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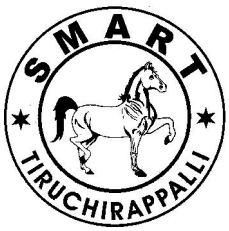

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INVESTIGATING THE EFFECTS OF SECTORAL DIVERSIFICATION OF LOAN AND ADVANCES ON RISK AND RETURN OF INDIAN COMMERCIAL BANKS: POST - FINANCIAL CRISIS OF 2008.

Jawed Mohammad Shameem*
Research Scholar (Finance & Accounting), Indian Institute of Management, Indore, India,
Email: - f12mohammads@iimidr.ac.in

Tiwari Santosh Kumar
Research Scholar (Strategic Management), Indian Institute of Management, Indore
Email: - f12santosht@iimidr.ac.in

Dhaigude Amol Subhash
Research Scholar (OM&QT), Indian Institute of Management, Indore
Email: - f12amold@iimidr.ac.in
and
Tapar Archit Vinod
Research Scholar (Marketing Management), Indian Institute of Management, Indore.
Email: - f13architt@iimidr.ac.in

Abstract

This paper seeks to investigate the effects of sectoral diversification of loan and advances on risk and return of Indian commercial banks in the aftermath of the financial crisis of 2008. Forty Indian commercial banks were taken up for the study during the period 2009-2013. Using the Hirschman-Herfindhl Index (HHI) as a measure of diversification, a panel data regression analysis was performed. It is found that the sectoral diversification of loan and advances helps in reducing the bank risk while its impact on bank return was found to be inverted U-shaped.

Keywords: Sectoral Diversification Strategy; Bank Return; Bank Risk; Indian Banking; Concentration Measures; HHI Index; Panel Data Regression.

JEL Code : G21, G28, G32, C23, L25

*** Corresponding Author**

1. Introduction

The shifting focus on diversification strategy in the business activities of firms is among the most debated subjects in corporate finance. The impact of diversification on performance and risk is a mixed one. There are evidences to indicate that diversification is value-destroying, which leads to what is known as the *diversification discount* **(Villalonga, 2004)**. Theoretical explanations for this include managerial risk aversion, agency problems between managers and shareholders, inefficiency of internal capital markets, and power struggles between different segments of a firm. On the other hand, some studies support the diversification as a strategic option to reduce risk and enhance performance **(Diamond, 1984; Morris, 2001).**

However, in the case of banking, diversification has an important role to play subject to its nature as a financial intermediary. Since risk management is an integral part of the business of financial firms, the ability to gain from diversifying risks is important for such firms. Sometimes, diversification may be a regulatory compulsion, leading to sub-optimal performance. At the same time, different sources of bank financing such as equity, debt, subordinated debt etc. may have competing interests rather than causing higher risk and lower returns. Also, some banks decide to involve in sectors for which they have expertise and thus enjoy comparative advantages. Therefore, diversification may not necessarily lead to an improved performance or reduced risk.

The impact of financial crisis of 2008 was heavy, both on policy makers as well as financial intermediaries. More than $1.73 trillion were wiped out of the balance sheet of financial institutions during August 2007 and late 2009 **(Acharya, et al, 2011)**. Indian banking system, though not severely affected, was not immune to the adverse effects of this crisis. The prevalent mood in Indian banking system, in the post crisis period, can at best be described as cautious, if not gloomy. At the same time, The Reserve Bank of India, the Indian Regulator, has put many prudential requirements on banks and thereby limiting their exposure to different sectors. For example, the regulator increased the weight of risk exposure for commercial real-estate firms from 100 to 150 percent and that of consumer credit and capital market exposures from 100 to 125 per cent **(Mohan 2008)**. In such an environment, it becomes imperative for banks to revisit and investigate the impact of sectoral diversification as a strategic choice on risk and performance.

An attempt has been made in this paper to dwell upon the effects of sectoral diversification of loan and advances on risk and return of Indian commercial banks in the aftermath of the financial crisis of 2008.

