes in the estimated risk of measures (beta) in these three different sub-periods. The results of beta estimation using GARCH model is given in the following Tables (2, 3 and 4).These tables contain the estimated beta coefficients for the exchange rate, interest rate and mark*et al*ong with the ARCH and GARCH parameters of the variance equation of the model.

Irrespective of the periods, it is observed that the market beta () for most of the banks are found to be statistically significant 1% level and the beta coefficient for exchange rate and interest rate (and are occasionally found to be significant at acceptable levels. However, the ARCH (and GARCH (coefficients are found to be positive and statistically significant for most of the cases which indicate the presence of ARCH affect in the Indian bank stock return series (Table 2, 3 and 4). Further, stability of the GARCH process is absolutely attended as sum of the ARCH (and GARCH (coefficients across most of the series under investigation are less than unity. Thus, these results strongly hint that the bank stock returns distributions contain a time-varying risk element and it is affected by systematic market risk.

On the basis of our first stage empirical analysis, we observe that the market beta coefficients are significant consistently for the entire study period (2001-2015), while the risk measures for foreign exchange and interest rate are significant occasionally by relaxing the significance criteria (in fewer cases 10% level).

4.2. Association between Accounting variables and Risk Measures

The coefficient obtained for market, interest rate and exchange rate from the equation (1) in the first stage are deployed in the second stage to examine

Table 2: Estimation of bank stock returns sensitivity for market, exchange rate and interest rate for first sub-period (2002-2005)

Bank Name	*Intercept* β_0	*CNX_500* β_i^m	*INTRate* β_i^I	*NEER* β_i^F	*Alpha(0)* α_0	*ARCH* α_1	*GARCH* α_2	*Stability* $(\alpha_1 + \alpha_2)$
Allahabad Bank	5.335	1.156***	0.087***	-5.947	0.876***	0.234***	0.637***	0.871
Corporation Bank	-1.716	0.924***	-0.132	2.548***	3.575***	0.268***	0.124	0.392
Dena Bank	-1.098	1.136***	0.016***	0.807***	1.814***	0.254***	0.469***	0.723
Dhanlaxmi Bank Ltd.	7.242	0.897***	0.222	-8.736	3.776***	0.319***	0.341***	0.660
Federal Bank Ltd.	2.671	1.298***	0.03***	-2.869	2.743***	0.153***	0.392***	0.545
H D F C Bank Ltd.	-2.161	0.714***	0.048**	1.839***	1.649***	0.223***	0.225***	0.448
I C I C I Bank Ltd.	0.795	0.859***	0.012***	0.781**	0.248***	0.073***	0.868***	0.941
I D B I Bank Ltd.	8.581***	1.24***	0.093	-9.151	2.123***	0.37***	0.465***	0.835
I N G Vysya Bank Ltd.	5.151	0.687***	0.112	-5.902	3.807***	0.243***	0.114*	0.357
Andhra Bank	3.9	1.334***	0.129	-4.758	0.58***	0.189***	0.723***	0.912
Indian Overseas Bank	-0.094	1.142***	-0.018**	0.251***	0.445***	0.085***	0.855***	0.940
Indusind Bank Ltd.	5.326	1.131***	0.069	-5.816	0.601***	0.072***	0.832***	0.904
Jammu & Kashmir Bank Ltd.	0.676	0.974***	0.09	-1.227	1.759***	0.255***	0.488***	0.743
Karnataka Bank Ltd.	2.626	1.148***	0.055***	-3.058	1.335***	0.212***	0.648***	0.860
Karur Vysya Bank Ltd.	4.074	0.77***	0.108	-4.753	3.882***	0.239***	0.452***	0.691
Kotak Mahindra Bank Ltd.	3.872	0.817***	0.025***	-3.916	0.866***	0.194***	0.694***	0.888
Lakshmi Vilas Bank Ltd.	-2.213	0.79***	-0.042**	2.435***	0.451***	0.214***	0.772***	0.986
Oriental Bank of Commerce	6.731	1.141***	0.061	-7.104	0.112***	0.083***	0.899***	0.982
Punjab National Bank	9.66***	1.198***	0.135***	-10.494	0.271***	0.192***	0.783***	0.975
South Indian Bank Ltd.	0.827	1.117***	-0.063	-0.501	3.784***	0.265***	0.064	0.329
Axis Bank Ltd.	10.466***	1.005***	0.07***	-10.794	0.417***	0.063***	0.878***	0.941
State Bank of India	3.572	1.149***	0.143**	-4.475	1.649***	0.092***	0.407***	0.499
Syndicate Bank	3.259	1.385***	-0.002	-3.256	1.312***	0.458***	0.411***	0.869
Uco Bank	-3.674	1.178***	-0.282	5.124***	1.329***	0.647***	0.317***	0.964
Union Bank of India	6.072	1.217***	0.14***	-6.914**	0.253***	0.09***	0.871***	0.961
Vijaya Bank	8.045	1.148***	-0.063	-7.544	0.344***	0.132***	0.821***	0.953
Yes Bank Ltd.	26.368	0.735***	1.339	-35.275	3.989***	0.045	0.574***	0.619
Bank of Baroda	4.306	1.501***	0.004***	-4.337	0.087***	0.051***	0.935***	0.986
Bank of India	2.892	1.502***	0.23***	-4.441	1.622***	0.149***	0.566***	0.715
Bank of Maharashtra	8.383	1.066***	0.395***	-11.248	1.972***	0.596***	0.116***	0.712
Canara Bank	0.966	1.376***	-0.013	-0.873	0.337***	0.116***	0.838***	0.954
City Union Bank Ltd.	6.886***	0.697***	0.118	-7.606	0.282***	0.234***	0.724***	0.958

