

## Article

# Does Banking Management Affect Credit Risk? Evidence from the Indian Banking System

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**Abstract:** This study investigated the impact of banking management on credit risk using a sample of Indian commercial banks. The study employed dynamic panel estimations to evaluate the link between banking management variables and credit risk. The empirical results show that an increase in loan portion over total assets does not necessarily increase problem loans. The findings suggest that high capital requirements and large bank size do not reduce default risk, whereas high profitability and strong income diversification policies lower the likelihood of default risk. The overall empirical results supported the “operating efficiency”, “diversification” and “too big to fail” hypotheses, confirming that credit quality in the banking industry is mainly driven by profitability, banking supervision, high credit standards and strong investment strategies. The findings are relevant to bank managers, investors and bank regulators, in formulating effective credit policies and investment strategies.

**Keywords:** capitalization; generalized method of moment (GMM); income diversification; non-performing loan; profitability

**JEL Classification:** E44; G21

## 1. Introduction

The non-performing loan (NPL) is a significant predictor of a bank run and is a major source of financial vulnerability all over the world. Low levels of NPLs signify a sound financial system, whereas a high level of NPLs point to a vulnerable financial system. An increase in NPLs deteriorates asset quality and ultimately causes failure of the financial system (Barr et al. 1994; Demirguc-Kunt 1989). Failed financial institutions can cause an economic downturn, as such identifying the causal factors affecting the growth of problem loans is fundamental to maintaining a stable economic system.

Both internal and external factors are responsible for an increase in the NPL level. However, the effect of banking management has been argued to be higher than any other factors (Berger and DeYoung 1997; Peristiani 1996; Shi et al. 2017) because, only strong banking management can formulate effective credit policies in response to the changing macro-economic environment within a short period of time.

Banking management is a prominent issue in credit risk management. Poor banking management leads to cost inefficiency, lowers profitability and increases problem loans, which can eventually cause bank failure. The past financial crisis has highlighted the need for further studies on banking management and credit risk as a means to enhance banking profitability and financial stability across

the world (Festić et al. 2011). Although few previous studies have evaluated the relationship between efficiency and credit risk (Berger and DeYoung 1997; Kwan and Eisenbeis 1997), studies exploring the impact of banking management on credit risk with policy implications are also largely limited.

In the present study, we empirically investigate the relationship between credit risk and banking management (capitalization, credit growth, cost inefficiency, diversification and profitability) using a panel of Indian commercial banks. Whilst some papers have used cross-country data to examine such relationships, this study focuses on a single banking system to ensure comparability between problem loans and banking management indicators. We specifically aim to answer the following questions: (1) Does credit expansion necessarily lead to problem loans? (2) Can regulatory capital control credit risk? (3) Does investment policy and bank-size matter in reducing bad loans? (4) Does lending behavior depend upon the efficiency of banking management?

## 2. Effects of Banking Management on Non-Performing Assets (NPAs)

The capital adequacy ratio (CAR), which measures the capital strength of banks, is a fundamental indicator of moral hazard (Berger and DeYoung 1997; Konishi and Yasuda 2004). Past studies have recommended CAR as a straightforward proxy for regulatory capital. Moral hazard and adverse selection significantly drive high non-performing assets in financial institutions, particularly when capital levels are low (Jeitschko and Jeung 2005). Podpiera and Weill (2008), in their study on Czech banks, confirmed undercapitalized banks have high problem loans. Similarly, using threshold value in the Chinese banking industry, Zhang et al. (2016) argued that banks with moral hazard experience problem loans frequently. Several other studies (e.g., Antzoulatos and Tsoumas 2014; Cheng et al. 2016; Mariathasan et al. 2014), found moral hazard as the prime cause of problem loans in financial institutions.

