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Article

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BANKING & FINANCE | RESEARCH ARTICLE

The impact of diversification on bank stability in India

Krishnan Chandramohan^{1*}, CA Dipti Lunawat¹ and CA Ajay Lunawat²

Abstract: We study the concurrent impact of functional, geographic and loan portfolio diversification on the stability of commercial banks in India. The sample of 48 banks includes public sector banks, private sector banks and foreign banks operating in India. The unbalanced panel details operational and financial performance for the decade starting from 2007. We employed a dynamic Generalised Method of Moments (GMM) model to estimate the impact of diversification on bank stability. Two reasons justify the use of this approach. First, it incorporates the persistence in risk and stability, thus far neglected in diversification literature. Second, it addresses the concerns of endogeneity between diversification and stability. We find that all three dimensions of diversification, namely; functional, geographic and loan-portfolio diversification, improve bank stability. Apart from the methodological improvements, the multi-dimensional view of diversification adopted in this paper improves on the existing studies of Indian banks. Our analysis of Indian banks suggests that diversification has helped improve resilience. Our findings encourage policymakers and top management to pursue strategic functional, geographic and loan-portfolio diversification.

Subjects: Banking; Risk Management; Financial Services Industry

Keywords: Indian Banking System; Bank Stability; Diversification; Functional Diversification; Geographic Diversification; Revenue Diversification; Loan portfolio diversification

JEL: G21

1. Introduction

Banks, acting as financial intermediaries, play a vital role in the development and sustenance of a robust economy. Governments, central banks and multilateral organisations consequently pursue policies to improve access to banking services. However, this nodality of banks in economic activity also makes the economy susceptible to its vagaries. The domino effect, triggered by the failure of a bank, could threaten an entire nation's financial well-being. The significance of solvency and stability of commercial banks was highlighted anew by the global financial crisis (Lepetit & Strobel, 2014). Even when such financial crises originate beyond the Indian shores, the adverse

PUBLIC INTEREST STATEMENT

When stability of a banking system is threatened either due to increase in non performing assets or lower profitability, central banks invoke prompt corrective measures. Our study investigates the impact of functional, geographic and loan portfolio diversification on bank stability in India. Since a stable banking system is an important aspect for the growth of an economy, the finding of the study will be of great significance for banking professionals, policy makers and regulators. The results of the study indicate that functional, geographic and loan portfolio diversification aid in improving banking stability.

effects could impact Indian banks (Arrawatia et al., 2019). Effective regulation thus necessitates an understanding of the determinants of banking stability.

Policymakers tasked with regulating banks are challenged by the changes in the industry. Over the last three decades, banks have broadened their functions, expanded their reach and changed their portfolios. While finance theory extolls the virtue of such diversification in mitigating risk (Haugen, 2001), the margin of error for financial regulators is slender. In the years leading up to the global financial crisis, banks diversified while maintaining thin capital and liquidity buffers (Buch & Dages, 2018). Diversification, along with an under-appreciation of the risks, played a crucial part in the global financial crisis. Notwithstanding the steps to tighten banking regulations after the crisis (Ichiue & Lambert, 2016), the global trend over the last three decades has been to relax the constraints imposed on banks.

The empirical literature has thus far failed to build consensus on the impact of diversification. Stiroh (2004), in his seminal work, finds an inverse relationship between functional diversification and stability. Some of the later studies, however, report results to the contrary (see, Chiorazzo et al., 2008; Hsieh et al., 2013). Similarly, the impact of diversification of the loan portfolio (see, Berger & DeYoung, 2001; Gulamhussen et al., 2014; Liang & Rhoades, 1991) and expansion to new localities is inconclusive (see, Acharya, Hasan & Saunders, 2006; Berger et al., 2010; Rossi et al., 2009). More importantly, these results are often the product of isolated inquiries into a specific kind of diversification. Since banks pursue multiple diversification strategies simultaneously, it is crucial to analyse their impacts together. To the best of our knowledge, only Berger et al. (2010) have studied the concurrent impact of functional, geographic and loan-portfolio diversifications.

