An empirical examination of the relationship between credit risk management, size, profitability, and ownership of Indian banks

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Abstract: The study examines the impact of bank size, profitability, and ownership on excess capital for credit risk management (CRM) held by Indian banks. The model is estimated by panel regression method using data on 34 Indian banks during 2009 to 2016. The results suggest that size of Indian banks is related to excess capital held by them for managing credit risk. The positive relationship implies that large banks hold higher excess capital beyond the required minimum as per Basel norms. The study assumes importance in the context of significant changes in the institutional and regulatory framework of the Indian financial system.

Keywords: credit risk; excess capital; bank size; profitability; ownership; Indian banks.

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1 Introduction

Credit risk management (CRM) is an important indicator of the stability of financial system globally (Mishkin, 1999), particularly in the emerging economies (Rojas-Suarez and Weisbrod, 1994). The extant research on CRM has primarily focused on the risk-taking behaviour of financial institutions (Ayuso et al., 2004; Rochet, 1992), impact of profitability (Athanasoglou et al., 2008; Staikouras and Wood, 2004; Hoffmann, 2011; Sufian, 2009), size (Laeven et al., 2016; Hannan, 1991; Jokipii and Milne, 2011; Distinguin et al., 2013), and ownership (Mian, 2003; Micco et al., 2007; Abedifar et al., 2013; Hassan and Dridi, 2010; Srairi, 2013) on CRM practices of banks. Thus, there is enough evidence to help us understand the CRM practices of banks in different regulatory jurisdictions. However, our understanding of whether bank size, profitability, and ownership contribute to capital adequacy for credit risk remains limited and hence needs further evidence.

We attempt to examine the impact of bank size, profitability, and ownership on the capital adequacy for CRM of banks in India. The evidence will help us understand the phenomenon in an economy characterised by strong regulatory and institutional infrastructure which ensured that Indian banking and financial system did not suffer due to significant events like Asian Financial Crisis (1997), and Global Financial Crisis (2008) despite the integration of Indian financial system with those across the globe.

There is greater emphasis on capital requirements for credit risk of banks in many countries, particularly emerging economies (Hellmann et al., 2000). Many bank regulators across the world prescribed minimum standards for CRM as credit risk is believed to be the main cause of bank failures (Estrella et al., 2002). The banks are expected to maintain minimum capital as excess capital (held) limits their competitiveness. However, the largest US banks held excess capital above the minimum requirement since 1990s (Berger et al., 2008). Motivation for excess capital ranged from hedging against issuing new equity at short notice, avoidance of classical debt overhang situation (Myers, 1977), retain earnings, and record higher profitability in the long run (Berger et al., 2008). Further, excess capital will improve the stability of the financial

system and prevent additional costs of market discipline and/or supervisory intervention (Furfine, 2001).

Though there is evidence (Majcher, 2015) that holding excess capital neither creates safe banks nor ruins them, banks with higher capital monitor loans better and hence achieve higher profits and/or better market valuation (Allen et al., 2011; Berlin, 2011; Mehran and Thakor, 2011). On the contrary, less capitalised banks might experience excessive risk (Estrella et al., 2002) so that debt-holders need an assurance to finance banks. Therefore, market discipline compels banks to set aside enough capital buffers (Calomiris and Kahn, 1991). Studies confirm that there are significant differences in banks' capital adequacy ratios which are not fully explained by differences in riskiness of bank's portfolios (BCBS, 2014). Further, there is a possibility that excess capital will serve as buffer to help banks tide over a crisis/run on (Diamond and Rajan, 2000).

We examine the research questions in the Indian context. The Indian banks are obliged to implement standardised approach of Basel Accord for assigning risk weights to estimate capital required for credit risk since 2007 (RBI, 2012). The risk weights are determined by ratings assigned by recognised and independent credit rating companies (CRISIL, ICRA, CARE, Fitch Ratings, and others) in India. The Indian banks are gradually moving towards Basel III and adopting internal rating-based models to estimate capital requirements for credit risk (Jayadev, 2013). Thus, estimating the required capital is among the main pillars of Basel Accord, and given renewed emphasis/importance in every new publication of Basel series. According to current Basel norms, banks are obliged to raise more capital depending on their business models, geographical location, and require customised actions for every individual bank's circumstances (Schneider et al., 2017). Therefore, capital framework of Indian banks includes capital preservation buffer and countercyclical capital buffer. Currently, the Reserve Bank of India (RBI) recommends the standardised approach for credit risk though it has been reviewing requests from some banks to approve internal ratings-based models (IMF, 2018).