2. Literature Review

The issue of diversification versus concentration is central to the banking sector. There is one strand of literature, which supports the diversification theory of bank loan portfolio, borrowing from the traditional portfolio theory **(Markowitz, 1959; Bebczuk** and **Galindo, 2008; Hayden et al., 2007; Rossi et al., 2009).** According to this school of thought, due to the asymmetry of information, loan diversification may reduce financial intermediation cost **(Diamond, 1984; Morris, 2001).Antonio (1979)** and **Teece (1982),** and argue that diversification brings economy of scale by spreading fixed costs over products and regions. At the same time, diversification leads to more efficient resource allocation **(Stein, 1997)**. Diversification provides the opportunity for bank to exploit specific resources, including managerial skills and capabilities. **(Bodnar et al., 1997; Iskandar-Datta** and **McLaughlin, 2007)**. Basel Committee on Banking Supervision also acknowledges that the banking crisis in the past few decades was caused mostly by the concentration of bank assets. **Jeyachitra et al., (2010)** has studied portfolio risk and return relationship of Nifty stocks. They argue

that the portfolio unsystematic risk declines due to diversification.

Drawing from the corporate finance literature, advocates of concentration prefer the logic of concentrating on sectors of expertise to achieve competitive advantage **(Acharya, et al, 2006)**. This thread of literature highlights the cost associated with diversification in the banking sector **(DeYoung and Roland, 2001; Stiroh, 2004).** Diversification leads to higher agency cost due to more hierarchy and complexity where managers may tend to further their own utility through diversification **(Jensen, 1986). Rajan et al., (2000)** argue that internal capital market may not be efficient and diversification may lead to sub-optimal resource allocation. Moreover, **Winton (1999)** argues that the diversification strategy becomes less attractive in the case of higher competition **(Mercieca et al., 2007; Tabak et al., 2011).**

3. Statement of the Problem

The issue of focus versus diversification of loans and advances in the banking sector took the center stage in the aftermath of the 2008 global financial crisis. Banking industry around the globe took cognizance of the benefits and risk associated with the issue of diversification versus concentration of their sources of earnings, assets and liabilities. Since the industrial advances and loans form a very important component of banks' asset, its health affects the banks' risk-return performance significantly. Keeping this in mind, this research paper investigates the impact of sectoral diversification of loan and advances of the Indian commercial banks on their risk and returns performance and explores the nature of the relationship between them.

4. Objectives of the Study

The present study has the following key objectives.

- To study the effects of sectoral diversification of loan and advances on risk and return of Indian commercial banks, in the aftermath of the 2008 financial crisis.
- To explore and analyze the nature of relationship between sectoral diversification of Banks' loan and advances with its risk and return.

5. Hypotheses of the Study

H1a: Higher sectoral diversification of loan and advances has a linear positive relationship with bank's return.

H1b: Higher sectoral diversification of loan and advances has a non-linear relationship with bank's return.

H2a: Higher sectoral diversification of loan and advances has a linear negative relationship with bank's risk.

H2b: Higher sectoral diversification of loan and advances has a non-linear relationship with bank's risk.

6. Methodology of the Study

6.1 Source of Data

Data were collected from the *Center for Monitoring the Indian Economy's* (CMIE), Prowess, Capitaline and RBI official websites.

6.2 Sample Space

As per the Banking Codes and Standards Board of India, there are 70 scheduled commercial banks in India, out of which top 50 banks were selected, based on their asset size. Banks for which data were missing for more than three years, were not included in the sample. After screening the sample data set, 21 public sector banks, 16 private domestic banks and 3 private foreign banks were selected for the study **(Table 6)**.

6.3 Period of the Study

The period of study was 2009-2013, in the aftermath of the global financial crisis of 2008.

6.4 Tools Used for the Analysis

To investigate the relationship, a *panel data regression* analysis was applied, using the *STATA 12.0*.

6.5 Operationalization of Variables

6.5.1 Dependent Variables:

Bank's performance was captured by Return on Assets (ROA) **(Kumar 2014; Saha, 2008)**. Non-Performing Assets (NPA) was used to measure Bank's risk **(Arellano and Bond, 1991; Chen et al., 2013).**

6.5.2 Independent Variables

Hirschman-Herfindhl Index (HHI) was used to measure the degree of diversification (refer annexure 14.1 for details).

6.5.3 Control Variables

Total Asset, Credit-to-Deposit Ratio (Ibrahim, 2009) and Equity Ratio were used as control variables.

7. Limitations

The regional rural banks and the scheduled co-operative banks were not considered in this study. The study did not consider the industry - specific systematic risk while calculating the HHI parameters.