Much like regulators across the globe, the Reserve Bank of India has deregulated the Indian banking industry. Banks in India were only allowed to lend and borrow as per their original mandate. When India started to liberalise its economy in the 1990s, public sector banks dominated the highly regulated industry. Financial regulatory reforms led to the gradual and monitored emergence of modern-era banks and new financial products. Today, banks in India are allowed to offer a much broader gamut of services to their clients. The regulatory reforms have not only triggered multi-dimensional diversification among the Indian banks but also exposed them to newer risks that challenge their stability.

The motivation to study the Indian banking system stems from its differences from most developing and emerging economies. First, the financial advisory services sector in India is still in its nascence. This has allowed banks to emerge as the major partner for cross-selling financial products. Second, Indians prefer bank term deposits over bonds and debentures as a safe avenue for investments. Indian banks, rather than the debt market, facilitate capital intermediation for Indian industries. Third, the Indian banks play a crucial role in establishing the credibility of businesses in commercial transactions by offering products like bank guarantees and letter of credit.

This paper investigates the impact of functional, geographic and loan-portfolio diversification on the financial stability of banks in India. The study contributes to the literature in three ways. First, the multi-dimensional view of diversification adopted in this paper improves on the existing studies of Indian banks, most of which are limited to a single diversification strategy. Commercial banks often pursue functional, geographic and credit diversification simultaneously. Since we incorporate the concurrent impact of all the three strategies, our study provides a more realistic assessment of the impact of diversification. Second, we decompose functional diversification into its constituents. Commission income and trading income have very different implications for bank stability. Functional diversification reduces risk, only if new sources of revenue are uncorrelated to existing streams (Chiorazzo et al., 2008). We analyze the individual impacts of these two income streams to shed more light on the impact of functional diversification. Third, the difference GMM approach adopted in this study is better suited to address the persistence in risk and stability. Moreover, GMM addresses any existing endogeneity between bank stability and diversification, leading to more

robust results. The next section provides a brief review of the scholarship on diversification. The following section outlines the data, methodology and variables employed in the analysis. The subsequent section discusses the results of the analysis and the final section concludes.

2. The dimensions of bank diversification

The scholarship on bank diversification can broadly be classified into three sub-streams. The first category investigates the impact of diversification on financial performance. Measures of profitability and risk-adjusted return are often utilized to understand the impact of diversification (DeYound & Rice, 2004; Meslier et al., 2014 Trivedi, 2015). The second group of studies concentrates on the impact of diversification on the market valuation of banks. Franchise value (Baele et al., 2007) and price to book ratio (Mnasri & Abaoub, 2009; Sawada, 2013) are the preferred market valuation measures. The final body of scholarship concerns itself with the impact of diversification on the stability of banks (Berger et al., 2010; Amidu & Wolfe, 2013;). Insolvency risk, estimated as the distance to default, is employed to understand the impact of diversification. The current study contributes to the third body of literature by highlighting the implications of multi-dimensional diversification. Although risk-adjusted returns and franchise value are of great interest to investors, policy makers emphasise the stability of the financial institution. Consequently, this study concentrates on the impact of diversification on the insolvency risk of banks and puts forward policy recommendations.

The literature suggests that banks can pursue at least three diversification strategies. First, they can diversify their operational activities, which is termed functional diversification or activity diversification. Next, banks expand their operations into different localities. Such expansion, which promotes access to different regions, is referred to as geographic diversification. Third, banks diversify their loan portfolio by lending to a wider array of clientele. Such diversification helps banks originate advances with different contract terms and sizes. The rest of this section discusses these three strategies and their respective impacts.