Note: In the above table ***, **, & * represent significance at 1, 5, & 10 percent level.

Table 3: Estimation of bank stock returns sensitivity for market, exchange rate (NEER) and interest rate for first sub-period (2006-2008).

Bank Name	*Intercept* β_0	*CNX_500* $\beta_i^{\bar{m}}$	*INTRate* β_i^I	*NEER* β_i^F	*Alpha(0)* α_0	*ARCH* α_1	*GARCH* α_2	*Stability* $(\alpha_1 + \alpha_2)$
Allahabad Bank	-1.423	0.908***	0.053***	0.966*	1.262***	0.17***	0.537***	0.707
Corporation Bank	-1.333	0.903***	0.12***	0.314***	1.13***	0.096***	0.729***	0.825
Dena Bank	0.95	1.142***	-0.094	-0.182	2.555***	0.101***	0.543***	0.644
Development Credit Bank Ltd.	5.969**	1.386***	-0.304	-3.562	1.389***	0.158***	0.749***	0.907
Dhanlaxmi Bank Ltd.	1.639	0.571***	-0.082	-0.87*	0.986***	0.152***	0.763***	0.915
Federal Bank Ltd.	0.291	0.816***	0.025***	-0.387	1.3***	0.153***	0.573***	0.726
H D F C Bank Ltd.	-0.094	0.936***	0.036*	-0.128	0.46***	0.109***	0.779***	0.888
I C I C I Bank Ltd.	0.295	1.215***	-0.097	0.423*	0.218***	0.096***	0.86***	0.956
I D B I Bank Ltd.	-1.98	1.353***	0.136**	0.884**	1.197***	0.113***	0.677***	0.79
Andhra Bank	3.046	0.704***	0.032*	-3.239	4.275***	0.266***	0.135	0.401
Indian Bank	0.502	1.014***	-0.009	-0.32	1.503***	0.119***	0.749***	0.868
Andhra Bank	-1.339	0.926***	0.117***	0.353***	1.087***	0.162***	0.591***	0.753
Indian Overseas Bank	0.702	1.079***	0.042	-1.039	0.288***	0.055***	0.902***	0.957
Indusind Bank Ltd.	-1.719	1.445***	0.113*	0.782*	3.398***	0.164***	0.494***	0.658
Jammu & Kashmir Bank Ltd.	3.24	0.576***	-0.181	-1.792	0.918***	0.096***	0.702***	0.798
Karnataka Bank Ltd.	3.116	0.854***	0.03***	-3.305	0.677***	0.08***	0.781***	0.861
Karur Vysya Bank Ltd.	0.598	0.559***	0.077*	-1.232	1.1***	0.367***	0.339***	0.706
Kotak Mahindra Bank Ltd.	1.143	1.311***	0.138	-2.05	0.136	0.035***	0.948***	0.983
Lakshmi Vilas Bank Ltd.	-0.728	0.784***	0.182	-0.622	0.616***	0.1***	0.828***	0.928
Oriental Bank of Commerce	-3.234	1.029***	0.159	1.829***	0.191*	0.056***	0.91***	0.966
Punjab National Bank	-3.472	1.026***	0.03**	3.155*	0.181**	0.053***	0.903***	0.956
South Indian Bank Ltd.	2.975	0.782***	0.071*	-3.46	4.21***	0.228***	0.357***	0.585
Axis Bank Ltd.	-0.696	1.125***	0.025	0.571**	3.887***	0.174***	0.247	0.421
State Bank of India	0.541	1.049***	0.127***	-1.454	0.126***	0.074***	0.892***	0.966
Syndicate Bank	-2.282	1.038***	0.041*	1.889*	0.359***	0.076***	0.857***	0.933
Uco Bank	-0.977	1.024***	0.073	0.382**	5.124***	0.165***	0.006	0.171
Union Bank of India	-3.961	1.144***	0.159*	2.673	0.795***	0.068***	0.807***	0.875