8. The Models

Many studies in the past have explored the relationship between banks' risk-return and loan diversification **(Acharya et al., 2006; Langrin & Roach 2009; Berger et al., 2010; Chen et al., 2013)**. Building on these studies, two sets of regression equations were developed. First, regressing the return and risk on the diversification measure while controlling for size, liquidity and banks' capital structure (equation *I, iii*). Second, to check the non-linearity of relationship between diversification and risk-return, a square term of diversification was introduced in another set of regression equations (equation *ii, iv)*. ROA, natural log of NPA, natural log of total assets, loan-deposit ratio, and equity ratio were used as proxies of bank's return, risk, size, liquidity and capital structure respectively, in all the regression equations.

8.1 Relationship between sectoral diversification of loan and advances and bank returns

$$ROA_{kt} = \beta_{k0} + \beta_1 . HHI_{kt} + \gamma_1 . Log(Asset)_{kt} + \gamma_2 . LnDp\_ratio_{kt} + \gamma_3 . EqAt\_ratio_{kt} + \varepsilon_{kt} \quad \ldots (i)$$

$$ROA_{kt} = \beta_{k0} + \beta_1 . HHI_{kt} + \beta_2 . HHI_{kt}^2 + \gamma_1 . Log(\text{asset})_{kt} + \gamma_2 . \text{LnDp}_{\text{ratio}_{kt}} + \gamma_3 . \text{EqAt}_{\text{ratio}_{kt}} + \varepsilon_{kt} \quad \ldots (ii)$$

8.2 Impact of sectoral diversification of loan and advances on bank risk

$$Log(NPA)_{kt} = \beta_{k0} + \beta_1 . HHI_{kt} + \gamma_1 . Log(Asset)_{kt} + \gamma_2 . LnDp\_ratio_{kt} + \gamma_3 . EqAt\_ratio_{kt} + \varepsilon_{kt} \quad \ldots (iii)$$

$$Log(NPA)_{kt} = \beta_{k0} + \beta_1 . HHI_{kt} + \beta_2 . HHI_{kt}^2 + \gamma_1 . \text{Log(Asset)}_{kt} + \gamma_2 . \text{LnDp\_ratio}_{kt} + \gamma_3 . \text{EqAt\_ratio}_{kt} + \varepsilon_{kt} \ldots (iv)$$

Where,

NPA$_{kt}$*(risk),* is the risk of bank ***k*** at time ***t*** measured by non-performing loan,

ROA$_{kt}$*(return),* is the return of bank ***k*** at time ***t*** measured by ROA,

Asset$_{kt}$, is the Net Asset of the bank ***k*** at time ***t***,

$LnDp\_ratio_{kt}$, is the loan-to-deposit ratio of bank ***k*** in time ***t***,

$EqAt\_ratio_{kt}$ is the equity ratio, equity to Net Asset for bank ***k*** in time period ***t***, HHI_{kt} *(diversification),* is diversification of bank ***k***'s loan portfolio in the time period t, and ε_{kt}, is the residual value.

9. Results and Discussion

Table-1 provides the Summary Statistics of the data used for the study. Hausman Specification Test was used to investigate whether the models (section 8.1, 8.2) could be analyzed more efficiently, using the fixed effect estimates or the random effect estimates of the panel data regression analysis. The *Chi-Squre* values were less than 0.05 (0.0008, 0.0006 and 0.0006, 0.0000) which means that all the models used for panel data analysis were fixed effect models.

First model analyzes the effect of sectoral diversification of loan and advances on bank return (section 8.1), where the *F-test* value (0.0001) of the model was found to be significant but the coefficient of the independent variable was non-significant (p-value=0.69) at both 95% and 90% confidence levels **(Table-2),** not supporting hypothesis *H1a***.** The non-linear relationship was tested by using square value of the independent variable (HHI). It was found that the coefficients of HHI and its square value were significant at 95% confidence level**(Table-3),** with p-value estimates of 0.036 and 0.034, respectively, supporting the hypothesis *H1b*. Given that the sign of the coefficient of HHI was negative and that of its square term was positive, it signifies that there existed an inverted U-shaped relationship between banks' return and diversification of loans and advances.

These results are in consonance with Acharya et al. (2006), who argues that performance may take a hit due to increased monitoring cost at higher levels of diversification. In the Indian banking scenario, with regulatory constraints like priority sector lending, the effect of bank diversification at times may not reflect the strategic diversification but rather a forced one.