2.1. Functional diversification

Recent empirical studies concentrate solely on the diversification of bank activity. Two reasons explain this focus on functional diversification. First, banks have diversified their revenue-generating activities from interest income to unconventional and innovative non-interest income. These new products and services offered by banks have captured the attention of regulators and researchers due to their role in the global financial crisis. Second, comparable data on income diversification is widely available, which facilitated cross country studies on bank diversification.

Studies on the impact of functional diversification on bank stability report conflicting results. Early evidence suggested that functional diversification among American Bank holding companies tend to reduce stability and risk-adjusted return (Stiroh, 2004). A subsequent study of community banks in the US corroborates these findings (Stiroh & Rumble, 2006). This was further supported by studies from other regions (Williams, 2016; Abuzayed et al., 2018). However, evidence from other markets like Europe (Chiorazzo et al., 2008), Asia (Hsieh et al., 2013) and Asia-Pacific (Lee et al., 2014) find diversification to be beneficial.

This dichotomy in the impact of functional diversification could be explained by the heterogeneity of non-interest income. Non-interest income is a mix of service income, commissions and trading income (Stiroh, 2004). Aggregating heterogeneous revenue streams obfuscate the influence of these dissimilar components. Since trading income is expected to be more volatile than commissions, the stability of a bank diversifying into trading activities will be different to one pursuing commissions. Functional diversification reduces risk, only if new sources of income are not perfectly correlated with interest income (Chiorazzo et al., 2008). For instance, service income, which could be highly correlated with interest income, might provide limited diversification benefits.

To address the heterogeneity, non-interest income is decomposed into its constituents. However, the impact of the individual components is still inconclusive. For instance, the impact of commissions and fees is reported to be positive (Ammar & Boughrara, 2019; Sawada, 2013), negative (Hidayat et al., 2012; Lepetit et al., 2008) and insignificant (Edirisuriya et al., 2019). The same holds true for trading income, which has been reported to have a positive (Ammar & Boughrara, 2019; Mostak, 2017), negative and insignificant (Bian et al., 2015; Hidayat et al., 2012) influence. These findings raise the possibility that the impact of functional diversification is country-specific.

2.2. Geographic diversification

Banks diversify geographically by expanding their network of branches and catering to new client cohorts. These expansions may be motivated by the benefits of networking, better utilisation of managerial skills, policies and procedures coupled with benefits of geographic risk diversification. Geographic diversification brings forth its own set of challenges. Distance from the parent organisation and lack of core competency in the geographical territory can diminish the motivation for geographical diversification (Berger & DeYoung, 2001). Empirical studies support the conditional benefit suggested by the theoretical literature. While, geographic diversification seems to improve stability by reducing insolvency risk (Liang & Rhoades, 1991), these benefits reduce as the distance between the headquarters and branches increases (Deng & Elyas, 2008). This uncertainty also extends to international diversification. The impact of international diversification on stability has been variously reported as beneficial (García-Herrero & Vazquez, 2013), conditional (Le et al., 2020) and adverse (Gulamhussen et al., 2014).

2.3. Loan portfolio diversification

Banks can diversify their loan portfolio by lending to a wider array of industries. Although banks generally offer similar financial products to different industries, diversification benefits could accrue from the mitigation of industry-specific risk. Alternatively, the loan portfolio can be diversified by originating advances of different sizes (Rossi et al., 2009). There are fewer studies investigating the impact of loan portfolio diversification due to two reasons. First, bank-wise data on disaggregated loan portfolios are not widely available. Second, there is little uniformity in the data reported by different countries. This lack of comparable datasets impedes cross-national studies.

Much like earlier diversification strategies, empirical studies report the conflicting impact of loan portfolio diversification. A study of Chinese banks finds that loan portfolio diversification leads to reduced profits and higher costs (Berger et al., 2010). On the other hand, a comprehensive study of Austrian banks suggests that portfolio diversification reduces risk and increases profit efficiency (Rossi et al., 2009). The benefits from loan portfolio diversification could be conditional on bank's competencies. Banks with lower levels of risk (Acharya, Hasan & Saunders, 2006) or expertise in monitoring (Berger et al., 2010) tend to benefit from diversification.