Contd. table 3

Bank Name	*Intercept* β_0	*CNX_500* $\beta_i^{\bar{m}}$	*INTRate* β_i^I	*NEER* β_i^F	*Alpha(0)* α_0	*ARCH* α_1	*GARCH* α_2	*Stability* $(\alpha_1 + \alpha_2)$
Vijaya Bank	-0.576	1.008***	-0.026	0.716	2.559***	0.173***	0.381***	0.554
Yes Bank Ltd.	1.545	1.046***	-0.012	-1.306	1.771***	0.207***	0.56***	0.767
Bank of Baroda	-4.338	1.05***	0.223*	2.545*	2.008***	0.114***	0.519***	0.633
Bank of India	-3.2	1.24***	0.072**	2.667	0.944***	0.153***	0.732***	0.885
Bank of Maharashtra	3.07	0.699***	-0.018	-2.839	3.639***	0.265***	0.187***	0.452
Canara Bank	-3.467	1.063***	0.048***	2.97**	2.876***	0.207***	0.332***	0.539
Central Bank of India	0.923	0.966***	-0.285	1.128*	3.907***	0.122	0.339***	0.461
City Union Bank Ltd.	4.738***	0.692***	-0.07	-4.051	0.751***	0.216***	0.684***	0.9

Note: In the above table ***, **, &* represent significance at 1, 5, &10 percent level.

Table 4: Estimation of bank stock returns sensitivity for market, exchange rate and interest rate for first sub-period (2009-2015).