Similarly, the relationship between risk and diversification of loans and advances was tested by using the second model (section 8.2), where the F-test statistics (0.0000) shows that the model was significant **(Table-4)**. A significant positive coefficient estimate of the dependent variable at 95% significance level, with p-value of 0.008 was obtained, supporting the hypothesis *H2a*.

The non-linear relationship of the dependent and independent variable was then tested by the introduction of squared independent variable. The results (p-value=0.116) indicate that there was no significant non-linear relationship of risk with diversification **(Table-5),** not supporting the hypothesis *H2b*. This confirms that there was a negative (positive) relationship between banks' risk and diversification (concentration) of loan and advances.This is in support of literatures **(Diamond, 1984; Acharya et al., 2006; Kamp et al., 2005),** which argue that diversification strategy of banks on their sectoral loan portfolio leads to reduced risk.

10. Findings and Suggestions

Higher sectoral diversification of loan and advances had significant impact on banks' risk. The relationship is linear and negative, which means that banks with more diversified portfolio of loan and advances in various sectors of the industry would be less risky when compared to banks which have a concentrated sectoral loan portfolio. However, higher diversification did not linearly impact banks' return, although they recorded a non-linear (inverted U-Shaped) relationship. This signifies that any increase in banks' sectoral diversification of loan and advances first positively impacts the returns, but after a point, any further increase in diversification starts to negatively impact the returns.

It is worth investigating further the optimal point of banks' diversification of its loan portfolio, where the benefits of diversification on risk and return could be optimized. This may be achieved with the use of more robust measures of risk-return while controlling bank and industry - specific factors.

11. Conclusion

This study aims at testing the effects of bank loan portfolio diversification on banking performance in terms of risk and return. The main finding of the study is that sectoral diversification strategy of loan and advances helps in reducing risk significantly. In a scenario where macroeconomic activities are weakening and balance sheet cannot guide the future valuation, it becomes even more imperative for banks to keep risk under check. This finding is in consonance with the findings of others researchers **(Markowitz, 1959; Diamond, 1984; Acharya et al., 2006; Kamp et al., 2005).**

However, returns did not show significant linear effect with diversification of loan and advances, but there was inverted U-shaped relationship. The reason may be that diversification after a certain level may result in higher monitoring costs, which overshadows the overall profits **(Acharya et al., 2006).** Lower performance may also be because of obligatory diversification. In India, the regulator mandates to invest into priority sector which has lower profitability and thereby dragging the overall performance. At the same time, emphasis on financial inclusion by government also forces banks to diversify into less lucrative sectors.

12. Scope for Future Research

ROA is the only index used for measuring bank performance. For future studies, composite performance measure should be used. At the same time, for measuring the effect of sectoral diversification on bank assets and risk, a risk-adjusted HHI index should be used which could capture the systematic risk of the industry as well. In future, study on the impact of diversification on the regional rural and the co-operative banks may also be undertaken. To develop better insights into the effects of diversification, comparative study could be used for the period before and after the 2008 financial crisis. More robust and extensive control variables like market concentration, non-interest income, sectoral-beta, etc. could also be used.

13. References

Acharya, V. V., Gujral, I., Kulkarni, N., & Shin, H. S. (2011). *Dividends and bank capital in the financial crisis of 2007-2009* (No. w16896). National Bureau of Economic Research.

Acharya, V. V., Hasan, I., & Saunders, A. (2006). Should Banks Be Diversified? Evidence from Individual Bank Loan Portfolios*. *The Journal of Business*, *79*(3), 1355-1412.

Antonio, R. J. (1979). The Visible Hand: The Managerial Revolution in American Business. *Telos*, *1979*(42), 188-193.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The review of economic studies*, *58*(2), 277-297.

Bebczuk, R., & Galindo, A. (2008). Financial crisis and sectoral diversification of Argentine banks, 1999–2004. *Applied Financial Economics*, *18*(3), 199-211.

Berger, A. N., Hasan, I., & Zhou, M. (2010). The effects of focus versus diversification on bank performance: Evidence from Chinese banks. *Journal of Banking & Finance*, *34(7),* 1417-1435.

Bodnar, G. M., Tang, C., &Weintrop, J. (1997). *Both sides of corporate diversification: The value impacts of geographic and industrial diversification* (No. w6224). National Bureau of Economic Research.

Chen, Y, Wei, X., Zhang, L., & Shi, Y. (2013). Sectoral Diversification and the Banks' Return and Risk: Evidence from Chinese Listed Commercial Banks. *Procedia Computer Science*, *18*, 1737-1746.