2.4. Banking and diversification in India

Liberalisation of the Indian economy in 1991 and the financial regulatory reforms thereafter led to the emergence of various private and foreign financial institutions and financial products in India. Following the global trend, Indian banks also started diversifying from traditional interest income to non-interest income. Especially, the new private banks and foreign banks have been keener on pursuing diversification (Pennathur et al., 2012). The regulatory reforms have not only triggered multi-dimensional diversification among the Indian banks but also exposed them to newer risks that challenge their stability.

There are very few studies on the impact of diversification on Indian banks. For banks listed in India, functional diversification translates into higher returns and lower risk (Thota, 2020). When the sample is expanded to include all banks operating in India, the benefits from diversification seem to be linked to ownership. Diversification into fee-based activities as well as the brokerage has helped improve the stability of public sector banks. However, the impact on private and foreign banks seems insignificant (Pennathur et al., 2012). Surprisingly, banks with lower asset quality

benefit more from income diversification (Mostak, 2017). While international diversification seems to benefit foreign and public banks with increased returns, no significant impact on bank risk has been noticed (Sharma & Anand, 2019). To the best of our knowledge, no existing study of Indian banks considers functional, geographic and loan portfolio diversification simultaneously.

3. Data and methodology

3.1. Sample and data

This study examines the impact of diversification on the financial stability of 48 banks over the decade starting in 2007. The sample includes public sector banks, private sector banks and foreign banks operating in India. The Reserve Bank of India (RBI) periodically publishes data pertaining to banks operating in India. Most of the data used in the current study were extracted from the RBI database. The only exception was the loan portfolio of banks categorised by industry. This was extracted from the CMIE database. The panel used in this study is unbalanced due to two reasons. First, a small group of banks weren't operational throughout the period under consideration. Second, the construction of certain variables, discussed in length in the next section, made some observations redundant.

3.2. Variables of interest

In line with the current scholarship, the stability of banks is measured using the distance to default (Lepetit et al., 2008; Stiroh, 2004). The distance to default for each firm-year is estimated using the z-score proposed by Hannan and Hanweck (1988). The measure employs accounting measures to estimate the probability of insolvency of a commercial bank. Following the seminal work by Stiroh (2004), the measure has been widely used in empirical banking literature to estimate bank stability (Chiorazzo et al., 2008; Hsieh et al., 2013; Lepetit et al., 2008). The popularity of the measure stems from its robustness and ease of use. However, one weakness attributed to the measure is the loss of initial observations due to the application of the rolling moments approach (Lepetit & Strobel, 2014).

In our study, we employ two different operationalisations of the z-score. In the first approach, the z-score (Z1) is estimated as $\left(\frac{k + \mu_{ROA}}{\sigma_{ROA}}\right)$. Herein, k represents the ratio between total equity and total assets for the current period. The mean and standard deviation of the return on assets (ROA) is calculated over three successive years. The second approach (Z2) is estimated as $\left(\frac{1 + \mu_{ROE}}{\sigma_{ROE}}\right)$, which is the measure of the mean and standard deviation of the return on equity (ROE) over five successive years. Higher values of Z1 and Z2 indicate stability while lower values allude to fragility.

The model incorporates three of the diversification strategies discussed in the literature. These are the diversification of income, geography and advances. The measures employed to capture the degree of income diversification are derived by decomposing the net operating income into net interest income and net non-interest income. The measure estimates income diversification (NNII) as the ratio of net non-interest income to net operating income.

$$NNII = \frac{\text{Net Non Interest Income}}{\text{Net Operating Income}} \quad (1)$$

Non-interest income was further decomposed into commission income and trading income to understand the impact of these constituents. Commission (COM) was estimated as the ratio of commissions to the net operating income. Similarly, trading income (TRAD) was estimated as the share of trading income to operating income. Higher values of NNII, TRAD and COM represent higher levels of diversification.

