ANALYSING THE DETERMINANTS OF TOTAL RISK IN BASEL III TRANSITION ERA: EVIDENCE FROM INDIAN PUBLIC AND PRIVATE SECTOR BANKS

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ABSTRACT

Banking sector in India has implemented Basel norms since 1998. To comply with Basel norms, Banks in India had to undergo a series of reforms and changes such as technological advancements, balance sheet restructuring, credit quality enhancements and capital raising strategies. From Basel I to Basel III, requirement of maintaining Capital Adequacy Ratio has changed which brought significant changes in portfolio management of Banks in India. With the introduction of Basel III norms, Banks had to revisit and challenge their own old business strategies fundamentally for raising quality capital as prescribed by Basel III norms and maintain profitability at the same time. In this paper, we will focus on impact of Basel III norms on Indian Banks and determine dependent and independent factors of total risk in Basel III transition era. This study aims at investigating the internal and external factors affecting bank's total risk. We applied panel data regression and relevant econometric tests such as unit root test, multicollinearity test, panel data analysis and test of heteroscedasticity and serial correlation for 35 Indian public and private sector banks from 2011 to 2016. We concluded that among internal factors, capital and profitability are statistically significant, whereas size, deposits to total asset ratio, loans to total asset ratio, operating expenses to total asset ratio, interest expense to total asset ratio, and liquid asset to total asset ratio do not show any significant relationship with bank's total risk in India. In addition, total risk does not show any association with macroeconomic indicators such as GDP growth rate and inflation rate in our sample. Based on the findings, we proposed solvency model for Indian Banks.

Keywords: Total risk; Internal and External factors; Panel data analysis; Banks in India

INTRODUCTION

The financial crisis of 2007 led to emergence of new capital regulations known as Basel III. According to the report of Basel Committee for Banking Supervision known as BCBS (2010), Basel III regulations raised the necessity for strong capital base, liquidity management and robust risk management with risk mitigation techniques. It adopted more stringent and transparent regulatory framework for banks and emphasized more on strengthening of capital base. According to the report issued by Finance Ministry of India (2016), Public Sector Banks which accounts for 70% of banking business in India struggle with the problems of capital shortfall, declining profitability and asset quality. Basel III regulations raised the concerns about capital and risk management. Additionally, Basel Committee on Banking Supervision BCBS (2016) reported that higher capital requirements will affect Bank's profitability, balance sheet structure and overall business model.

Jayadev (2013) studied the impact of Basel III on Indian Banking sector. Banks in India will require $80 billion of capital to meet requirements of Basel III. Firstly, Basel III

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implementation trigger will increase the total risk weighted assets of banks by 20% every year whereas banks will be able to fund it only to the extent of 1% by way of own retained earnings. Secondly, increased capital requirement will lead to decrease in lending growth. He is of the opinion that, banks in India will end up taking less exposure to less risky customers and increase their exposure to highly risky borrowers. Higher capital requirements and leverage ratio requirement will result in lowering the Return on Equity (ROE).

In such challenging scenario for banks in India, it is highly important to assess factors affecting risk of banks. Results of which can lead to better understanding of parameters which need focus for better implementation of Basel III.Total risk, capital, and profitability are the central topics for discussion and emphasized by regulators. The literature review is focused to address following questions through the existing management research on similar topic:

a) What are the key drivers of total risk in Indian Banking?
b) Which internal or external factors needs more attention in Indian Banking?

Indian Banking Sector

Banking structure in India is split into Scheduled Banks and Non-Scheduled Banks. Scheduled Banks are further divided into Commercial Banks and Co-operative Banks. Commercial Banks consist of Public Sector Banks, Private Sector Banks, Foreign Banks and Regional Rural Banks. Regional Rural Banks and Unscheduled Banks are not subject to Basel III guidelines. For the purpose of this study, all 20 Public Sector Banks and 15 Private Sector Banks are taken into consideration.

LITERATURE REVIEW

Increasing bank failures is a feature of inadequate risk management in banks. Greuning and Bratanovic (2009) categorized banking risk in three major risk frameworks of financial risk, operational risk and environmental risk. Financial risk includes balance sheet structure risk, credit risk, solvency risk and treasury risk. Operational risk related to bank's internal processes, management, compliances and business continuity planning. Environmental risks relate to macro-economic policy concerns. Hence, analysing total risk is essential for study of banks.