DeYoung, R., & Roland, K. P. (2001). Product mix and earnings volatility at commercial banks: Evidence from a degree of total leverage model. *Journal of Financial Intermediation*, *10*(1), 54-84.

Diamond, D. W. (1984). Financial intermediation and delegated monitoring. *The Review of Economic Studies*, *51*(3), 393-414.

Hayden, E., Porath, D., &Westernhagen, N. V. (2007). Does diversification improve the performance of German banks? Evidence from individual bank loan portfolios. *Journal of Financial Services Research*, *32*(3), 123-140.

Ibrahim, M. S. (2009). Credit deposit ratio and Net Interest Margin (NIM) of Indian commercial banks–an analysis. *SMART Journal of Business Management Studies, 5*(2),27–38.

Iskandar-Datta, M., McLaughlin, R., 2007. Global diversification: new evidence from corporate operating performance. *Corporate Ownership and Control, 4,* 228–250.

Jensen, M., (1986). Agency costs of fee cash flow, corporate finance, and takeovers. *American Economic Review, 76,* 323–329.

Jeyachitra, A., Selvam, M., &Gayathri, J. (2010). Portfolio Risk and Return Relationship—An Empirical Study. *Asia Pacific Business Review, 6(4),* 57-63.

Kamp, A., Pfingsten, A., &Porath, D. (2005). *Do banks diversify loan portfolios? A tentative answer based on individual bank loan portfolios* (No. 2005, 03). Discussion Paper, Series 2: Banking and Financial Supervision.

Kumar, M. (2014). Most profitable bank in India: A comparative analysis of Indian nationalized banks. *SMART Journal of Business Management Studies, 10*(2), 24–37.

Langrin, R. B., & Roach, K. (2009). Measuring the effects of concentration and risk on bank returns: evidence from a panel of individual loan portfolios in Jamaica. *Journal of Business, Finance & Economics in Emerging Economies, 4(1)*, 73-118.

Markowitz, H.M. (1959). *Portfolio Selection: Efficient Diversification of Investments*. New York: John Wiley.

Mercieca, S., Schaeck, K., & Wolfe, S. (2007). Small European banks: Benefits from diversification?.*Journal of Banking & Finance*, *31*(7), 1975-1998.

Mohan, R. (2008). Global financial crisis and key risks: impact on India and Asia. *RBI Bulletin*, 2003-2022.

Morris, J., (2001). Risk diversification in the credit portfolio: an overview of country practices. IMF Working Paper WP/ 01/200, International Monetary Fund.

Rajan, R., Servaes, H., &Zingales, L. (2000). The cost of diversity: The diversification discount and inefficient investment. *The Journal of Finance*,*55(1)*, 35-80.

Rossi, S.P., Schwaiger, M. S., & Winkler, G. (2009). How loan portfolio diversification affects risk, efficiency and capitalization: A managerial behavior model for Austrian banks. *Journal of Banking & Finance*, *33*(12), 2218-2226.

Saha, A. (2008). Performance indicators of banking sector in Bangladesh: a comparative overview of NCBs, PCBs, SCBs &FCBs.*SMART Journal of Business Management Studies, 4*(1), 1-9.

Stein, J. C. (1997). Internal capital markets and the competition for corporate resources. *The Journal of Finance*, *52*(1), 111-133.

Stiroh, K.J., (2004). Diversification in banking: is noninterest income the answer? *Journal of Money, Credit and Banking,36,* 853-882.

Tabak, B. M., Fazio, D. M., &Cajueiro, D. O. (2011). The effects of loan portfolio concentration on Brazilian banks' return and risk. *Journal of Banking & Finance*, *35*(11), 3065-3076.

Teece, D.J. (1982). Towards an economic theory of the multiproduct firm. *Journal of Economic Behavior & Organization*, *3*(1), 39-63.

Villalonga, B. (2004). Does Diversification Cause the "Diversification Discount"?, *Financial Management, 33,* 5-27.

Winton, A. (1999). Don't put all your eggs in one basket? Diversification and specialization in lending. *Manuscript, University of Minnesota*, Twin Cities.