Geographic diversification has previously been estimated by disaggregating the asset portfolio of a particular bank by administrative province (Berger et al., 2010). Other studies have employed bank deposits by the administrative province to gauge geographic diversification (Liang & Rhoades, 1991; Morgan & Samolyk, 2003). Data on assets or deposits by province are unavailable for Indian banks.

Instead, we constructed an alternate variable to compute the extent of geographic diversification. Banks in India are mandated to classify branches based on the population of the locality. The four categories of this classification are metropolitan branches, urban branches, semi-urban branches and rural branches. The first variable, BRANCH, is estimated as an HHI type index of the share of branches in each category. A value of 1 identifies branch networks restricted to a single category of the urban-rural spectrum. The lower limit of 0.25, on the other hand, represents a network spread equally across all categories. The use of the HHI type index isn't completely new to the banking literature. It was used to study the impact of international diversification (see, Sharma & Anand, 2019).

The diversification of advances was estimated from the loan portfolio disaggregated by industry. RBI periodically publishes data on credit extended by Indian banks. Apart from aggregate figures, annual data of loans segregated by major industries are also made available. The variable ADVANCES was operationalised as the share of the five most prominent industries in the loan portfolio. ADVANCES is a measure of concentration wherein a high value indicates concentrated lending. A low value, on the other hand, signifies a loan portfolio diversified across industries.

The model also includes three control variables widely used in the literature. Size and market power could play an important role in determining the impact of diversification. Banks with low market power have exhibited more reliance on revenue diversification activities, while powerful banks have concentrated more on traditional products (Nguyen, Skully et al. 2012a, Nguyen, Skully, Perera et al., 2012b). Even the insolvency risk from functional diversification could be higher for small banks (Lepetit et al., 2008). Geographic diversification into remote areas with limited competition is associated with a considerable increase in franchise value and a minor reduction in risk (Deng & Elyas, 2008). The variable SIZE is estimated as the natural logarithm of total advances (Sanya & Wolfe, 2011; Sharma & Anand, 2018). NPA, which represents the bad debts, is estimated as the ratio of bad and doubtful debts to net advances. It captures the bank risk and is expected to have an inverse relationship with bank stability (Berger et al., 2010; Sharma & Anand, 2019). Finally, ROE is estimated as the ratio of net income to equity capital and is used as a measure of profitability. More profitable banks could be more stable positing a positive relationship between ROE and Z Score (Lepetit et al., 2008; Stiroh & Rumble, 2006)

3.3. Model specification

We employ a two-step difference GMM dynamic panel to investigate the impact of diversification on the stability of banks. Two reasons underline the adoption of this estimation technique. First, literature has documented the persistence of bank risk in developed as well as developing countries. Modelling the persistence necessitates the use of a dynamic panel. Second, banks often adjust their strategy and operations in light of perceived risks. Consequently, bank-specific variables may not be strictly exogenous to the measures of stability. The GMM technique provides the flexibility to categorise variables as endogenous, predetermined and exogenous.

The GMM equations can be expressed as:

$$\Delta Y_{it} = \alpha \Delta Y_{it-1} + \beta \Delta X_{it} + \Delta v_{it} \quad (2)$$

$$Y_{it} = \alpha Y_{it-1} + \beta X_{it} + \delta_i + v_{it} \quad (3)$$

Where Y_{it} is the measure of bank stability expressed as the distance to default (z score). X_{it} represents the vector of independent variables defined in Table 1. v_{it} is the error term. Finally, δ_i represents the unobserved heterogeneity which is bank-specific.