The guiding principles related to Basel III norms on capital requirement for credit risk of Indian banks were issued on May 2, 2012, implemented from April 2013, and estimated to achieve full implementation by March 2019. The RBI ensures the setting up of CRM systems using an internal risk rating system, financial analysis, projections, and stress testing. This should be reviewed twice every year by independent review officers, and banks are obliged to submit quarterly reports on loan quality, classification, and provisions (IMF, 2018). The banks and regulators have to continuously review and revise the capital requirements and other obligations given the pace of innovations in the financial markets (Harle et al., 2016).

This study assumes significance in the context of the ongoing debate on the need for stringent regulations and risk-based capital requirements for banks. The findings of the study will be of interest to Indian banks which have been implementing new Basel norms (Basel III). The study also has implications for regulators and policy makers who have been trying to address the problem of high and rising non-performing (loss) assets of Indian banks.

The paper is organised as follows: The literature review is included in Section 2. Section 3 presents the research design, and discussion of results is included in Section 4. Finally, the conclusions and implications of the study are included in Section 5.

2 Literature review

The area of risk management has continuously received the attention of regulators, risk managers, and researchers (Hull, 2012). However, Fatemi and Fooladi (2006) suggest that there is little evidence in the area of CRM in general and CRM in banks in particular.

The large banks are assumed to be less risky and hence hold less capital for their risks. According to the 'too-big-to-fail hypothesis', large and complex banks take excessive risk (Bhat et al., 2012) as they expect the government to bail them out in the event of failure (Brewer and Jagtiani, 2013; Molyneux et al., 2010; Farhi and Tirole, 2012), resulting in moral hazard (Laeven et al., 2016). These banks hold less capital for risk management (Dewenter and Hess, 2003) and grow in size by undertaking riskier activities to compete (Tabak et al., 2012). This behaviour has been cited as the main cause of crisis in financial institutions (Boyd et al., 2009).

According to 'economies of scale and scope' argument, scale benefits exist for small and medium-sized banks while benefits from scope are available to all banks irrespective of their size (Wheelock and Wilson, 2001; Rime and Stiroh, 2003; Sharifi et al., 2016). Large banks hold less capital buffer due to (expected) government support, economies of scale, and better diversification of their asset (loan) portfolios (Shim, 2013). Further, their ability to better diversify their loan portfolios is higher (Diamond, 1984), and they employ sophisticated techniques of screening and monitoring leading to less excess capital held as insurance (Jokipii and Milne, 2011; Distinguin et al., 2013). Thus, liberalisation, financial innovation, and technological sophistication created larger, more diversified, and profitable banks as they were able to manage risk better (see, e.g., DeLong, 2001; Laeven and Levine, 2007; Demsetz and Strahan, 1997; Stiroh and Rumble, 2006; Baele et al., 2007; Serino et al., 2019).

On the contrary, there is evidence of positive relationship between bank size and their risk. Using a sample of 270 large banks from 48 countries, Laeven and Levine (2009) provide evidence of positive relationship. Similarly, Beltratti and Stulz (2012) examined the question using a sample of 164 large banks ($50+ billion of total assets) globally during the crisis period from 2007–2008. Their findings suggest that banks with concentrated ownership are associated with higher idiosyncratic risk. Using data on 412 financial institutions from 56 countries, Laeven et al. (2016) document that systemic risk has a positive relationship with bank size and an inverse relationship with bank capital. Lately, single country studies based on US banks from 1984–2010 (Berger and Bouwman, 2013), and 702 US financial institutions from 2002–2012 (Bhagat et al., 2015) suggest positive relationship between credit risk and bank size.