14. Annexure

14.1 Hirschman-Herfindhl Index (HHI)

Hirschman-Herfindhl Index (HHI) is a commonly used accepted measure of market *concentration*. It assumes perfect diversification as equal exposure to every sector.Relative exposure x_{it} of each bank *i* in time *t*is obtained by dividing the different nominal sectoral exposure ex_{it} to total exposure, $\sum_{K=1}^{N} ex_{it}$

$$x_{it} = \frac{ex_{it}}{\sum_{k=1}^{N} ex_{it}} \quad \text{... (i)}$$

HHI is the sum of the squares of the relative exposures, . And thus for each individual bank, it is defined as:

$$HHI_t = \sum_{i=1}^{N} ex_{it}^2 \quad \text{..(ii)}$$

Where,

N is the total number of sectors/ industries the banks provide their lending to, in the given business year,

ex_{it}, is the nominal exposure of bank loan for the **i**th sector/industry in the **t**thtime period.

Table 1: Summary Statistics of the Panel Data

Variable	Obs	Mean	Std. Dev.	Min	Max
bankID	200	20.5	11.57236	1	40
Time(yr)	200	3	1.417762	1	5
HHI	200	0.183839	0.107285	0.051377	0.563049
Sq_HHI	200	0.045249	0.055318	0.00264	0.317025
ROA	200	1.04508	0.561155	-1.5	2.9
ln_NPA	191	5.655721	1.657074	0.609766	9.349589
ln_Asset	200	11.37342	1.118771	8.638168	14.26579
Eq_Ratio	200	0.009473	0.020645	0.000436	0.145519
CrDep_Ratio	200	0.738851	0.084329	0.4631	1.009

Source: Output of data analysis using STATA12.0

Table 2: Output of panel data regression for relationship between credit portfolio diversification of loans and advances on bank return, model 8.1, eq uation-(

Fixed-effects (within) regression				Number of obs	=	200
Group variable: bankID				Number of groups	=	40
R-sq: within = 0.1348				Obs per group: min	=	5
between = 0.0928				Avg	=	5
overall = 0.0490				Max	=	5
				F(4,156)	=	6.08
corr(u_ i, Xb) = -0.7638				Prob> F	=	0.0001
ROA	Coef.	Std. Err.	T	P>| t|	[95% Conf.	Interval]
HHI	-0.133	0.332593	-0.4	0.69	-0.78997	0.523967
ln_Asset	-0.25862	0.094551	-2.74	0.007	-0.44539	-0.07186
Eq_Ratio	-19.2764	7.417305	-2.6	0.01	-33.9277	-4.62508
CrDep_Ratio	2.250759	0.75013	3	0.003	0.769037	3.732481
_cons	2.530594	0.949398	2.67	0.008	0.655261	4.405927
sigma_u	0.760645					
sigma_e	0.284106					
Rho	0.877572	(fraction of variance duetou_i)				
F test that all u_i=0: F(39, 156) = 13.35 Prob> F = 0.0000						

Source: Output of data analysis using STATA12.0

Table 3: Output of panel data regressionfor relationship between credit portfolio diversification of loans and advances on bank returns, while controlling non-linearity, model 8.1, equation (*ii*).

Fixed-effects (within) regression				Number of obs	=	200
Group variable: bankID				Number of groups	=	40
R-sq: within = 0.1590				Obs per group: min	=	5
between = 0.0948				avg	=	5
overall = 0.0486				max	=	5
				F(5,155)	=	5.68
corr(u_i, Xb) = -0.7812				Prob> F	=	0.0001
ROA	Coef.	Std. Err.	T	P>|t|	[95% Conf.	Interval]
HHI	-2.23934	1.049459	-2.13	0.034	-4.31243	-0.16625
Sq_HHI	3.82349	1.809001	2.11	0.036	0.250012	7.396968
ln_Asset	-0.25591	0.093526	-2.74	0.007	-0.44066	-0.07116
Eq_Ratio	-21.1179	7.387781	-2.86	0.005	-35.7116	-6.52417
CrDep_Ratio	2.417763	0.746126	3.24	0.001	0.943877	3.89165
_cons	2.607985	0.939733	2.78	0.006	0.751649	4.464322
sigma_u	0.789639					
sigma_e	0.281					
Rho	0.887598	(fraction of variance due to u_i)				
F test that all u_i=0: F(39, 156) = 13.69 Prob> F = 0.0000						

Source: Output of data analysis using STATA12.0

Table 4: Output of panel data regression for impact of loan portfolio diversificationof loans and advances on bank risk, model 8.2, equation *(iii*)