All bank-specific variables, with the sole exception of NPA, are introduced into the model as predetermined variables. NPA, on the other hand, is modelled as an endogenous variable. Lagged values of predetermined and exogenous variables are used as instruments to address

Table 1. Definition of variables

Classification	Notation	Explanation
Bank Stability	Z1	$\frac{Equity + \mu_{ROA}}{\sigma_{ROA}}$ Mean and SD calculated over 3-year periods
	Z2	$\frac{1 + \mu_{ROE}}{\sigma_{ROE}}$ Mean and SD calculated over 5-year periods
	Z3	$\frac{Equity + \mu_{ROA}}{\sigma_{ROA}}$ Mean and SD calculated over 5-year periods
Functional Diversification	NNII	$\frac{Net\ Non\ Interest\ Income}{Net\ Operating\ Income}$
	RDiv	$1 - \frac{Net\ Interest\ Income - Net\ Non\ Interest\ Income}{Net\ Operating\ Income}$
	COM	$\frac{Commission\ Income}{Net\ Operating\ Income}$
	TRAD	$\frac{Trading\ Income}{Net\ Operating\ Income}$
Geographic Diversification	BRANCH	HHI type index of the share of branches in each branch category
	BRANCH2	$\frac{1}{Number\ Of\ Branches}$
Diversification of Loan Portfolio	ADVANCES	Sum of Top 5 Industry Exposure in Percentage
Bank Size	SIZE	$\ln(Total\ Assets)$
Bank Capitalisation	EQUITY	$\frac{Total\ Equity}{Total\ Assets}$
Bank Profitability	ROE	$\frac{Net\ Income}{Total\ Equity}$
Non-Performing Assets	NPA	$\frac{Non\ Performing\ Assets}{Net\ Advances}$

endogeneity. The roster of predetermined and endogenous variables in this study could lead to the proliferation of instruments. This, in turn, could make GMM estimators inconsistent. To this end, lags were limited to 4.

Table 2. Results

	MODEL 1	MODEL 2	MODEL 3	MODEL 4
DEPENDENT	Z1	Z1	Z2	Z2
L1	0.33*** (0.02)	0.34*** (0.01)	0.48*** (0.04)	0.47*** (0.03)
NNII	95.98*** (26.59)		74.64*** (18.85)	
COM		141.73*** (36.81)		88.31*** (20.71)
TRAD		49.59 (52.43)		149.87*** (20.21)
BRANCH	-232.55*** (38.22)	-230.72*** (36.88)	-36.05*** (11.65)	-40.78*** (13.04)
ADVANCES	-1.06*** (0.31)	-0.45** (0.21)	-0.27** (0.11)	-0.19 (0.13)
SIZE	-5.87 (6.72)	-4.82 (5.38)	0.88 (1.83)	-1.48 (1.31)
EQUITY	4.30*** (0.65)	3.47*** (0.53)	1.06*** (0.37)	0.69* (0.37)
ROE	0.01 (0.60)	0.02 (0.44)	0.62*** (0.10)	0.68*** (.10)
NPA	-5.60** (2.14)	-5.36*** (1.84)	-0.89 (0.38)	-1.01** (0.45)
GROUPS	48	48	48	48
INSTRUMENTS	39	43	37	41
AR (2)	0.42	0.42	0.12	0.11
HANSEN	0.34	0.46	0.47	0.36

Further, post-diagnostic tests were performed to guard against instrument proliferation. The Hansen's J statistic was employed to check whether the over-identification restrictions are valid. This was complemented with the Anderson-Rubin (AR) test.

4. Results and discussion

Table 2 reports the results for the model discussed in the previous section using a difference GMM panel estimator. The lagged dependent variable is significant across the different specifications of our model. This confirms our earlier assertion that bank stability is indeed persistent. However, the degree of persistence among Indian banks, as highlighted by the coefficient, seems to be low.