The loan to assets ratio (LAR) reflects the credit growth and risk appetite of a bank. Failure to maintain effective credit standards with increasing loan portfolios may raise the possibility of bad loans (Ekanayake and Azeez 2015; Klein 2013). Keeton (1999), Khemraj and Pasha (2009), Meela and Prasad (2016), and Sinkey and Greenawalt (1991) showed that rapid credit growth is usually associated with poor lending decisions, indicating the probability of bad loans and the likelihood of a banking crisis increase with the increase in the LAR (Peña 2017). In contrast, Shingjergji (2013) found a negative effect of LAR on NPLs in the Albanian banking industry, which suggest an increase in the loan portfolio may not increase the NPL level. However, there are theoretical reasons to believe that with the increase in credit over total assets, the likelihood of adverse selection and the possibility of bad loans increases.

Cost efficiency is represented by the ratio between operating expenses and total assets (Berger and DeYoung 1997) and is a primary factor for improving loan quality (Podpiera and Weill 2008). It is widely used as a proxy for the bad management hypothesis (Kwan and Eisenbeis 1997). Inefficient banks tend to advance loans with low credit standards to cover cost inefficiencies (Altunbas et al. 2007; Williams 2004), whereas efficient banks tend to hold relatively safer loans (Fiordelisi et al. 2011). This indicates that operationally inefficient banks (i.e., banks with inefficient management) have a high tendency to grant risky loans (Gorton and Rosen 1995; Kwan and Eisenbeis 1997).

The return on assets ratio (ROA) is a measure of operating performance or profitability. It strongly influences the problem loans of both failed and successful banks (Kwan and Eisenbeis 1996; Resti 1996). Highly profitable banks have better management and are more prudent in their lending behavior. Conversely, banks with low profitability are less efficient in screening their customers and have a higher loan cost. Therefore, compared to highly profitable banks, banks with low profitability are likely to have higher NPL levels (Kwan and Eisenbeis 1997). By pooling a sample of Indian banks, Patra and Padhi (2016) and Saha and Ravisankar (2000) found that profitability played a significant role in improving loan performance.

The proportion of non-interest income as a part of total income shows income diversification opportunities. High non-interest income indicates a smaller loan portfolio and a low proportion of bad

loans. Studies have confirmed an inverse relationship between credit risk and income diversification (Chaibi and Ftiti 2015; Ghosh 2015; Louzis et al. 2012). Whilst non-interest income has been widely used as a proxy for diversification, some researchers have alternately used bank size as its proxy.

Large-sized banks are effective in controlling problem loans because they have advanced technologies and skilled manpower to tactfully handle moral hazard and agency problems (Rajan and Dhal 2003; Salas and Saurina 2002). In addition, large-sized banks collect ample relevant information related to borrowers, enabling them to take correct lending decisions. On the other hand, large-sized banks may also expand their activities in risky sectors to achieve monopoly profit. This tendency may increase the proportion of bad loans and cause market failures (Gennaioli et al. 2013; Ratnovski 2012; Shleifer and Vishny 2010). Farhi and Tirole (2012) stated that large-sized banks have a high tendency to grant loans to risky customers because large-sized banks receive protection from the government when they fail. Therefore, large banks are more prone to default risks than small banks (Bardhan and Mukherjee 2016). Although several studies have suggested bank size as a strong determinant of problem loans, Khemraj and Pasha (2016) showed bank size as a statistically insignificant determinant of credit risk in the Guyanese banking industry.

### 3. Methodological Frameworks

#### 3.1. Data Sample and Sources

The study was carried out using a panel dataset of 50 Indian commercial banks covering a period between 2000 and 2013. The sample represented the largest and leading commercial banks in the Indian banking system covering over 80% of total commercial banking assets in India. The annual reports and bulletins of the Reserve Bank of India, publications from the Indian Bank Association and the annual reports of individual banks were used as primary data sources.

The selected variables, non-interest income to total assets ratio (non-interest income), return on assets (ROA), capital adequacy ratio (CAR), loan to assets ratio (LAR), bank size, and operating expenses to total assets (cost inefficiency) were used as indicators of banking management. These variables were known to have a strong impact on problem loans and were useful in formulating banking policies too.

The ratio between aggregate data of non-performing assets (NPA) and total gross loans was used as a dependent variable. Since there was no internationally harmonized definition of NPA which has been applied to all banking systems, this study followed the Reserve Bank of India's definition, as the unpaid loans in the form of principal and interest for a minimum 90 days or beyond the due date.

