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The relationship between competition and risk-taking behaviour of Indian banks

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Abstract

Purpose – Under the traditional franchise value paradigm, competition in banking markets is considered to be risk enhancing because of its tendency to raise interest rates on deposits. Taking a contrarian view, Boyd and De Nicolo (2005) have argued that competition in the loan market can lead to lower interest rates and hence reduce bank risk-taking. Following these contradictory theoretical results, the empirical evidence on the relationship between risk and competition in banking has also been mixed. This paper analyses the competition–stability relationship for the Indian banking sector for the period 1999-2000 to 2012-2013.

Design/methodology/approach – Banking competition is measured using structural measures of concentration, namely, five-bank concentration ratios and the Herfindahl-Hirschman Index as well as a non-structural measure of competition – the Panzar-Rosse H-Statistic. Panel regression methods are used to estimate the relationships.

Findings – Our results show that while concentration leads to lower levels of default, market and asset risks, it exacerbates the levels of capital and liquidity risks.

Practical implications – These results have interesting implications for banking sector policy in emerging economies. For instance, any strategy on entry of new banks has to be carefully coordinated with supervisory efforts and macro-prudential policy to derive the benefits of greater competition in the banking industry.

Originality/value – This is the first paper that analyses the competition – stability relationship using a large number of alternative measures for the banking sector, an emerging economy.

Keywords Banks, Market structure

Paper type Research paper

1. Introduction

The health of the financial sector aids in good economic performance and therefore it is important that the banking sector of a country operates on sound lines. In recent years, the debate regarding the effects of competition on the risk-taking behaviour of banks has gained momentum and has become an area of increased interest for both

JEL classification – G21, G28

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academicians and policymakers. Two hypotheses are predominant in literature with respect to the above relationship (Schaeck *et al.*, 2006; Berger *et al.*, 2008). The "competition–fragility" view states that increased competition among banks lowers market power and profit margins, thereby increasing their risk-taking. On the other hand, the "competition – stability" view suggests that more market power in the market for loans results in increased risk because higher interest rates on loans make repayment more difficult for borrowers. However, the overall risk of banks may not increase if they protect themselves through higher capital or use other risk-mitigating strategies (Berger *et al.*, 2008).

These arguments indicate that no consensus has been reached so far in literature on the nexus between competition and bank risk-taking. Further, most studies analysing this relationship, whether single or cross-country, have focused mainly on advanced economies. Research on emerging market economies (EMEs) is extremely sparse. This is despite the fact that recent global events demonstrate a key challenge facing banking regulators in EMEs today is maintaining the stability of their domestic banking systems in the face of increased competition from domestic and foreign banks. In EMEs, a rapidly developing financial system can pose systemic risks if policymakers underestimate its wider ramifications.

To fill this gap in literature, this paper analyses the competition–risk-taking relationship by considering the Indian banking sector as a case study. India is one of the most important EMEs with a gross domestic product (GDP) growth rate that has recently surpassed China's. India's banking sector is quite well-developed and is characterised by a vast spectrum of banks of different sizes and ownership categories. With the liberalisation of the economy in the 1990s, as new banks entered the market, the increasing competition has often raised concerns about its implications on stability. There are similar concerns in policy circles across EMEs. Our study contributes both specifically to the existing literature on EMEs and generally to the existing knowledge on the relationship between competition and risk-taking behaviour of banks. A number of considerations make the Indian banking sector an interesting case study for the analysis of the impact of competition on risk. First, India is an important emerging economy, which is currently the world's third largest economy in terms of purchasing power parity and has one of the highest GDP growth rates in the world. Second, over the 1990s, India went through a series of liberalisation measures of the banking sector with the objective of enhancing the performance of banks through inducement of competition. Therefore, it would be interesting to study the implications of these changes on competitive conditions in the banking sector and risk-taking by banks. Third, most existing studies on competition are either in the nature of cross-country studies or are based on banking markets in developed economies, Latin American or transition countries (Crystal *et al.*, 2002; Berger *et al.*, 2008; Liu *et al.*, 2013). Little systematic empirical research is available on this aspect for a leading emerging economy like India.

Our basic theoretical framework depends on the Boyd and De Nicolo (BDN) model. Boyd and De Nicolo (2005) developed a bank competition model to show that increased competition across both the loan and deposit markets can lower loan rates, decrease borrower credit risk and increase financial stability. This is in line with the competition–stability view. For capital and liquidity risks (which we define as buffers in our paper), we depend on the charter value hypothesis (CVH) model as our theoretical framework.