The analysis suggests that functional diversification has tended to improve the stability of Indian banks. The findings are robust to different model specifications. Across the two measures of bank stability, functional diversification tends to increase stability. Our results are in line with those reported in earlier studies in Italy (Chiorazzo et al., 2008) and Asia (Hsieh et al., 2013). However, the results are less conclusive when non-interest income is decomposed into commission income and trading income. Across specifications, commission income seems to exert a positive and statistically significant impact on bank stability. However, the impact of trading income on bank stability, while positive, is statistically significant on one of the two occasions. These findings corroborate the evidence so far from other Asian countries (Nisar et al., 2018).

For our sample of Indian banks, diversification of branch networks seems to benefit stability. Banks concentrating on a single geographic category are less stable, as reflected by the negative coefficients in all nine models. Conversely, banks operating in areas across the urban-rural spectrum tend to improve their stability. To the best of our knowledge, no other study uses a comparable metric of branch diversification. However, previous studies that incorporate other proxies of geographical diversification suggest a similar direct relationship between diversification and bank stability (Goetz & Levine, 2016). Our results also suggest that the concentration of loan portfolios is associated with lower stability. The direction of the relationship is unequivocal across model specifications. However, in one of the models tested, i.e. Model 4, the relationship is not statistically significant.

The relationship between capitalisation (EQUITY) and bank stability is positive and significant across the models. Our results suggest that well-capitalised banks are more stable compared to banks with lower levels of capitalisation. Capitalisation improves stability without distorting the advances and loans originated by a bank. Moving on to the second control variable, i.e. ROE, the results are less concrete. The coefficients suggest a direct relationship between return on equity and stability. However, the results are statistically significant in only two of the four models. The impact of size on the stability of the banks is inconclusive. Size seems to have an adverse and statistically insignificant impact on bank stability.

The diagnostic test suggests that our model is appropriately specified. The lagged dependent variable is significant across all the models. Moreover, in each case, there is no second-order auto-regression as suggested by the AR(2) test. The Hansen (1982) J was employed to confirm the validity of instruments. The results presented in Table 2 confirm the joint validity of the instruments used in the analysis.

5. Robustness check

We employ an alternate measure to estimate functional diversification. It estimates revenue diversification (RDiv) from the ratio between the difference in shares of net interest income and net non-interest income and net operating income.

$$RDiv = 1 - \frac{\text{NetInterest Income} - \text{Net Non Interest Income}}{\text{Net Operating Income}} \quad (4)$$

Table 3. Robustness Check

	MODEL 5	MODEL 6	MODEL 7	MODEL 8	MODEL 9
DEPENDENT	Z1	Z2	Z3	Z3	Z3
L1	0.40*** (0.03)	0.41*** (0.04)	0.49*** (0.02)	0.48*** (0.02)	0.50*** (0.02)
NNII			49.55** (18.73)		
RDiv	64.67*** (11.88)	53.80*** (10.37)		20.75** (9.20)	
COM					22.08** (9.74)
TRAD					14.95 (26.56)
BRANCH			-59.31*** (15.75)		-51.18*** (10.31)
BRANCH 2	-2.11*** (0.44)	-0.04 (0.22)		-0.45* (0.26)	
ADVANCES	-0.88*** (0.27)	-0.31** (0.14)	-0.22* (0.12)	-0.43** (0.18)	-0.20 (0.19)
SIZE	1.45 (4.23)	0.01 (2.04)	2.39* (1.41)	-5.32** (2.09)	2.72* (1.49)
EQUITY	0.52 (0.83)	0.78** (0.36)	1.62*** (0.37)	-0.10 (0.36)	1.89*** (0.35)
ROE	0.42 (0.43)	0.93*** (0.12)	0.19 (0.16)	0.33 (0.20)	0.21 (0.14)
NPA	-3.37** (1.55)	0.46 (0.43)	-2.47*** (0.68)	-0.99 (0.72)	-2.28*** (0.73)
GROUPS	48	48	48	48	48
INSTRUMENTS	39	37	37	37	41
AR (2)	0.51	0.13	0.27	0.32	0.27
HANSEN	0.52	0.55	0.38	0.33	0.46

Similarly, we also employ an alternate specification for geographic diversification. The second variable, BRANCH2, is the multiplicative inverse or the reciprocal of the number of branches. The greater the number of branches in a bank's network, the lower the value of BRANCH2.