Dionne (2013) defines risk management as combination of financial and/or operational activities with an aim to maximize profit with a reduction in cost. Total Risk is a measure of standard deviation of total return of assets. Standard deviation measures volatility of the portfolio. Total risk is the summation of systematic risk and diversifiable risk. Systematic risk includes market risk, undiversifiable risk and systemic risk. Hence, systematic risk includes risk arising from external factors which are not in control of the Banks. Unsystematic risk arises in Bank due to internal factors such as credit risk, operational risk, concentration risk, counterparty risk etc.

Bonfim (2009) suggested categorized determinants of risk in three parts such as accounting variables, market information and macroeconomic variables. Many researchers have considered sources of risk used both internal and external factors affecting the risk (Das and Ghosh, 2007; Maji and Hazarika 2016). Some researchers such as Moses (2013) considered only internal factors affecting the credit risk whereas, some researchers focused on external variables only (Poudel, 2013).

Internal factors comprise of financial ratios as source of risk. According to Jahankhani and

Lynge (1980), total risk is explained more by the use of financial ratios. Solvency risk of a bank gets assessed by total risk and it is a measure of standard deviation of return on assets. Majority of the previous literature assessed the sources of credit risk for which profitability, productivity, liquidity, management efficiency, activity and solvency ratios are used as variables (Das and Ghosh, 2007; Manab et al., 2015). Limited literature is available for total risk wherein indicators such as capital adequacy, profitability, liquidity ratio, efficiency and solvency ratios are used (Moussa, 2015). Moreover, external factors comprise of macroeconomic indicators. Macro-economic factors are part of systematic risk. Empirically, it is evidenced that downturn in economic activities gives rise to non-performing loans in banks resulting in an increased total risk (Jimenez and Saurina, 2006). Major determinants of economic activities are GDP growth rate and inflation rate.

Table 1. List of internal and external factors adopted by scholars in the previous literature

Author	Year	Country	Ratios Adopted		Risk determinant
			Internal factors	External factors	
Ayaydin &Karakaya	2014	Turkey	Equity to total assets, net loans to total assets, liquidity ratio, foreign ownership	GDP, HHI Index, and Inflation Rate	Total Risk and Profitability
Moussa	2015	Tunisia	Size, Equity to Total Asset, Total Loan to Total Asset, Return on Asset, Return on Equity, Operating asset to total asset, Liquidity Ratio, Financial expenses to total asset	GDP Rate and Inflation Rate	Total Risk
Thaiagarajan et al.	2011	India	Bad loan growth, Size, Branch business,	GDP, and Inflation rate	Credit Risk
Bittu and Dwivedi	2012	India	Non-performing loans, ownership, efficiency, capital ratio	GDP	Credit Risk

RESEARCH METHODOLOGY

This study uses the data of 35 Public and Private Sector Banks in India over the period of 2011-2016. The data is collected from secondary sources, particularly fromannual reports of the banks, which are available on the websites of the respective banks. Macroeconomic indicators adopted in this paper are collected from the 'Planning and Commission website of Government of India'. We ran a panel data analysis for our dataset which contains 210 observations. Since the data may contain high level of heterogeneity and panel data model also controls heterogeneity of the data, panel data regression is preferred over ordinary least square (OLS) linear regression. Moreover, static panel data model is used over dynamic panel

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data model as data of each bank is available individually which combines time series and cross sections.

SPECIFICATION OF THE MODEL

Based on the empirical evidence, we adopted the internal and external factors influencing total risk for developing model as follows. The model has been operationalised before and is based on previous studies undertaken (Moussa, 2015). The model for this paper is as follows:

$$Y = \beta_0 + \beta_1 F_{it} + \ldots + \beta_{12} F_{it} + e_{it}$$

Y is the dependent variable, β_0 is constant/point of interception, β_i is the coefficient of variables, explanatory variable is denoted as F_{it} and e_{it} is the error term. β_0 considers cross-sectional time invariant effect as well. F_{it} are all explanatory variables used in this study. *i* denotes name of bank or number of banks and *t* denotes year or time period considered in this study. Total risk is the dependent variable. Size, profitability, capital, operating expenses to asset ratio, interest expenses to asset ratio, liquidity to asset ratio, GDP and inflation rate are independent variable.