#### 3.2. Expected Hypotheses

Different studies have applied different mechanisms to analyze how banking management affects credit risk (Thakor 1996). This study evaluates three hypotheses: too big to fail, income-diversification and operating inefficiency, based on six banking management indicators (loan to assets ratio, capital adequacy ratio, return on assets, bank-size, non-interest income and operating expenses ratio), to analyze the impact of banking management on credit risk.

The effect of capitalization on NPA can be ambiguous. Management of undercapitalized banks have a moral hazard incentive to engage in risky lending practices (Keeton and Morris 1987). Concomitantly, management of highly capitalized banks may also resort to liberal credit policies ("too big to fail" hypothesis: Rajan (1994), Stern and Feldman (2004)). This means that large-sized banks often take excessive risks, expecting government protection in the case of a failure (Stern and Feldman 2004). The 'too big to fail' hypothesis, suggests a positive effect of the capital adequacy ratio and bank size on non-performing assets.

The operating inefficiency or bad management hypothesis is measured by the profitability ratio and/or operating expenses ratio. Managerial risk preference is associated with bank operating efficiency (Hughes et al. 1995; Hughes and Moon 1995), indicating that the operationally inefficient

banks tend to invest in risky activities (Gorton and Rosen 1995). Based on past empirical results, inefficiency is expected to have a positive effect on bad loans, whilst profitability is expected to have a negative effect on bad loans (Table 1).

**Table 1.** Banking management variables and their expected relation to non-performing assets.

Variable	Definition	Expected Sign
Capital adequacy	Equity capital/total assets	(−)
Return on Assets	Net income/total assets	(−)
Bank size	Log of total assets	(−)
Diversification	Non-interest income/total assets	(−)
Loan growth	Loans/total assets	(+)
Cost inefficiency	Operating expenses/total assets	(+)

In the banking system, income-diversification reflects an alternative source of revenue other than interest income. The loan portfolio may decline due to income diversification. In this study, non-interest income to total assets ratio and bank size were used as proxies for the diversification hypothesis, where bank size was measured as the log of assets to the assets of all banks included. Salas and Saurina (2002), Rajan and Dhal (2003) and Hu et al. (2004) argued that large-sized banks are less affected by asymmetric information compared to small-sized banks. This allows increased diversification opportunities while investing in a credit portfolio, which ultimately improves the business model and the loan portfolio. Increased diversification in the banking industry improves credit quality and reduces credit risk. Hence, this study anticipated a negative effect of non-interest income and asset size on credit risk (Table 1).

### 3.3. Model Description

The study tested the expected hypotheses and evaluated the effect of banking management on credit risk using a panel of individual banks. The relationship was estimated using the following general regression model:

$$NPA_{it} = f(\text{Income diversification}_{it}, CAR_{it}, ROA_{it}, LAR_{it}, \text{Size}_{it}, \text{Inefficiency}_{it}) \quad (1)$$

where  $i$  and  $t$  refer to bank and time dimensions, respectively.  $NPA_{it}$  is the non-performing loans ratio for bank  $i$  at time  $t$ ; Income diversification is the ratio between non-interest income and total assets; CAR is the capital adequacy ratio; ROA is the return on assets ratio; LAR is the loan to assets ratio; Size is the log of total assets; Inefficiency is the ratio between operating expenses and total assets. The above model states that the dependent variable (NPA) is a function of the banking management measures. To evaluate whether a linear or non-linear functional form best fits our data, we performed the Ramsey's RESET test using no functional misspecification as the null hypothesis. The test statistic ( $F_{(1,659)} = 2.3048$ ;  $p = 0.129$ ) suggested the non-linear combinations of the explanatory variable have no power in explaining the response variable. Therefore, a linear functional form was used in the following analysis. The econometric analysis was carried out using the following benchmark model:

$$NPA_{it} = \alpha NPA_{it-1} + \beta X_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

where the dependent variable is the logit transformation of a bank's non-performing assets (NPA) ratio, which changes the variable's support from unit interval to real number line. There was a significant degree of persistence in the transformed NPA variable. Hence, a lagged dependent variable was included as an explanatory variable (Salas and Saurina 2002) in Equation (2).  $\alpha$  is the coefficient of the lagged dependent variable.  $X_{it}$  is a matrix of banking management variables (non-interest income, return on assets, asset size, capital adequacy ratio, operating expenses to total assets ratio, loan to assets ratio) and  $\beta$  is its coefficient.  $\mu_i$  is the unobserved fixed effect and  $\varepsilon_{it}$  is the error term.