Hellmann *et al.* (2000) pointed out that competition erodes a bank's charter value leading to fall in the bank's capital-to-asset ratio which increases the degree of risk. This seems to support the prediction of the competition–fragility hypothesis. We empirically test both these alternative frameworks for Indian banking data.

The paper's novelty lies in the fact that it is the first study to empirically examine the validity of the BDN and CVH models for Indian banks. We do that by studying the impact of competition on the various risks (i.e. default, market, asset, capital and liquidity risks) faced by Indian scheduled commercial banks (SCBs). Following the study conducted by Anzoategui *et al.* (2010), we consider a non-structural measure of competition, namely, Panzar–Rosse H-Statistic (1987), and following the study conducted by Liu *et al.* (2010), several structural measures of market power, namely, five-bank concentration ratios (based on loans, deposits and assets) and the Herfindahl–Hirschman Index (HHI), are considered. We also take into account the effects of other bank-specific and macroeconomic controls such as return on assets (ROAs), size and the annual GDP growth rate. The risk and concentration/competition measures, along with control variables, are explained in greater detail in Section 3. The study spans the period from 1999-2000 to 2012-2013 and uses an unbalanced panel data set consisting of 756 observations. Our results show that increased competition leads to higher stability when related to default, market and asset risks. However, competition adversely affects capital and liquidity risks, thus lowering the safety buffers. This mixed evidence has interesting policy implications as discussed in the concluding section.

The remaining paper is organised as follows. Section 2 reviews the existing literature on the competition–stability nexus. Section 3 highlights the data sources and methodology applied for data gathering and analysis. Section 4 provides the analysis of descriptive statistics and broad trends, while Section 5 highlights the estimation results from panel data regressions. Section 6 concludes the paper with a discussion on the policy implications of our findings.

2. Literature review

In the past couple of decades, an extant theoretical and empirical literature has come up, investigating the issue of competition and stability in banking. This has occurred because of questions regarding the type of market structure that leads to a productive and sound environment for banks to function (Liu *et al.*, 2010).

Hellmann *et al.* (2000) developed a theoretical model that showed that competition in the banking market encourages banks to attract customers by offering them higher interest rates on deposits. As this puts pressure on banks' profits or charter, they end up taking undue risks. This so called charter value hypothesis is often referred to as the CVH model or the competition–fragility view. Its implication is that higher concentration and lower competition in banking systems lead to greater stability, as higher profits act as a cushion against fragility. The need to protect their franchise value provides banks with incentives against excessive risk-taking (Hellmann *et al.*, 2000). In more competitive environments, there is greater pressure on maintaining profits, which makes banks take on more risks, resulting in higher fragility. On the other hand, in systems where entry is restricted, there is limited competition. Thus, banks have better profit opportunities, capital cushions and, therefore, fewer incentives to take on excessive risks, which affects financial stability positively (Beck, 2008).

In contrast to the above view, the competition–stability argument asserts that greater concentration in banking structures results in more risk-taking by banks (Beck, 2008). Boyd and De Nicoló (2005) argue that the viewpoint of market power boosting profits and, hence, stability ignores the potential impact of banks' market power on firm behaviour. Instead of banks choosing the riskiness of their assets, borrowers end up having to choose the riskiness of their investment, undertaken with the bank loans. The BDN model demonstrates that concentrated banking systems enhance market power, which then allows banks to increase the interest rate they charge firms. These higher interest rates may induce firms to assume greater risk, which results in a higher probability of loans turning bad/non-performing[1].

Arping (2014) presents a model in which competition makes banks more reluctant to take on excessive risks. The author shows that as competition intensifies and margins decline, banks face greater threats of failure. They respond to such contingencies by reducing their risk-taking. Yet, at the same time, banks become riskier. This is attributed to the fact that the direct, destabilising effect of lower margins outweighs the disciplining effect of competition. Moreover, an increase in competition reduces banks' incentive to build precautionary capital buffers. The vital implication following this is that the effects of competition on risk-taking and on failure risk can move in opposite directions.