ACTUAL MODEL

$$Risk_{i,t} = \beta_0 + \beta_1.Bsize_{i,t} + \beta_2.CAPTA_{i,t} + \beta_3 TLTA_{i,t} + \beta_4.ROA_{i,t} + \beta_5.ROE_{i,t} + \beta_6.OETA_{i,t} + \beta_7.TDTA_{i,t} + \beta_8.CAPTL_{i,t} + \beta_9.LATA_{i,t} + \beta_{10}.IETA_{i,t} + \beta_{11}.TPIB_{i,t} + \beta_{12}.TINF_{i,t} + E_{i,t}$$

where *i* is the name of a bank and *t* is time of study and β_i is coefficients of each parameter used in the model. Model is based on previous studies (Moussa, 2015).

Table 2(Part-I). Description of Variables

Symbol	Description	Importance
Risk	Risk is measured as standard deviation of return on assets over summation of expected return on assets and CAPTA	It is the measure of insolvency of the banks
Bsize	Natural logarithm of total assets	The size of the bank shows diversification abilities. The big banks can make more diversification to reduce risk.
CAPTA	Equity/Total assets	It denotes capitalization and in turn shock/loss absorbency capacity of the banks
TLTA	Total loans/Total assets	It shows total percentage of loans in total assets.
ROA	Net profit/Total assets	It is the ratio of net profits earned by banks over total size of the bank.
ROE	Net income/Equity	It is the ratio of net profits earned by banks over equity capital of the bank.
OETA	Operating expenses/Total assets	It shows the percentage share of operating expenses in total assets of the banks

Table 2(Part-II). Description of Variables

TDTA	Total deposits/Total assets	It shows the percentage share of total deposits in total assets of the banks
CAPTL	Equity/Total loans	It is the percentage share of total equity in total loans of the banks
LATA	Liquid assets/Total assets	It is the percentage share of liquid assets in total assets of the banks
IETA	Interest expenses/Total assets	It shows the percentage share of interest expenses in total assets of the banks
TPIB	------	GDP growth rate
TINF	------	Inflation rate

To arrive at research conclusions, a number of relevant statistical tests is performed. Econometric tests are divided in four sub-parts such as unit root test, multicollinearity test, panel data analysis and test of heteroscedasticity and serial correlation amongst all variables.

Econometrics Tests

Unit Root Test

In regression analysis, it is important to determine the nature of variables whether stationary or non-stationary even before performing multi-collinearity test. To determine stationary of variables used we performed "Augmented Dickey-Fuller t-statistics Unit Root Test (ADF)". While performing ADF unit root test, 'URCA' package of R studio is used. We observed that all the variables used in the regression model are stable and can be used in panel data method (Table 3 below).

Table 3. Augmented Dickey-Fuller t-statistics Unit Root Test (ADF)

Variables	t statistics	Decision
Risk	-3.7436	Stationary
Bsize	-3.2571	Stationary
CAPTA	-2.4258	Stationary
TLTA	-5.9356	Stationary
ROA	-5.9356	Stationary
ROE	-5.2215	Stationary
OETA	-4.2381	Stationary
TDTA	-4.0128	Stationary
CAPTL	-1.919	Stationary
LATA	-5.3216	Stationary
IETA	-6.4117	Stationary
TPIB	-18.8517	Stationary
TINF	-22.21	Stationary

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Multi-Collinearity Test

Mansfield and Helms (1982) concluded that finding existence of multi-collinearity in multiple regression is very much essential as its existencemay have adverse impact on estimated coefficients and results can be misleading. Multi-collinearity test should be carried out first in multiple regression. Hence, to detect multi-collinearity, correlation matrix and VIF test is performed.

Table 4. Correlation between variables

	Risk	Bsize	CAPTA	TLTA	CAPTL	ROA	ROE
Risk	1						
Bsize	0.1541	1					
CAPTA	-0.8385	-0.1416	1				
TLTA	0.1354	0.0699	-0.2044	1			
CAPTL	-0.8038	-0.1411	0.9868	-0.3447	1		
ROA	-0.5659	0.0150	0.3458	0.0910	0.3012	1	
ROE	-0.2537	0.0899	0.0709	0.2472	0.0262	0.8508	1
TDTA	0.5207	-0.1531	-0.5231	0.3014	-0.5421	-0.3910	-0.1118
OETA	-0.5869	-0.3333	0.6184	-0.0638	0.5867	0.1457	-0.1529
LATA	0.1159	0.3389	-0.0919	-0.1240	-0.0728	-0.1042	-0.0885
IETA	0.17	-0.4773	-0.1363	0.1087	-0.1442	-0.3721	-0.3269
TPIB	-0.0065	0.1414	0.0755	0.0258	0.0588	-0.2908	-0.3369
TINF	0.0136	-0.1652	-0.0801	-0.0865	-0.0534	0.3241	0.3831
TDTA	1						
OETA	-0.4379	1					
LATA	0.0302	-0.1975	1				
IETA	0.3155	-0.0084	-0.4415	1			
TPIB	-0.0378	0.0669	0.0248	0.0881	1		
TINF	0.0088	-0.0741	0.0123	-0.2251	-0.8710	1	