Using an econometric framework, a baseline model was estimated where the primary objective was to investigate how credit risk is influenced by banking management. It is widely accepted that endogeneity should be considered when examining dynamic panel estimations. Generally fixed effects and instrumental variables (IV) estimators are used to control endogeneity.

However, fixed effects estimators are unable to control endogeneity strictly. Similarly, IV estimators require strong external IVs, which are very hard to find in practice (Himmelberg et al. 1999). Therefore, the study employed the generalized method of moments (GMM) estimation developed by Arellano and Bond (1991) and generalized by Arellano and Bover (1995) and Blundell and Bond (1998), which resolves the problems of endogeneity and dynamic panel bias (Baltagi 2008). Specifically, we used the two-step system GMM estimator (Windmeijer 2005). Studies have shown that system GMM performs better on panel data with more cross sectional units and a small time period (Alhassan et al. 2014; Bond 2002; Dimitrios et al. 2016; Ghosh 2015; Roodman 2009), which was exactly the case in this study. Furthermore, the system-GMM estimator overcomes the drawbacks of fixed effects and IV method by eliminating both firm unobserved heterogeneity and dynamic panel bias (Arellano and Bond 1991; Arellano and Bover 1995; Blundell and Bond 1998; Holtz-Eakin et al. 1988). Because of these advantages, the empirical results obtained from system GMM are considered reliable for interpretation and forecasting. Additionally, following Chaibi and Ftiti (2015), this study employed the difference GMM estimation in order to check the magnitude of the estimated variables.

Following Abid et al. (2014), the study employed first and second period lagged variables as instruments for the explanatory variables. The number of instruments was less than the number of cross sections. Since the panel was unbalanced, each variable was tested for unit roots to assess their integration level. The Augmented Dickey-Fuller (ADF) Fisher type test was also employed using non-stationarity as the null hypothesis. For consistencies in the GMM estimation results, the Arellano-Bond specifications test suggested by Arellano and Bond (1991) was followed. Firstly, the Sargan test was applied to identify validity of the instruments used as moment conditions. Secondly, the fundamental hypothesis of auto-correlation in the error term was examined.

#### 4. Estimations and Discussion of Findings

Descriptive statistics for all variables used in this study, are outlined in Table 2. The results of the unit root test are reported in Table 3 where all variables were found to be stationary in their levels. Empirical analysis was carried out in the econometric model using these stationary variables. The estimation results are presented in Table 4, and were used to interpret the findings. This section mainly discusses two important issues: (1) the impact of banking management indicators on credit risk with past evidence, and (2) policy implications.

**Table 2.** Statistical description of the variables.

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
CAR	694	0.1635	0.1136	0.017	0.9658
ROA	694	0.0109	0.0146	−0.0792	0.1943
Bank size	699	0.0199	0.033	0.0000608	0.2744
Diversification	698	0.0208	0.0275	−0.0044	0.2752
LAR	696	0.4926	0.1434	0.001738	0.8343
Cost inefficiency	698	0.0235	0.0228	0.000444	0.3078
NPA	686	0.06596	0.07897	0	0.7143