Thus, we state the following hypothesis.

Hypothesis 1 There is a positive relationship between bank size and excess capital held for credit risk in Indian banks.

There is evidence of negative relationship between profitability and capital requirement of banks across developed and developing countries. Using fixed effect (FE) estimator and data on European banks from 1994–1998, Staikouras and Wood (2004) provided evidence of negative relationship between bank risk and profitability. However, Goddard et al., (2004) suggested a positive relationship between capital asset ratio and profitability using data on European banks from 1992–1998. They re-examined the question using data from 1993–2000, and provided evidence of an inverse relationship between profitability and capital (Goddard et al., 2013). Similar evidence (akin to Goddard et al.,

2004) is found in Liu and Wilson (2010) in the case of Japanese banks, and Havrylchyk (2006) in the case of Polish banks. The data on Greek banks from 1985–2001 suggests a significant relationship between market capitalisation, credit risk, and bank profitability (Athanasoglou et al., 2008). Similar evidence was provided by Hoffmann (2011) for US banks during 1995–2007.

In emerging economies such as China, Sufian (2009) suggests that commercial banks with higher levels of credit risk, capitalisation, and size have higher profitability. The liquidity and overhead costs are negatively related to profitability of commercial banks. Whereas, state owned and joint stock commercial banks with higher levels of capitalisation report low profitability measured by ROE (Tan and Floros, 2012). Victor et al. (2007) analysed the performance of the four largest joint stock and city commercial banks in China and suggest that joint stock banks fared better than state owned and city commercial banks. However, Heffernan and Fu (2010) found that rural commercial banks in China have performed better than state-owned, joint-stock, and city commercial banks.

Multi country study of 46 listed Asian banks found significant relationship between profitability and total risk after controlling for country-specific factors (Agusman et al., 2008). Hence, we state the following hypothesis:

Hypothesis 2 There is a positive relationship between excess capital for credit risk and profitability of Indian banks.

The evidence on the relationship between bank ownership and risk management practices is mixed and inconclusive. While some argue that ownership has an impact on bank's risk-taking behaviour (Saunders et al., 1990; Gorton and Rosen, 1995; Houston and James, 1995; Widyaningsih et al., 2017; Demsetz et al., 1997), others find no significant difference between government owned and private sector banks in the USA (Kwan, 2004). In the case of European banks, Iannotta et al., (2007) suggest that government owned banks had inferior loan quality and faced higher risk of failure than others. Similar findings were reported by Sapienza (2004) in the case of Italian banks. The evidence from Middle East and North Africa region suggests insignificant differences in the stability of Islamic and conventional banks (Taboada, 2011; Abedifar et al., 2013; Hassan and Dridi, 2010). However, Srairi (2013) suggests that Islamic banks were exposed to lower credit risk compared to other commercial banks, thus contradicting the earlier evidence.

Cross country studies in developing and developed nations suggest that government owned banks were associated with sub-par performance (Micco and Panizza, 2006; Micco et al., 2007) as their resource allocation was guided by government's political goals which eventually hurt capital allocation. Similar evidence is provided by studies in emerging markets (Mian, 2003; Firth et al., 2009).

Finally, in the Indian context, Sharifi et al. (2016) suggest that there is no significant relationship between ownership and operational risk management practices of commercial banks. However, Pennathur et al. (2012) suggest that default risk was lower in the case of government owned banks as they were likely to pursue fee-based activities. Thus, the evidence on the relationship between ownership and risk management practices of banks is limited and conflicting.

The *a priori* expectation is that public sector (government owned) banks will hold higher excess capital for credit risk compared to that held by private sector banks in India as they (public sector banks) enjoy relatively less operational freedom due to the

government ownership (and control) and the resultant interference from politicians and bureaucrats. Hence, we state the following hypothesis.

Hypothesis 3 There is a difference between excess capital for credit risk held by public sector (government owned) banks and that held by private sector banks in India.