We conclude from the above analysis that there exists a significant, strong correlation between equity to total loans ratio (CAPTL) and equity to total assets ratio (CAPTA) (i.e., 0.98). Therefore, we eliminate variable CAPTL.

Table 5. VIF Test (without CAPTL)

Variable	VIF	Variable	VIF
Bsize	2.0699	TDTA	2.1434
ROA	8.5201	LATA	1.4899
CAPTA	4.1108	IETA	2.4211
TLTA	1.4581	TPIB	4.6066
OETA	2.5395	TINF	5.3955
ROE	6.6533		

VIF is also one of the widely used indicators in detecting multicollinearity of the *i*th independent variable with other independent variables in multiple regression analysis. In the literature, there are numerous recommendations for different acceptable level of VIF. Value of 10 is widely preferred by various researchers. According to Marquardt (1970), VIF if greater than 10 indicates presence of severe multi-collinearity in the data. Whereas, O'Brien (2007) claims that in some circumstances a VIF greater than 10 is also acceptable. To tackle the problem of multicollinearity in our dataset, we removed CAPTL from the model as it was not within the acceptable range. We then re-ran the analysis and observed no evidence of multi-collinearity.

Panel Data Analysis and Hausman Test

According to Hsiao (1985), panel data set in research is more advantageous as it gives large data points an increase in degree of freedom (*df*) and a reduction in the collinearity among independent variables as compared with the traditional cross-sectional time series data sets. fixed effects model and random effects model methods are used to analyse panel data. Hausman Test is also performed for identifying the endogeneity in the explanatory variables. We used R Studio with plm package for panel data analysis.

$$Risk_{i,t}= \beta_0+\beta_1 Bsize_{i,t}+\beta_2 CAPTA_{i,t}+\beta_3 TLTA_{i,t}+\beta_4 ROA_{i,t}+\beta_5 ROE_{i,t}+\beta_6 OETA_{i,t}+\beta_7 TDTA_{i,t}+\beta_8 CAPTL_{i,t}+\beta_9 LATA_{i,t}+\beta_{10} IETA_{i,t}+\beta_{11} TPIB_{i,t}+\beta_{12} TINF_{i,t}+E_{i,t}$$

Table 6: Comparative results of Multiple regression, Fixed Effects and Random Effects

Particulars	**Multiple regression**	**Fixed Effects**	**Random Effects**
	Coefficients	Coefficients	Coefficients
Constant	0.01806**		0.01809513***
Bsize	0.00005303	-0.000728	0.00004132
CAPTA	-0.09008***	-0.07406***	-0.08038414***
TLTA	0.001937	-0.00945*	-0.00555773
ROA	-0.3355***	-0.13388**	-0.22909342***
ROE	0.007199**	0.00569**	0.00752300***
OETA	-0.08741*	-0.06717	-0.10025977*
TDTA	-0.001481	0.00238	0.00273890
LATA	-0.002888	-0.002526	-0.0025603
OETA	0.01526	0.00685	-0.00843980
TPIB	0.004524	0.014425	0.00964293
TINF	0.01174	-0.00806	0.00139556
Multiple R-Squared	0.8184	0.6014	0.6805
Adjusted R-Squared	0.8083	0.4697	0.6416
P-value	p <0.05	p<0.05	p<0.05

***CAPTL factor is removed from original equation due to multicolinearity*

In our research, result of Hausman Test is significant at 5%; therefore, the Fixed Effect Model can be used.