##### 4.1. Impact of Banking Management Indicators on Credit Risk

A positive influence of bank size on NPA was observed in both specifications (difference and system GMM). Both specifications showed significant effects of bank size on non-performing assets supporting the “too big to fail” hypothesis (Berger and DeYoung 1997). This implies that

large-sized banks have a high tendency to expand their lending activities to achieve monopoly profit. Because large-sized banks have government protection, they also tend to expand their lending portfolio to risky sectors, thereby increasing the probability of bad loans. The empirical results suggest that large-sized banks have less efficient lending practices compared to small-sized banks and that bank size fails to work as a proxy for diversification. These findings suggest an increase in bank size does not necessarily reduce the possibility of bad loans (El-Maude et al. 2017), contrary to the findings of Ćurak et al. (2013) who argued that large-sized banks have low defaults on loans due to their ability to manage the problem of asymmetric information. The empirical findings are consistent with the financial instability hypothesis (Minsky 1992), which states that the rapidly increasing lending activities of large-sized banks to maintain their market share in the economy may lead to adverse selection and a decrease in credit quality. Overall, the results suggest that financial stability depends upon the financing regimes of the banking industry.

**Table 3.** Panel unit root test results.

Variables	ADF-Fisher Chi-Square (Statistics)	ADF-Fisher Chi-Square (p-Value)
NPA	133.221	0.0148
CAR	174.892	0.0000
ROA	211.317	0.0000
Bank-size	175.886	0.0000
Diversification	132.066	0.0175
LAR	140.334	0.0049
Inefficiency	214.566	0.0000

Income diversification showed a significant negative association with NPAs (Table 4), which supports the general fact that banks rely on alternative types of income other than interest income to reduce credit risk. The estimation results suggest the need to increase income diversification to reduce the likelihood of banking crises. The results also support the finance theory, which states that the diversification of income sources leads to low risk levels and high risk-adjusted performance. However, the findings on income-diversification in this study run contrary to findings from studies on the German and Greek banking systems (Chaibi and Ftiti 2015; Louzis et al. 2012).

As expected, the return on assets ratio was significantly negatively correlated with credit risk over the entire analysis supporting the findings of Ćurak et al. (2013) and Beaton et al. (2016). This evidence is in line with the bad management hypothesis (Berger and DeYoung 1997), which states that banks with poor performance are more vulnerable to risk taking behavior than banks with sound performance. More profitable banks tend to utilize credit resources effectively and have low default risk. A negative relationship between the ROA and credit risk signifies that performing banks are always inclined towards improving their asset quality by advancing safe loans.

Likewise, the coefficient for cost inefficiency was positive in the entire data span as expected (Table 4). It was, however, statistically insignificant, which indicate the inability of banks to consider cost inefficiency while lending loans. These empirical results did not statistically support the results of Berger and DeYoung (1997), Podpiera and Weill (2008) and Louzis et al. (2012).

The negative beta coefficient for the LAR (Table 4) indicate that credit growth do not necessarily lead to high NPAs if strict credit standards are maintained by banks. This is in contrast to the findings of Keeton (1999) and Sinkey and Greenawalt (1991) who argued that rapid credit expansion increases problem loans. The results suggest the need to maintain strict credit standards and acquire accurate information on collateral values while granting loans. The overall empirical results indicate that a high portion of loans over total assets create better opportunities to diversify loan portfolios and decrease non-performing assets. This is consistent with the findings of Macit (2012) in the Turkish banking system. However, it is contrary to the findings of Khemraj and Pasha (2009) in the Guyana banking system where they argued that high risk takers are likely to attract high non-performing assets.

**Table 4.** Dynamic panel estimation results. Numbers in parentheses are z-statistics of respective variables.

Variables	Difference GMM	System GMM
Lagged NPA	0.864599 *** (40.11)	0.8326597 *** (78.00)
CAR	0.037739 (0.71)	0.1626566 *** (7.38)
ROA	−4.996087 *** (−7.03)	−6.40897 *** (−12.84)
Bank size	0.1815425 * (1.91)	0.022929 ** (2.27)
Diversification	−8.844363 *** (−8.15)	−8.71721 *** (−13.85)
LAR	−0.485447 *** (−5.72)	−0.402756 *** (−10.99)
Cost inefficiency	0.0103258 (0.16)	0.0146784 (0.86)
Sargan test <i>p</i> -value	0.018	0.1031
A-B AR (2) test <i>p</i> -value	0.0929	0.0903
Cross section/N	50/552	50/612

\*\*\* Significance level of 1%; \*\* significance level of 5%; \* significance level of 10%.