Bank Name	*Intercept* β_0	*CNX_500* $\beta_i^{\bar{m}}$	*INTRate* β_i^I	*NEER* β_i^F	*Alpha(0)* α_0	*ARCH* α_1	*GARCH* α_2	*Stability* $(\alpha_1 + \alpha_2)$
Allahabad Bank	12.27	1.128***	-0.76	-6.557	0.5	0.112***	0.788***	0.900
Corporation Bank	-1.406	0.776***	0.113**	0.736***	0.141	0.034	0.925***	0.959
Dena Bank	5.216	1.232***	-0.374	-2.516	0.19***	0.106***	0.867***	0.973
Development Credit Bank Ltd.	-3.269	1.577***	0.185***	1.601***	2.283***	0.187***	0.493***	0.68
Dhanlaxmi Bank Ltd.	-5.239	1.108***	0.049**	4.962**	3.401***	0.085**	0.595***	0.68
Federal Bank Ltd.	4.05	0.858***	-0.174	-2.805	0.098	0.114***	0.868***	0.982
H D F C Bank Ltd.	2.815	0.837***	-0.085	-2.167	1.965***	0.145**	0.578***	0.723
I C I C I Bank Ltd.	2.432	1.542***	-0.035	-2.24	0.038	0.083***	0.906***	0.989
I D B I Bank Ltd.	0.507	1.431***	0.008**	-0.741	0.173**	0.104***	0.867***	0.971
I N G Vysya Bank Ltd.	-5.56	0.821***	0.29**	3.518***	5.99***	0.201***	0.578***	0.779
Indian Bank	6.838	1.148***	-0.274	-4.894	0.113	0.075***	0.907***	0.982
Andhra Bank	7.347	0.946***	-0.499	-3.656	0.079	0.048***	0.933***	0.981
Indian Overseas Bank	-0.432	1.008***	0.125**	-0.673	0.658***	0.303***	0.597***	0.900
Indusind Bank Ltd.	-2.87	1.358***	0.338***	0.67***	5.255***	0.207***	0.108	0.315
Jammu & Kashmir Bank Ltd.	-15.53	1.025***	1.058***	7.98***	1.239***	0.378***	0.544***	0.922
Karnataka Bank Ltd.	5.856	0.826***	-0.351	-3.437	0.928***	0.168***	0.654***	0.822
Karur Vysya Bank Ltd.	6.966	0.491***	-0.272	-4.854	2.168***	0.407***	0.467***	0.874
Kotak Mahindra Bank Ltd.	-0.589	1.55***	0.06	0.015**	0.247	0.177***	0.772***	0.949
Lakshmi Vilas Bank Ltd.	-4.855	0.776***	0.238***	3.155*	1.154***	0.314***	0.54***	0.854
Oriental Bank of Commerce	-0.067	1.157***	0.291***	-1.998	2.442***	0.214***	0.42***	0.634
Punjab National Bank	-4.428	0.946***	0.545	0.386	0.083	0.177***	0.807***	0.984
South Indian Bank Ltd.	4.431	0.881***	-0.162	-3.032	0.043	0.046	0.943***	0.989
Axis Bank Ltd.	0.385	1.331***	0.092***	-1.023	0.016	0.042***	0.953***	0.995
State Bank of Bikaner & Jaipur	-0.237	0.875***	-0.385	3.047**	1.609***	0.654***	0.325***	0.979
State Bank of India	-0.312	1.249***	0.074	-0.311	2.679***	0.125	0.111***	0.236
State Bank of Mysore	5.666	0.449***	-0.476	-2.128	2.768***	0.559***	0.363***	0.922
State Bank of Travancore	-7.384	0.55***	0.396***	4.38*	0.833***	2.968***	0.432***	3.400

Contd. table 4

Bank Name	*Intercept* β_0	*CNX_500* $\beta_i^{\bar{m}}$	*INTRate* β_i^I	*NEER* β_i^F	*Alpha(0)* α_0	*ARCH* α_1	*GARCH* α_2	*Stability* $(\alpha_1 + \alpha_2)$
Syndicate Bank	1.885	1.167***	-0.106	-1.204	0.056	0.071***	0.923***	0.994
Uco Bank	6.979	1.027***	-0.403	-4.061	3.053***	0.251***	0.658***	0.909
Union Bank of India	4.322	0.756***	-0.143	-3.195	3.627***	0.164**	0.219***	0.383
Vijaya Bank	-0.355	1.267***	0.165	-1.024	2.833***	0.255***	0.06	0.315
Yes Bank Ltd.	-1.774	1.32***	0.2***	0.396***	0.231	0.054***	0.913***	0.967
Bank of Baroda	5.094	0.885***	-0.141	-3.95	0.073	0.048	0.934***	0.982
Bank of India	-1.27	1.251***	0.03***	0.948***	3.604***	0.368***	0.548***	0.916
Bank of Maharashtra	4.071	0.771***	-0.208	-2.608	2.541***	0.377***	0.512***	0.889
Canara Bank	6.119	1.035***	-0.25	-4.256	0.073	0.08***	0.907***	0.987
Central Bank of India	-3.834	1.039***	0.247***	2.136*	0.851***	0.098***	0.787***	0.885
City Union Bank Ltd.	-6.16	0.87***	0.373***	3.428**	5.723***	0.165***	0.007	0.172

Note: In the above table ***, **, & * represent significance at 1, 5, & 10 percent level.

the relationship between market risk measures and banks accounting variables. The multivariate regression models are estimated separately of these three risk of measures along with accounting variables. Our approach is consistent with the approach used by Choi and Elyasiani (1998), Mansur *et al*. (1993), and Beaver *et al* (1970). We use OLS regression technique for model estimation.