Finally, we also estimate an alternate measure of z-score as $\left(\frac{k + \mu_{ROA}}{\sigma_{ROA}}\right)$. Herein, k represents the ratio between total equity and total assets for the current period. The mean and standard deviation of the return on assets (ROA) is calculated over five successive years.

The estimates from the regression, presented in Table 3, corroborate the findings from our primary models. Functional, geographic and loan portfolio diversifications seem to increase the stability of Indian banks. While an increase in the share of commission income increases bank stability, the impact of trading income is inconclusive. The diagnostic test suggests that our model is appropriately specified. Lagged dependent variables are significant, there is no second-order autoregression, and all instruments are valid.

6. Conclusion

We study the impact of functional, geographic and loan portfolio diversification on the stability of banks in India. To the best of our knowledge, this is the first study to investigate the concurrent impact of the three dimensions of diversification for Indian banks. We find that all three dimensions of diversification improve the stability of banks. These results hold great significance for policymakers.

With our findings, we conclude that banks can reduce their business risk by foraying into new financial products and services. The strategy toward generating alternative sources of revenue generation reduces the overall risk for the banks. Geographical expansion through branches further strengthens the Bank stability and should be considered as a strategy for reducing bank risk. Banks should look at geographical diversification by closely developing their urban and rural matrix for harnessing such benefits. Loan portfolio diversification must be strategically analysed

regularly to avoid a concentrated portfolio as they were found to have lower stability. The banks need to strategically design their future lending policies so that loan portfolio diversification benefits are available for the bank.

This study could be useful for banks in their existing strategic stability evaluation and forecasting of stability during expansion strategies. For the existing stability evaluation, the banks should give special emphasis to their functional, geographical and loan portfolio diversification. They can strategically restructure these diversifications for enhancing overall stability. When a bank is going for inorganic diversification through an expansion strategy, they can evaluate the resulting functional, geographical and loan portfolio diversification to manage their overall business risk. Apart from operational synergy, inorganic expansion could also bestow functional, geographic and loan-portfolio diversification. Consequently, dealmakers should consider the potential benefits of diversification while conducting due diligence.

Banks in India often extend loans to non-banking financial companies (NBFCs) for further lending. In such instances, banks must be cognizant of the impact on their loan portfolio diversification. On the one hand, these advances could help improve diversification if NBFCs originate loans to industries in which bank has limited exposure. On the other hand, it could result in concentration if the loans originated by NBFCs are offered to similar firms or industries, the bank already has exposures. Consequently, regulators must devise mechanisms to monitor the end-consumer beneficiary of secondary lending.

When the stability of Indian banks is threatened, either by increasing net non-performing assets or reducing profitability, RBI invokes prompt corrective action measures. Such measures curtail the activities a bank can involve in. For instance, banks placed in the prompt corrective action framework cannot open new branches or originate loans to certain customer groups. Our results suggest that these measures might be counter-productive by mitigating diversification benefits.

Banks have broadened their functions, expanded their reach and changed their portfolios. Our analysis of Indian banks suggests that such diversification has helped improve resilience. Our findings encourage policymakers and top management to pursue strategic diversification. The primary limitation of our study is that our sample is restricted to banks operating in India. This is mainly due to constraints surrounding the operationalization of variables. For instance, constructing a comparable measure of Geographic Diversification across countries is difficult. In fact, the underlying data necessary for estimating Geographic Diversification is available for very few countries. Even there, the measures might not be comparable. We recommend future studies consider deposit diversification as well as observe the interaction of different types of diversification.

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