The coefficient for capitalization (CAR) was positive in both models. The positively significant coefficient for CAR implies that highly capitalized banks tend to have more risk-taking behavior than undercapitalized banks (too big to fail hypothesis). This might be so because, the lending channels of large-sized banks are influenced by asymmetric information, which cause adverse selection and moral hazard problems and consequently bad loan portfolios (Kishan and Opiela 2000; Stein 1995). Adverse selection normally replaces high-quality borrowers with low-quality borrowers, and this process, in the long run diminishes the overall credit quality (Bofondi and Gobbi 2003; Bofondi and Ropele 2011; Makri et al. 2014). Moreover, highly capitalized banks are incapable of taking advantage of information sharing technique to solve asymmetric information problems. As both empirical models (system GMM and difference GMM) supported a positive association between capitalization and credit risk, this study argues that capitalization does not necessarily always control credit risk. This is in accordance to the findings of Vatansever and Hepsten (2013) and Rime (2001) for the banking systems of Turkey and Switzerland, respectively. However, it should be noted that maintaining regulatory capital without adequate banking supervision cannot effectively ensure the safety of financial institutions.

The instruments for dynamic panel estimation were satisfactorily valid in all cases, as shown by the Sargan test (Table 4). Moreover, the residuals had a significant first-order serial auto-correlation and an insignificant second-order auto-correlation. This suggests that the findings are robust. The magnitudes of all the explanatory variables in the difference GMM estimations were consistent with those in the system GMM estimations, which indicate that the results are unbiased and reliable for forecasting.

#### 4.2. Policy Implications

Central banks typically raise capitalization requirements to decrease the likelihood of banking crisis. The results of dynamic panel specifications in this study suggest that high capitalization do not necessarily control bad loans, as evidenced by a statistically significant positive coefficient for CAR and bank size (see Table 4). Since large-sized banks are likely to get government protection in case of a failure, they do not hesitate to invest in risky customers to maintain their market share (Minsky 1992). Therefore, governments should strictly monitor the lending policies of large-sized banks to minimize

risks. Furthermore, for overall banking stability, micro-level studies on credit-risk taking behavior should be carried out from time to time by banking regulators and individual banks.

The negative coefficient for the loan to assets ratio signifies that credit growth does not always attract problem loans. The findings suggest that by maintaining a strict credit standard, and frequent banking supervision, the risk of problem loans could be avoided during credit expansions. A high coefficient for non-interest income to total assets ratio strongly suggests that banking institutions should diversify their sources of income to ensure banking stability. The negative effect of ROA on NPA implies that strong financial performance reduces the chances of risky lending behavior.

The empirical results have potential contributions in the formulation of credit and investment policies. In addition, the findings of this study could be useful in setting the credit to core capital-cum-deposit ratio. This study emphasizes the maintenance of high credit standards, and the need for regular supervision by central banks to improve the overall credit quality. The findings also recommend the acquisition of relevant information on collateral quality and regular income sources of borrowers by the Banking Financial Institutions (BFI) to mitigate adverse selection and moral hazard problems. Specifically, the recommendation is that banking regulators need to continuously monitor the lending channels of large-sized banks and their investment strategies to control default risks.

## 5. Conclusions and Insights

The empirical results were in line with the “too big to fail” hypothesis evidenced by positive and statistically significant coefficients for bank-size and capitalization. Similarly, the empirical results for profitability and income-diversification significantly supported the “bad management” and “diversification” hypotheses. Based on these results, we recommend raising income-diversification sources and profitability through diversified investment strategies. Our findings reveal that high capital requirements and bank-size do not necessarily control problem loans. In addition, credit expansion does not lead to bad loans if a strict credit standard is maintained. Moreover, the findings suggest the need for frequent banking supervision to improve credit quality. The overall empirical results confirmed that loan quality in the banking system is mainly driven by internal events, implying that, in addition to monitoring the financial indicators of banks, banking regulators should also monitor the banking management indicators while conducting their supervision activities. Our findings could be significantly useful in formulating effective credit policies and investment strategies to maintain a stable financial system.

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