Empirical literature contains several cross-country studies on the competition–risk relationship. Beck *et al.* (2005) empirically examine the relationship between concentration and banking system fragility using a cross-sectional sample of about 2,500 US banks in 2003 and a panel data set of about 2,600 banks in 134 non-industrialised countries from 1993 to 2004. They find that a banking system that is highly concentrated also has larger and more diversified banks, which help to generate stability. Their results also suggest that concentration is associated with lower probability of a country facing a systemic banking crisis.

Schaeck *et al.* (2006) analyse the relationship between competition and banking system fragility, using data from 38 countries during the period from 1980 to 2003. Using the Panzar and Rosse H-Statistic as a measure for competition, their results suggest that banking systems that are more competitive are less vulnerable to systemic crises. They conclude that competition and concentration are significantly different from each other and describe different characteristics of banking systems. Whereas concentration is definitely a measure of market structure, they argue that competition can be said to measure competitive dynamics among financial institutions.

Berger *et al.* (2008) focus on the impact of market power on measures of loan risk, bank risk and bank equity. Based on data for 8,235 banks in 23 developed economies, their results show that banks with a greater degree of market power have less overall risk exposure. Although this result appears consistent with the "competition–fragility" view, their work also finds that market power increases loan portfolio risk, which is in line with the "competition–stability" view. Beck *et al.* (2011) show that not only is the relationship between bank competition and stability ambiguous, but it can also differ across countries depending on market, regulatory and institutional features. They show that higher competition will have a stronger impact on banks' risk-taking incentives in those systems that have stricter activity restrictions, more homogenous market structures, more generous deposit insurance schemes and better credit information sharing. Liu *et al.* (2013) study the relationship between competition and bank stability

in 11 European countries over the period of 2000-2008. They find evidence for a U-shaped relationship between competition and stability. In other words, there is an optimum level of bank competition that would keep bank risks at a minimum level.

Although the above studies are based on data taken mostly from developed countries, there are a few studies pertaining specifically to EMEs. Crystal *et al.* (2002) study banks in select Latin American countries during the period from 1995 to 2000 and find that foreign banks show more robust loan growth – a more aggressive response to asset quality deterioration and a greater ability to absorb losses than domestic banks. They conclude that such characteristics can help strengthen the financial systems of host countries. Yeyati and Micco (2003) investigate bank competition and foreign entry in eight Latin American countries and the implications for risk-taking. Their results show that foreign bank entry leads to less competition in banking. They also find that banking sector fragility is positively related to competition and, therefore, foreign bank entry can lead to banking stability despite foreign banks in the region having higher insolvency risk and more volatile returns.

Zhang *et al.* (2013) report the relationship between bank performance measured by technical efficiency, risk and competition across Brazilian, Russian, Indian and Chinese (BRIC) economies, using 1,001 bank-year observations covering major domestic commercial banks for the period of 2003-2010. They find that efficient banks take lower level of risks and the presence of state ownership and foreign banks reduces bank efficiency. Amidu and Wolfe (2013) analyse the effects of competition on diversification and stability using a sample of 978 banks in 55 developing economies from 2000 to 2007. Their main finding indicates that competition increases stability, as diversification across and within both interest and non-interest income generating activities of banks increases. They identify revenue diversification as a channel through which competition reduces bank insolvency risk. Soedarmono and Tarazi (2014) study a sample of commercial banks in the Asia-Pacific region from 1994 to 2009 and highlight the fact that banks in less competitive markets exhibit lower loan growth and higher instability. Such instability is further followed by a decline in deposit growth, suggesting that Asian banks are also subject to indirect market discipline mechanisms through bank market structure. The study advocates greater reliance on market discipline and strengthening of financial intermediation to promote bank stability.

Some studies have examined the relationship between competition and stability using different kinds of market segmentation within the banking sector of individual countries as the basis for their investigation. Ghosh (2009) explores the liaison between charter value and bank risk-taking for India for the period 1996-2006. He also studies the determinants of charter value, particularly focusing on competition. The results indicate that concentration in deposit or loan markets exerts a strong influence on the charter value of banks. Thus, there is a strong link between competition and charter value. Further, banks' size, their operating efficiency and non-interest income are the main determinants of charter value. Zhao *et al.* (2009) analyse the lending market of Indian banks in an attempt to understand the effect of financial reforms on competition and risk-taking incentives of banks during 1992-2004. They observe that there is an increase in competition because of reforms, which also amplifies banks' risk-taking.