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Table 7. Hausman Test

Data: y~x
Chisq = 32.52, df = 11, p-value = 0.0006292
Alternative hypothesis: one model is inconsistent

Based on the results of Fixed Effect Model, variables such as CAPTA, ROA, ROE and TLTA have a significant relationship with the dependent variable risk, excluding all other factors. Therefore, we concluded that the revised model is as follows:

$$Risk_{i,t} = \beta_1.CAPTA_{i,t} + \beta_2 TLTA_{i,t} + \beta_3.ROA_{i,t} + \beta_4.ROE_{i,t} + E_{i,t}$$

Test of Heteroscedasticity and Serial Correlation

It is important to check presence of heteroscedasticity and serial correlation in the panel data because it may contain heteroscedasticity biases. Therefore, we performed the 'Bresusch Pagan Test' for detecting the heteroscedasticity in multiple regression model and Breusch-Godfrey-Wooldridge test for serial correlation detection in panel model. This test is based on the framework of Lagrangian Multiplier test (LM test). LM test examines jointly existence of serial correlation as well as individual effects of homoscedasticity. Additionally, Durbin-Watson test is performed for detecting autocorrelation of residuals in multiple regression models.

Table 8. Various Tests Results

Breusch-Pagan Test, *BP* = 62.23, p<0.05	**DW Test** *d* = 0.93, p<0.05
Breusch-Godfrey/Wooldridge test, Chisq = 46.71, p<0.05	

According to Table 8, the test results are significant at 5% significance level and thus, the null hypothesis is rejected; we conclude that in our panel dataset there is an existence of heteroscedasticity and autocorrelation. Long and Ervin (1998) stated that coefficient estimates of regression remain unbiased in the presence of heteroscedasticity; however, significance tests are inconsistent. Therefore, heteroscedasticity consistent covariance matrix test (HCCM) is performed to have consistent results. To run this test, we used R package 'sandwich'. We performed Newey-West test to examine estimators of heteroscedasticity and autocorrelation consistent (HAC).

Table 9: Final Results

	Coefficient	**Standard error**	**t value**	**p-value**
Intercept	0.018060	0.0056335	3.2057	0.001571**
Bsize	0.000053031	0.000016852	0.3147	0.753328
CAPTA	-0.090080	0.018081	-4.9819	0.000001368***
TLTA	0.0019366	0.0051162	0.3785	0.705451
ROA	-0.33551	0.063347	-5.2964	0.0000003128***
ROE	0.0071986	0.0027705	2.5983	0.010073*
OETA	0.087412	0.048468	-1.8035	0.072830
TDTA	0.0014807	0.0020668	-0.7164	0.474559
LATA	-0.0028878	0.0058693	-0.4920	0.623255
IETA	0.015264	0.022686	-0.6278	0.501834
TPIB	0.004524	0.017277	0.2619	0.793705
TINF	0.011743	0.0095158	1.2341	0.218643

*Significance at 0.01 level, **Significance at 0.001 level, ***Significance at 0 level

Our final regression model, therefore, is:

$$Risk_{i,t} = 0.018060 - 0.09008 * CAPTA_{i,t} - 0.33551 * ROA_{i,t} + 0.0071986 * ROE_{i,t} + E_{i,t}$$

ESTIMATION OF RESULTS

Our analysis shows that there is a negative relationship between total risk and capital. If capital increases by 1%, risk decreases by 0.090080% all other factors remaining constant. This finding is consistent with those of previous literature (Ghosh, 2014; Maji and Hazarika, 2016). While there is a positive relationship between total risk and return on equity, total risk and return on asset tends to move in opposite direction. However, our study does not show any statistically significant relationship between total risk and other factors such as size, total loans, operating expenses, total deposits, liquid assets, interest expenses, GDP growth rate and inflation rate.

CONCLUSION

Risk has a negative relationship with capital and return on assets (ROA) and a positive relationship with return on equity (ROE). Macroeconomic indicators such as GDP rate and inflation rate are not significant determinants of total risk for Indian Banks. This paper concludes that risk is influenced mainly by capital and profitability of Indian public and private sector banks. Our findings, as demonstrated by fixed effect model, show that total loans to total assets ratio was one of the significant factors in assessing risk; the FE model established a negative relationship between the two. However, further investigation showed existence of heteroscedasticity and serial correlation in the data. The results are then adjusted based on the Newey-West Test and after removing the effects of heteroscedasticity and serial correlation. Results of Newey-West Test showed no statistically significant relationship between loan and risk in our sample data of private and public sector banks in India . Future research papers in this area should investigate this matter further. Findings of this research would be useful for bankers in India to make stronger Internal Capital Adequacy Assessment Process (ICAAP) document as part of Pillar II Supervisory Approach under Basel III. These findings will be useful for developing capital optimization strategies. Increasing profitability by adopting various strategies can help Banks to generate capital internally. If banks could generate profits internally to cover major shortfall in capital every year, then it would, in return, reduce their high cost of capital.

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