3 Research design

3.1 Data

The data includes annual observations for 34 Indian banks during 2009–2016. We obtained data from Prowess, a database compiled by the Centre for Monitoring the Indian Economy (similar to Compustat). The database contains information drawn from annual reports of banks, and other sources. The Prowess data was previously used by other studies to analyse risk management in Indian banks (see Sharifi et al., 2016), innovative activity by banker on board (Ghosh, 2016), and bank client relationship during the financial crisis (Pennathur and Vishwasrao, 2014).

3.2 Variables

3.2.1 Excess capital as percentage of total risk-weighted assets – dependent variable

Excess capital is defined as the difference between actual capital (for credit risk) held by an Indian bank and the required minimum capital for credit risk as per Basel norms. The minimum capital is estimated as 8% of total risk-weighted assets of banks, using the credit ratings assigned by independent rating companies such as CRISIL, ICRA, CARE, and Fitch Ratings. Thus, the dependent variable is excess capital as a percentage of total risk weighted assets (ECTA).

$$\text{ECTA} = \%(\text{excess capital} / \text{total risk weighted assets})$$

where

$$\text{Excess capital (EC)} = \text{Actual capital (for credit risk)} - \text{Required minimum capital (for credit risk)}$$

$$\text{Required minimum capital} = 8\% * \text{total risk-weighted asstes}$$

3.2.2 Size of bank – independent variable

The proxy for size is total deposits and advances of banks. Previously, Sharifi et al. (2016) used this proxy to examine the relationship between size and operational risk management in Indian banks.

3.2.3 Return on assets as a measure of profitability – independent variable

Return on assets (ROA) is a measure of profitability in different organisations including financial institutions and banks. It demonstrates the management's ability to operate bank's financial and investment resources to generate profit from each unit of assets (Hassan and Bashir, 2003). It is also widely used as a measure of bank profitability in literature (Athanasoglou et al., 2008; Garcia-Herrero et al., 2009; Golin and Delhaise, 2013). So, we estimate ROA as a ratio (%) of net income to total assets.

3.2.4 Ownership as dummy variable

Ownership is a dummy variable, which categorises our sample of Indian banks into two distinct ownership groups, namely public sector (government owned) and private sector banks. Our sample includes 21 government owned and 13 private sector banks in India during the period from 2009 to 2016.

3.3 Methodology

The following model is estimated to examine the relationship between CRM, size, profitability, and ownership of Indian banks:

$$ECTA_{i,t} = \alpha + \beta_1 S_{i,t} + \beta_2 ROA_{i,t} + \beta_3 OS_{i,t} + \varepsilon_{i,t} \quad (1)$$

where

$ECTA_{i,t}$ % (excess capital / risk-weighted assets) for bank 'i' in period 't'

$S_{i,t}$ size of bank 'i' in period 't'

OS_j ownership dummy for bank 'i'

$\varepsilon_{i,t}$ random error term.

Equation (1) was estimated by pooling the data of all Indian banks (pooled OLS) (column 1, Table 3). The results may be biased due to omitted variables, and hence panel data methods are preferred. The 'F' test is conducted to check for the presence of individual FEs. We reject the null hypothesis as the estimated 'F' value (3.11) is greater than the threshold. So, the proposed model can not be estimated by pooled OLS. We estimated the FE and random effect (RE) models (columns 2 and 3, Table 3). We have also checked if the omitted variables (bank specific differences) are fixed or random using the Hausman (1978) test statistic (column 2, Table 3). We do not reject the null hypothesis and conclude that RE model is efficient {test statistic 0.17 < critical value of $\chi 2$ (1 df, 5%) 3.84}. This is also confirmed using additional test such as Breusch and Pagan (1979) and Lagrange-Multiplier (LM) for RE. In this case, we reject the null hypothesis as LM value (101.17) is greater than the critical value, suggesting the presence of individual REs. Further, the presence of autocorrelation cannot be ruled out in the case of panel data. Therefore, the feasible generalised least squares (FGLS) method is used to estimate the parameters (column 4, Table 3). The estimated FGLS model(s) is (are) used to examine the hypothesised relationship(s) as it is a cross-sectional time-series regression model. In this case, the autocorrelation parameter is same across all groups. The estimated Wooldridge (2002) test statistic (of 39.561 at 1% level of significance) confirms the presence of autocorrelation. The presence of group-wise heteroscedasticity

is tested with modified Wald test. Here, the $\chi 2$ value of 1,482 confirms the presence of heteroscedasticity. Thus, we use the generalised least squares model to overcome the problems of heteroscedasticity and autocorrelation (column 4, Table 3). The results confirm the *a priori* expectation of sign and significance of size after the correction.