Goetz (2012) examines the effect of a bank's diversification on its risk-taking behaviour and the risk-taking behaviour of competing, non-diversified banks in the USA. The results reveal that greater geographical diversification affects a bank's

lending behaviour and market interest rates. This has further ramifications for non-diversified competitors because of interactions in the banking market. By utilising the state-specific timing of a removal of intrastate branching restrictions, the study indicates that a bank's diversification also impacts the risk-taking of competitors, even if these banks are not diversifying their activities.

Liu and Wilson (2013) investigate how the relationship between competition and risk varies across different ownership structures for the Japanese banking system across the period of 2000-2009. They find that, on a national basis, City and Trust banks take on more risk on average than their regionally focused counterparts, which are Regional, Tier 2 Regional, Shinkin and Credit Cooperative banks. The relationship between competition and risk also differs across bank types on the basis of different initial levels of risk. Increasing competition seems to reduce the risk of City banks and increase the risk of the other types of banks.

Jime´nez *et al.* (2013) study the linearity of the relationship between bank competition and risk. Their paper uses data for 107 commercial and savings banks in Spain for the period 1988-2003. Their empirical results suggest a nonlinear relationship between banking market competition and bank risk-taking using standard concentration measures for both loan and deposit markets. However, when the Lerner index is used as a measure of bank competition, the result does not indicate a nonlinear relationship. Kick and Prieto (2013) analyse the competition–bank-risk nexus using bank-level data for German cooperative and savings banks for the period 1994-2010. Using bank-specific, efficiency-adjusted Lerner Index as a proxy for bank-specific market power, they conclude that market power tends to reduce risks. In contrast, using the Boone Indicator (the elasticity of profits to marginal costs) and/or the regional branch share as a measure of competition, the results suggest that higher competition leads to lower risks.

Relating competition and concentration to some specific types of risks, Agoraki *et al.* (2009) investigate whether the effects of regulation on banking risks are actually caused by the market power of banks. Using data for the Central and European banking sectors from 1998-2005, they suggest that higher market power is associated with lower credit risk and lower probability of default of banks. Shehzad *et al.* (2010) study the relationship between bank ownership concentration and risks measured by non-performing loans and capital adequacy ratio for around 500 commercial banks for more than 50 countries from 2005 to 2007. The results show that concentrated ownership significantly reduces a bank's bad loans ratio and increases capital ratio. At low levels of shareholder protection rights and supervisory control, ownership concentration can lead to a reduction in banks' riskiness. Schaeck and Cihak (2012) analyse the effect of competition on capital buffers held by banks. Based on an analysis of data for more than 2,600 banks from ten European countries during 1999-2004, the authors find that the Panzar–Rosse H-Statistic has a positive and significant effect on capital ratios indicating that banks hold more capital when faced with higher competition.

There is no existing empirical research that focuses on analysing the link between competition and risk-taking behaviour of banks in India, although studies for developed economies such as Europe, Germany, Japan and the USA and some EMEs do exist. The two studies which come closest to our paper and that also study Indian banking are the studies conducted by Ghosh (2009) and Zhao *et al.* (2009). While the former focuses on

charter value and risk-taking (but not competition), the latter investigates the impact of reforms on competition and risk-taking in the lending market. However, our study stands out in that we focus specifically on the impact of competition, measured by both structural and non-structural approaches on a variety of risks faced by banks.

In the light of the above discussion, our paper makes several contributions. This is the first study that attempts to relate competition with risk in the case of Indian banks. Second, we measure concentration/competition in a number of ways, namely, structural measures like the five-bank concentration ratios (based on loans, deposits and assets) and the HHI along with the non-structural Panzar – Rosse H-Statistic. Third, we study bank stability using a variety of risk indicators such as default, market, asset, capital and liquidity risks. Our empirical results provide a comprehensive understanding of the competition–stability link for Indian SCBs and, thereby, contribute to relevant literature.

3. Data and econometric methodology

Bank-wise figures of the relevant variables used in the study for Indian SCBs – public sector banks, Indian private banks and foreign banks – have been gathered from the various issues of Statistical Tables Relating to Banks in India. It is an annual publication of the Reserve Bank of India (RBI), which provides audited data on the balance sheet and income statements of individual banks. Our data set covers the period from 1999-2000 to 2012-2013. Macroeconomic data have been collected from RBI's Handbook of Statistics on the Indian Economy.