Table 5: Multivariate regression: Association between Risk Measures and Bank Specific Accounting variables

Parameter	*Beta Market*	*Beta NEER*	*Beta Interest*
	Model-1	Model-2	Model-3
Intercept	4.5199***	0.3420	-0.1250***
	(12.313)	(0.30)	(-8.69)
CapAdq	-0.0865***	-0.1320***	-0.0039***
	(-26.258)	(-4.99)	(-3.67)
TD/TA	-9.7311***	1.0510	-1.3160***
	(-6.516)	(0.125)	(-40.15)
Log(Investment)	-0.0803***	-0.1670***	-0.08476***
	(-2.563)	(-2.84)	(2.402)
ShrtBrrw	-0.0001***	-0.0020***	-0.0001***
	(4.023)	(-5.79)	(-8.28)
Log(Adv/fxAsst)	-0.0029***	-0.0140***	-0.0010***
	(-2.095)	(-4.28)	(-30.29)
Log(LoanAdvs)	-0.9089***	-0.3630**	0.0843***
	(-23.78)	(1.893)	(12.11)
Log(Sensall)	0.2357***	0.8990***	0.0096***
	(16.821)	(14.23)	(4.03)
Log(Brnch)	0.2798***	-1.2170***	-0.4025***
	(5.168)	(-6.99)	(-3.16)
IntCvr	-0.8309***	-2.0120***	-0.2950***
	(2.64)	(-3.144)	(18.322)
Log(TA)	-0.0241***	-0.0526***	-0.0956***
	(-5.91)	(-7.06)	(-12.95)
EPS	0.0018***	0.078	0.048
	(2.598)	(1.122)	(1.354)
RONW	-0.0168***	-0.0830***	-0.0254
	(-7.746)	(-11.598)	(-1.025)
ROA (%)	-0.0874	-1.4640***	-0.0462***
	(-1.024)	(-3.67)	(-7.56)
Log(ECB)	0.802***	0.1810***	0.0023***
	(2.586)	(17.602)	(16.22)
Observation	36	36	36
Adj R Sqr	0.694	0.924	0.936

Note: In the above table ***, **, & * represent significance at 1, 5, & 10 percent level.

Table 5 presents result for second stage analysis. Model-1 of Table 5 shows results for regression equation (4).The estimated coefficient of capital adequacy[11] (CapAdq) is negative and statistically significant at 1% level. It suggests that the banks with high capital base (Tier I and Tier-II) are able to minimize the effect of market risk. The coefficient for debt to equity (TD/TA) is negative, except for Model-2, suggesting banks are able to use debt as cushion against the market and interest rate risk. Sign for Investment is negative and significant. It indicates that banks use other investments as a safe guard against the external risks. The positive and significant coefficient attached to the lending to sensitive sector suggests that banks with higher lending to priority sectors (i.e.lending to capital market, commodity and real estate sector)are exposed to higher levels of market risk. The possible reason for such relationship may be attributed to the dependencies of these sectors on the market conditions. While, the coefficient of return on net worth (RONW) is negative indicating that banks with large net worth can lessen the market shocks. The positive EPS coefficient and negative investments coefficient suggests that banks with higher profit are more exposed to systematic market risk and banks with higher investments relatively help reducing the market risk. Additionally, external commercial borrowing (ECB) is positively associated with the bank risk measures indicating risk transmission from the external borrowing to the Indian bank. Our results are consistent with the earlier literature.

Model-2 in table 5 shows relationship between exchange rate risk and bank specific accounting variables. Similar to model-1 results, the sign of capital adequacy and RONW is negative suggesting that high capital and net worth provides a cushion to banks against the exchange rate risk. Moreover, the coefficient for loan to sensitive sectors, external commercial borrowings and bank leverage (TD/TA) is positive and statistically significant. This signifies that increase in bank debt level, external commercial borrowings and lending to priority sectors induces exchange rate risk due to sensitivity of these sector with global market conditions. However, the level of bank investment and utilization of bank assets (ROA) lessen the exchange rate shocks.

Model-3 of Table 5 presents the result for regression equation (6) where dependent variable is interest rate beta. Consistent with the model-1 and model-2 results, the sign of capital adequacy and investment is negative and significant. The coefficient of interest coverage ratio and ROA is negative showing that bank's interest rate risk reduces with increase in ROA and earnings which can be utilized to pay interest charges. The signs of other control variables are consistent with the literature.