4 Empirical results

The results suggest that bank size is positively related to excess capital held for CRM (row 1 of Table 3). This is in line with the findings of Berger and Bouwman (2013), and Bhagat et al. (2015) that the bigger banks hold higher excess capital as the credit risk faced by them is higher due to larger size of their loan portfolios. There is no significant relationship between ownership and profitability of banks, and excess capital held by them.

The summary statistics of our sample banks are included in Table 1. The logarithm of excess capital has a mean of –1.18 and a standard deviation of 1.42 whereas the logarithm of bank size has a mean of 13.93 with a standard deviation of 1.66. The estimated variance inflation factors confirm the absence of multicollinearity among the variables.

Table 1 Summary statistics

Variables	*Mean*	*Std. dev.*	*Min*	*Max*
Excess capital[a]	–1.19	1.43	–7.34	4.39
Bank size[a]	13.93	1.67	7.63	20.37
ROA[a]	–0.21	0.63	–2.66	0.67
Ownership	0.62	0.49	0.00	1.00

Note: [a]Natural logarithm.

Table 2 Correlation matrix

Variables	*Bank size[a]*	*ROA[a]*	*Ownership*
Bank size[a]	1.00		
ROA[a]	–0.16	1.00	
Ownership	0.56	–0.41	1.00

Note: [a]Natural logarithm.

The results of the regression of excess capital on size, profitability, and ownership of banks are included in Table 3. The results suggest a significant positive relationship between bank size and excess capital ($\beta = 0.21$, z-stat = 2.07, $p = 0.03$). This confirms the earlier evidence of positive relationship between size and excess capital held by banks for managing credit risk. The relationship ($\beta = 0.11$, z-stat = 0.60, $p = 0.55$) between profitability and excess capital held by Indian banks is not significant. Hence, there is no evidence in support of Hypothesis 2. The results ($\beta = 0.12$, z-stat = 0.38, $p = 0.70$) also suggest that there is no significant difference between excess capital held by public sector (government owned) banks and that held by private sector banks. Therefore, there is no evidence in support of Hypothesis 3.

Table 3 Relationship between size, profitability, ownership and (%of) excess capital for credit risk held by Indian banks (dependent variable = ECTAa)

Variables	*Pooled OLS*	*FE*	*RE*	*Feasible generalised least squares*
	(1)	*(2)*	*(3)*	*(4)*
Size[a]	0.21**	0.22	0.23**	0.21**
	(0.10)	(0.12)	(0.11)	(0.10)
ROA[a]	0.11	0.04	0.06	0.11
	(0.19)	(0.14)	(0.14)	(0.19)
Ownership	0.12	-	–0.16	0.12
	(0.31)	(0.56)	(0.31)	
Constant	–4.19***	–4.17***	–4.46***	–4.19***
	(1.32)	(1.66)	(1.47)	(1.31)
R-squared	0.04	0.04	0.04	
F-test/Wald $\chi 2$	3.11	1.64	4.79	9.55
	(0.02)	(0.19)	(0.18)	(0.00)
Number of banks	34	34	34	34
Hausman test		0.17		
		(0.92)		

Notes: [a]Natural logarithm.
Robust standard errors in parentheses.
***p < 0.01, **p < 0.05.