To examine the validity of the BDN and CVH models, we assess the impact of competition on banks' risk by estimating equation (1) as follows:

$$\text{Risk}_{it} = \alpha_i + \beta_1 c_{it} + \beta_2 x_{it} + \varepsilon_{it} \quad (1)$$

where, Risk represents a risk indicator; α_i represents bank-specific effects; c represents vector of concentration/competition variables; and x is the vector of bank-specific and macroeconomic controls. As the above equation is estimated for a panel data set of 37 banks over the period 1999-2000 to 2012-2013, it is advisable to use panel regression methodology such as fixed effects (FE) or random effects (RE) models. We choose the appropriate model based on the Hausman test. Although the above specification has contemporaneous variables on the right-hand side, we tried estimating with lagged independent variables. The results remain qualitatively unchanged, indicating that our results do not suffer from endogeneity problems.

Following the studies by Altunbas *et al.* (2007) and Zhang *et al.* (2013), we define five different measures of risk, default risk (non-performing assets [NPAs] ratio), asset risk (loan loss provisions ratio), market risk (inter-bank borrowings ratio), capital risk (equity ratio) and liquidity risk (liquid assets ratio). The last two indicate the capital and liquidity buffers of banks, which imply protection against risks and, hence, are closer to soundness in their interpretation. For concentration/competition variables, we use three types of concentration ratios (five-bank concentration ratio or CR5, based on assets, deposits and loans), the HHI and the Panzar–Rosse H-Statistic (Liu *et al.*, 2010; Anzoategui *et al.*, 2010). The control variables are bank size, profitability and GDP growth. Table I provides the detailed definition and computation for each risk, concentration/competition and control variables used in the study. Although the risk

Variable	Definition
Risk variables	
Default risk	*Default risk* is measured by the ratio of gross NPAs to gross advances. A high value of the ratio indicates a higher proportion of problem loans in a bank's overall portfolio and increased exposure to credit risk
Asset risk	*Asset risk* is measured by the ratio of loan loss provisions to total assets. While higher provisions help to absorb losses in a better fashion, making such banks less prone to bankruptcy, but in case of India where provisioning is pro-cyclical, the ratio is a backward looking indicator of the quality of assets on a bank's books. Therefore, a higher value of the ratio would indicate inferior asset quality, i.e. higher asset risk
Market risk	*Market risk* is measured by the ratio of inter-bank borrowings to total borrowings. A high value of this ratio for a bank indicates that it relies more on inter-bank borrowings and faces higher risk arising from movements in interest rates. Inter-bank markets are vital for banks' liquidity management when inter-bank markets function smoothly in normal time. However, in crisis periods, overreliance on inter-bank borrowing can lead to liquidity problems
Capital risk	*Capital risk* is measured by the capital buffer of banks given by the ratio of equity to total assets. It reflects to what extent a bank's total assets are funded by equity capital. A bank with a lower ratio indicates higher risk and vice versa
Liquidity risk	*Liquidity risk* is the risk that a bank faces from insufficient liquidity to meet its liabilities as and when they fall due. It is measured by the liquidity buffer or the ratio of liquid assets to total assets. The higher the ratio, the lower is the liquidity risk a bank faces
Concentration variables	
CR5	The n-bank concentration ratio, denoted by CR_n, measures the share of the industry's n largest banks with respect to a measure of total industry size. The most widely used size measures are based on loans, deposits and assets. $CR_n = \Sigma s_i$ where s_i is the share of the ith largest banks in total loans, deposits or assets of a particular bank segment. Further, $s_i = x_i/\Sigma x_i$, where x_i is the market share of bank i in total assets of the banking segment. CR_n for $n = 3$, 4, 5 or 8 are among the most widely quoted n-firm concentration ratios. We use CR5 for assets, deposits and loans
HHI	HHI is calculated as $HHI = \Sigma s_i^2$ where s_i is the market share of bank i in the total assets of a banking segment. In an industry where there is a single monopoly producer, HHI = 1. In an industry with n banks, the maximum possible value of the HHI is 1, while its minimum possible value is $1/n$
Competition variable	
H-stat	The H-statistic is calculated from a reduced form revenue equation as the sum of the coefficients of input price factors with respect to the bank's revenue. $0 < H < 1$ can be interpreted as a measure of the intensity of competition; higher the value, higher is the intensity of competition. Under perfect competition, H = 1