Overall, the results shown in Table 5 indicates that bank specific accounting variables are related with the bank's risk measures. Consistent with the prior literature (Mansur *et al.*, 1993; Choi and Elyasiani, 1998; Elyasiani and Mansur, 2005),we find that capital adequacy, investment by the banks, lending to sensitive sectors and external commercial borrowings are important factors in explaining the bank specific risks.

5. SUMMARY AND CONCLUSIONS

Examining the literature, we didn't come across with much of the literature that examines the relationship between accounting risk measures, market risk measures, interest rate risk measures and foreign exchange risk measures in the emerging world context and more particularly in the Indian context. As emerging market finds a special place in the current global economic and financial dynamics, this issue needs to be studied in-depth. Against this backdrop, this study has examined the relationship between accounting risk measures and market risk, interest rate risk and foreign exchange risk measures in the Indian market.

This study revealed two key findings. First, we show that all Indian banks in the sample are sensitive to the market and the exchange rate in a positive direction. The sensitivity of banks to the exchange rate is much stronger and more reliable than to the interest rate confirming external risk exposure of Indian banks. Secondly, we found strong and consistent support for the association between market beta and banking institutions' financial ratios. This association is comparatively weak for the foreign exchange beta and interest rate risk of measures.

Finally, we believe that our study significantly contributes to the literature in various ways. First, using GARCH model, this study employs a broader three-index model to extend bank risk analysis to interest and exchange rate risk, as well as the traditional market risk in the emerging market scenario. Second, this paper extends the literature by investigating the determinants of market and exchange rate risks in a second stage within a model incorporating balance sheet activities in the Indian market. Third, by using data on the public and private Indian banking institutions, weprovide a basis for analyzing the systematic risk and exchange rate risk and the strength of the links between the risk measures and the financial variables. Our analysis also sheds light on the robustness of the results concerning market, interest, and exchange risks and the determinants of market and exchange rate risk across the banks in India.

Notes

1. For details refer to Scott and Peterson (1986), Bae (1990) and Booth and Officer (1986) studies.
2. Refer to Choi, Elyasiani & Kopecky (1992) analyzed that the interest rate, market risk and exchange rate as a determinant for the bank stock returns.
3. Refer to the article *https://economictimes.indiatimes.com/industry/banking/finance/banking/view-india-needs-to-trim-the-size-of-its-public-sector-banks/articleshow/63371980.cms. Accessed on March 21, 2018.*
4. Refer to the news article *https://qz.com/1009293/indias-npas-what-is-rbis-solution-for-the-154-billion-bad-loan-problem/*, on bad-loan situation in India.
5. See the article *https://economictimes.indiatimes.com/news/economy/finance/government-to-borrow-rs-3-72lakh-crore-in-first-half-of-fy2018/articleshow/57882065.cms*
6. Published news article on "Government sticks to Rs2.08 trillion borrowing plan for FY18", *http://www.livemint.com/Politics/iGGnpByMwYWhf0jO0NFVgP/Govt-sticks-to-FY18-borrowing-target-leaves-window-ajar-for.html*, on government borrowing from the Indian central bank (RBI).
7. This hypothesis states that the analysts risk perception about the growth of the firm depends on the earning potential of the firm. (Schipper, 1991).
8. Nominal assets are assets which cash flow is fixed in nominal terms (ie. Account receivables, debts, and certain input contracts.). While the cash flow from the real or physical assets fluctuates with the change in the price level.
9. This study used CPH (Cox Proportion Hazard) model.
10. Banks and the regulators all over the world have been concerned about these risks, and the formal framework for banks' capital structure was evolved in 1988 with the introduction of the "International Convergence of Capital Measurement and Capital Standards", popularly known as Basel I, issued by the Basel Committee on Banking Supervision (BCBS). In India, the Reserve Bank of India (RBI) implemented Basel I norms from 1992 onwards till 2004. In 2005, the BCBS came out with a comprehensive framework of capital regulation popularly known as Basel II. Post 2008 crisis, several changes were made in Basel-II norms. The BCBS released the Basel III framework entitled "Basel III: A Global Regulatory Framework for more Resilient Banks and Banking systems" in December 2010 (revised in June 2011).
11. See details of type of bank capital as per RBI definition *https://www.rbi.org.in/scripts/BS_ViewMasCirculardetails.aspx?Id=8133&Mode=0*

References

Abbas Ali, D., Johari, F., & Haji Alias, M. (2014). The effect of exchange rate movements on trade balance: A chronological theoretical review. *Economics Research International*, 2014.