5 Conclusions

We analysed the relationship between excess capital held for credit risk, size, profitability, and ownership of Indian banks. The results suggest a significant positive relationship between excess capital for credit risk and bank size. The excess capital for credit risk held by bigger banks is higher than that held by smaller banks. This confirms the earlier evidence of positive relationship between size and excess capital held by banks for managing credit risk (Laeven and Levine, 2009; Berger and Bouwman, 2013; Bhagat et al., 2015). The evidence contradicts the *a priori* expectation of smaller banks holding higher excess capital as a buffer against credit losses. The bigger banks use sophisticated models and systems to estimate and manage credit risk, and hence are expected to hold relatively lower excess capital. However, the higher amount at risk due to credit events given the larger portfolio of loans, and the higher average loan value in the case of bigger banks may explain the higher excess capital held by them despite the use of sophisticated decision support systems for loan decisions.

There is no significant difference between excess capital for credit risk held by public sector (government owned) banks and that held by private sector banks. The differences in profitability do not seem to affect the excess capital held by banks. The public sector banks are expected to use the government support, and clout with the regulators to maintain lower excess capital given their obligation to ensure credit flow to different sectors of the economy. The evidence does not seem to support this *a priori* expectation of differences in excess capital held by public sector (government owned) and private

sector banks. The government budget support declined over the years, and public sector banks have been asked to raise resources from the market like the other government enterprises. The public sector banks have also been subjected to expectations of investors when the government sold its stake in many banks to investors, and the stocks were listed on Bombay Stock Exchange (BSE), and National Stock Exchange (NSE). The RBI did not distinguish between public sector (government owned) and private sector banks, and the regulatory requirements have been implemented without offering any concessions to public sector banks. So, it is no surprise that there is no significant difference between excess capital for credit risk held by public sector (government owned) banks and that held by private sector banks. Our evidence on profitability and excess capital for Indian banks is not in line with that reported by Goddard et al. (2013), Athanasoglou et al. (2008), Sufian (2009), Tan and Floros (2012). Thus, evidence on the relationship between excess capital and profitability of banks in different countries with different regulatory and institutional infrastructure is mixed and at times conflicting. This study is significant as it contributes Indian evidence on the relationship between excess capital held for credit risk, size, profitability, and ownership of Indian banks.

6 Implications

The study contributes to the ongoing debate on the need for stringent risk-based capital requirements for Indian banks in the context of high and rising levels of non-performing (loss) assets (NPAs) in the Indian banking industry (see Bawa et al., 2018). The RBI has introduced the mechanism of prompt corrective action (PCA), and prevented about 12 public sector banks from giving new loans as their capital as percentage of risk weighted assets is lower than the required minimum. This led to decline in credit flow to segments of the economy specified by government as priority sectors such as agriculture and allied areas, small and medium enterprises (SMEs) which employ large number of unskilled and semi-skilled workers. The conflict between objectives of the government and those of RBI resulted in public discussion of whether the central bank's independence should take precedence over the sovereign government's right and obligation to work in the larger public interest. So, this raises the question of whether uniform capital adequacy requirements across countries is justified given the requirements of developing countries, and differences in the financial systems as bank credit continues to be a significant source of capital in countries like India. The study has implications for regulators as they have to modify the obligations to suit the needs and requirements of their economies and financial systems.

The study has implications for Indian financial system as bank deposits account for little over half of the overall financial assets held by Indian households. The growth in bank deposits has also been on the decline in the recent past due to competition from other financial assets such as mutual fund products. There has also been increasing financial disintermediation as firms with good rating have been borrowing from the savers directly. So, the Indian banks have to compete with other financial intermediaries to mobilise savings by offering attractive interest rates. They also have to choose between lending to risky borrowers and investing in government bonds. The bank spreads have been under pressure, and banks are forced to increase their non-interest income. The banks may add to their stock of non-performing (loss) assets (NPAs) in their attempt to increase the size of their loan portfolio in the absence of prudential norms and appropriate

systems to estimate and monitor credit risk. Some banks have incurred huge losses in the recent past due to significant gaps in their systems for approving and monitoring loans (to big corporates). Bank failures can be fatal for the Indian economy as the capacity of its financial system to endure such tremors is highly doubtful. Further, this study would be of interest to regulators and policymakers across the world in the context of global financial crisis (2008) which emanated from the US mortgage market. Thus, an effective CRM system is a necessity for financial firms across the globe.

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