Fixed-effects (within) regression				Number of obs	=	191
Group variable: bankID				Number of groups	=	39
R-sq: within = 0.2974				Obs per group: min	=	3
between = 0.3212				Avg	=	4.9
overall = 0.4108				Max	=	5
				F(5,155)	=	15.66
corr(u_i, Xb) = -0.6017				Prob> F	=	0.0000
ln_NPA	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
HHI	2.243327	0.839728	2.67	0.008	0.583922	3.902734
ln_Asset	1.56345	0.242546	6.45	0	1.084151	2.04275
Eq_Ratio	68.42964	19.06999	3.59	0	30.74499	106.1143
CrDep_Ratio	-1.53421	1.969402	-0.78	0.437	-5.42599	2.357571
_cons	-11.9767	2.436222	-4.92	0	-16.791	-7.1624
sigma_u	1.674623					
sigma_e	0.709563					
Rho	0.847792	(fraction of variance due to u_i)				
F test that all u_i=0: F(38, 148) = 3.49 Prob> F = 0.0000						

Source: Output of data analysis using STATA12.0

Table 5: Output of panel data regression for impact of loan portfolio diversification of loans and advanceson bank risk, while controlling for non-linearity, model 8.2, equation (*iv*)

Fixed-effects (within) regression				Number of obs	=	191
Group variable: bankID				Number of groups	=	39
R-sq: within = 0.3091				Obs per group: min	=	3
between = 0.2810				avg	=	4.9
overall = 0.3775				max	=	5
				F(5,155)	=	13.16
corr(u_i, Xb) = -0.6187				Prob> F	=	0.0000
ln_NPA	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
HHI	6.272795	2.683656	2.34	0.021	0.969264	11.57633
Sq_HHI	-7.31756	4.631338	-1.58	0.116	-16.4702	1.835045
ln_Asset	1.564583	0.24133	6.48	0	1.08766	2.041507
Eq_Ratio	72.95973	19.18971	3.8	0	35.03639	110.8831
CrDep_Ratio	-1.82613	1.968212	-0.93	0.355	-5.71578	2.063513
_cons	-12.2199	2.42888	-5.03	0	-17.0199	-7.41981
sigma_u	1.76674					
sigma_e	0.706002					
Rho	0.862302	(fraction of variance due to u_i)				
F test that all u_i=0: F(38, 147) = 3.59 Prob> F = 0.0000						

Source: Output of data analysis using STATA12.

Where variable**,**

bankID is the unique identification number given randomly to the banks in our sample,

Time(yr) is the time period, t=1, 2, 3, 4, 5 (2009-13),

ROA is the Return on asset of individual banks,

Ln_NPAis the natural log value of non-performing assets of the banks

HHI is the calculated *Hirschman-HerfindhlIndex*ofbanks' loan portfolio diversification,

HHI_Sq is the square value of Diversification (HH Index),

ln_Asset is the natural log value of Net Asset,

CrDep_Ratio is the ratio of bank credit to Deposit in a given business year,

Eq_Ratio is the Equity to Asset ratio,

Table 6: List of banks studied (listed alphabetically and categorically)

Public Sector Banks	**Private Sector Banks**	
	Domestic Banks	***Foreign Banks***
Andhra Bank	Axis Bank Ltd.	Deutsche Bank A G
Bank of Baroda	City Union Bank Ltd	Hongkong& Shanghai Banking Corpn.
Bank of India	Development Credit Bank Ltd.	Standard Chartered Bank - India
Bank of Maharashtra	Dhanalaxmi Bank Ltd.	
Canara Bank	Federal Bank Ltd.	
Central Bank of India	H D F C Bank Ltd.	
Corporation Bank	Indusind Bank Ltd.	
Dena Bank	I N G Vysya Bank Ltd.	
Indian Bank	ICICI Bank	
Indian Overseas Bank	Jammu & Kashmir Bank Ltd.	
Oriental Bank of Commerce	Karnataka Bank Ltd.	
Punjab National Bank	KarurVysya Bank Ltd	
State Bank of Bikaner and Jaipur	Kotak Mahindra Bank Ltd	
State Bank of India	Lakshmi Vilas Bank Ltd.	
State Bank of Mysore	The South Indian Bank	
State Bank of Travancore	Yes Bank Ltd.	
Syndicate Bank		
Uco Bank		
Union Bank of India		
United Bank of India		
Vijaya Bank		

Source: Compiled by the authors.