Acharya, V. V., & Mora, N. (2015). A crisis of banks as liquidity providers. *The Journal of Finance*, 70(1), 1-43.

Agusman, A., Cullen, G. S., Gasbarro, D., Monroe, G. S., & Zumwalt, J. K. (2014). Government intervention, bank ownership and risk-taking during the Indonesian financial crisis. *Pacific-Basin Finance Journal*, 30, 114-131.

Agusman, A., Monroe, G. S., Gasbarro, D., & Zumwalt, J. K. (2008). Accounting and capital market measures of risk: Evidence from Asian banks during 1998–2003. *Journal of Banking & Finance,* 32(4), 480-488.

Bae S. C. (1990), "Interest Rate Changes and Common Stock Returns of Financial Institutions: Revisited." *Journal of Financial Research*, Vol. 13, pg. 71–79.

Beaver, W., Kettler, P., & Scholes, M. (1970). The association between market determined and accounting determined risk measures. *The Accounting Review*, *45*(4), 654-682.

Bollerslev, T. (1986). Generalized autoregressive conditional heteroskedasticity. *Journal of Econometrics*, *31*(3), 307-327.

Booth, J. R., & Officer, D. T. (1985). Expectations, interest rates, and commercial bank stocks. *Journal of Financial Research*, *8*(1), 51-58.

Bourke, P. (1989). Concentration and other determinants of bank profitability in Europe, North America and Australia. *Journal of Banking & Finance*, *13*(1), 65-79.

Brunnermeier, M.K., & Pedersen, L. H. (2009). Market Liquidity and Funding Liquidity. Review of Financial Studies, 22(6), 2201-2238.

Chamberlain, S., Howe, J. S., & Popper, H. (1997). The exchange rate exposure of US and Japanese banking institutions. *Journal of banking & finance*, *21*(6), 871-892.

Choi, J. J., Elyasiani, E., & Kopecky, K. J. (1992). The sensitivity of bank stock returns to market, interest and exchange rate risks. *Journal of banking & finance*, *16*(5), 983-1004.

Demirgüç-Kunt, A., & Huizinga, H. (2000). Financial structure and bank profitability. SSRN Working paper.

Elyasiani, E., & Mansur, I. (1998). Sensitivity of the bank stock returns distribution to changes in the level and volatility of interest rate: A GARCH-M model. *Journal of Banking & Finance*, *22*(5), 535-563.

Elyasiani, E., & Mansur, I. (2003). International spillover of risk and return among major banking institutions: A bivariate GARCH model. *Journal of Accounting, Auditing & Finance*, *18*(2), 303-330.

Elyasiani, E., & Mansur, I. (2005). The association between market and exchange rate risks and accounting variables: a GARCH model of the Japanese banking institutions. *Review of Quantitative Finance and Accounting*, *25*(2), 183-206.

Engle, R. F. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. *Econometrica: Journal of the Econometric Society*, 987-1007.

Engle, R. F., & Bollerslev, T. (1986). Modelling the persistence of conditional variances. *Econometric Reviews*, *5*(1), 1-50.

Farrelly, G. E., Ferris, K. R., & Reichenstein, W. R. (1985). Perceived risk, market risk, and accounting determined risk measures. *Accounting Review*, 278-288.

Flannery, M. J., & James, C. M. (1984). The effect of interest rate changes on the common stock returns of financial institutions. *The Journal of Finance*, *39*(4), 1141-1153.

Goddard, J. A., Molyneux, P., & Wilson, J. O. (2004). Dynamics of growth and profitability in banking. *Journal of Money, Credit, and Banking*, *36*(6), 1069-1090.

Gunsel N, (2008), "Micro and Macro Determinants of Bank Fragility in North Cyprus Economy", *International Research Journal of Finance and Economics,* Issue 22, pg 66-82.

Hassan, M. K. (1993). The off-balance sheet banking risk of large US commercial banks. *The Quarterly Review of Economics and Finance*, *33*(1), 51-69.

Jahankhani, A., and Lynge, M. (1980). Commercial bank financial policies and their impact on market-determined measures of risk, Journal of Bank Research, 11, 169-178

Jayadev, M. (2013). Basel III implementation: Issues and challenges for Indian banks. *IIMB Management Review*, *25*(2), 115-130.

Lane, W. R., Looney, S. W., & Wansley, J. W. (1986). An application of the Cox proportional hazards model to bank failure. *Journal of Banking & Finance*, *10*(4), 511-531.

Lintner, J. (1965). Security prices, risk, and maximal gains from diversification. *The Journal of Finance*, *20*(4), 587-615.

Mansur, I., Zangeneh, H., & Zitz, M. S. (1993). The association between banks' performance ratios and market-determined measures of risk. *Applied Economics*, *25*(12), 1503-1510.

Markowitz, H. (1952). Portfolio selection. *The Journal of Finance*, *7*(1), 77-91.

McDonald, J. G., & Stehle, R. E. (1975). How do institutional investors perceive risk?. *The Journal of Portfolio Management*, *2*(1), 11-16.

Molyneux, P., & Thornton, J. (1992). Determinants of European bank profitability: A note. *Journal of Banking & Finance*, *16*(6), 1173-1178.

Mossin, J. (1966). Equilibrium in a capital asset market. *Econometrica: Journal of the Econometric Society*, 768-783.

Muktadir-al-Mukit, D. (2012). Effects of interest rate and exchange rate on volatility of market index at Dhaka stock exchange. *Journal of Business and Technology (Dhaka)*, *7*(2), 1-18.

Papadamou, S., & Tzivinikos, T. (2013). The risk relevance of international financial reporting standards: evidence from Greek banks. *International Review of Financial Analysis*, 27, 43-54.

Pettway, R. H. (1976). Market tests of capital adequacy of large commercial banks. *The Journal of Finance*, *31*(3), 865-875.

Pettway, R. H., &Sinkey Jr, J. F. (1980). Establishing on site bank examination priorities: an early warning system using accounting and market information. *The Journal of Finance*, *35*(1), 137-150.

Scott, W. L., & Peterson, R. L. (1986). Interest rate risk and equity values of hedged and unhedged financial intermediaries. *Journal of Financial Research*, *9*(4), 325-329.

Selva, M. (1995). The Association Between Accounting Determined Risk Measures and Analysts' Risk Perceptions in a Medium Sized Stock Market. *Journal of International Financial Management & Accounting*, *6*(3), 207-229.

Sharma, M. (2012). Evaluation of Basel III revision of quantitative standards for implementation of internal models for market risk. *IIMB Management Review*, *24*(4), 234-244.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance*, *19*(3), 425-442.

Worzala, E. (1995). Currency risk and international property investments. *Journal of Property Valuation and Investment*, *13*(5), 23-38.

Appendix

Table A1: Details of variables used in this study

Variable Name	*Description*
Net fixed assets (INR bn)	Net Fixed Assets is the value of all fixed assets adjusted for Depreciation.
Total Assets (INR bn)	Total Fixed Assest of bank
Lending to sensitive sectors (INR bn)	Amount of loan offered by the banks to the economically sensitive sectors which includes real estate, capital market and commodities.
PAT (INR bn)	Profit After Tax in Billion Indian Rupees
RONW (%)	Return on Net Worth in percent
ROCE (%)	Return on Capital Employed in percent
Current ratio	ratio of current assets to current liabilities
No# of employees	Numer of employees
Outstanding shares (Mn)	Number of Shares floating in the secondary markets
Loans_advances (INR bn)	loan and Advances of bank reported annually in balancesheet
Loan & Adv to Fixed assets	Ratio of loan and advance to Fixed Assets
ROE (%)	Return on Equity in percent
ROA (%)	Return on Total Assets in percent
EPS (Ratio)	Earnings per Share Ratio
Branches	Number of branches in India
Investment by banks (INR bn)	Total book value of investment made by banks