Table I.
Definitions of variables

(*continued*)

Variable	Definition
Bank-specific controls	
Return on assets	ROA reflects the ability of a bank's management to generate profits from its assets. It is calculated as the ratio of profit during the year to total assets
Size	Size is an important characteristic of a bank in trying to understand what scale of operations may help in managing risk better. It is measured by the log of total assets
Macroeconomic control	
GDP growth rate	It is measured by annual growth rate of real GDP. High levels of GDP growth occurring during an upswing of business cycle might engender good business opportunities for banks

Table I.

and control variables are computed using simple formulas described in Table I, the estimation procedures for the concentration/competition variables require some explanation.

Following the study conducted by Liu *et al.* (2010), we calculate the five-bank concentration ratios (CR5) as follows:

$$CR_n = \Sigma s_i \quad (2)$$

Where, s_i is the share of the ith largest banks in total loans, deposits or assets. In other words, s_i equals $x_i/\Sigma x_i$, where x_i is the market share of bank i and n is the number of banks in the market. We calculate CR5 based on assets, deposits and loans. However, we note that Indian banking is characterised by different types of banks across ownership and size categories. Banks compete with their counterparts within the same market segment and, therefore, it is more appropriate to infer competitive conditions within a peer group. To allow this, we take n in equation (2) as the number of banks in the relevant market segment in which a bank operates.

To define market segments, we divide the banking market into the following peer groups: small domestic banks, large domestic banks and foreign banks. Foreign banks have better technological capabilities and marketing abilities than domestic banks but are constrained by limited branch network. Foreign banks in India operate as branches of foreign headquartered banks and are not locally incorporated. They cater to multinational companies or those with foreign exchange requirements and high net-worth individuals (e.g. business travellers). They compete among themselves in niche areas such as trade finance, Forex services and short-term financing products to highly rated Indian corporations. Hence, they are considered a separate peer group.

We divide domestic banks into small and large groups on the basis of the median value of their total assets. Banks above the median value are classified as large, while banks below it are classified as small. We assume that domestic banks compete with peers that are at par with them in terms of size. Large domestic banks have the advantage of a larger geographic network which facilitates delivery all over the country. Hence, they are a peer group that compete for pan-India customers as well as corporate products and services. Small domestic banks tend to cater to smaller retail customers and small and medium enterprises. There is enough anecdotal evidence from within the

Indian banking sector to support this approach. Large banks, such as the State Bank of India (a state-owned bank) and ICICI Bank (a relatively new private-sector bank), fiercely compete with each other at a pan-India level and with other large banks. At the other end of the size scale are smaller banks such as Vijaya Bank (a state-owned bank) and Federal Bank (an old private-sector bank) that target similar customers and business.

The HHI (Liu *et al.*, 2010) is defined as follows:

$$\text{HHI} = \Sigma s_i^2 \tag{3}$$

In case of a monopoly, HHI = 1. In case of an industry with n banks, the maximum possible value of the HHI would be 1 and the minimum possible value would be $1/n$.

Following the study by Anzoategui *et al.* (2010), we estimate equation (4) to obtain the Panzar–Rosse H-statistic:

$$\ln(TI_i) = \alpha + \beta_1 \ln(W_{1i}) + \beta_2 \ln(W_{2i}) + \beta_3 \ln(W_{3i}) + \gamma \ln(Z_i) + \varepsilon_i \tag{4}$$

where,

TI = total income/total assets (proxy for banks' output price);

W_1 = interest expenses/total deposits + total borrowings (proxy for input price of deposits);

W_2 = personnel expenses/total assets (proxy for input price of labour) and

W_3 = other operating and administrative expenses/total assets (proxy for input price of equipment/fixed capital).

In equation (4), Z is a matrix of controls, which includes equity/total assets, gross advances/total assets and size (logarithm of total assets). The error term ε is assumed to be normally distributed. The equation is estimated for each year and peer group using ordinary least squares method.

The H-statistic (henceforth, H-stat) is defined as $\beta_1 + \beta_2 + \beta_3$, the sum of the input price elasticity of total revenues. The H-stat essentially measures the responsiveness of bank revenues to changes in input prices. H-stat ≤ 0 is a sign of a monopoly; H-stat = 1 represents perfect competition, and $0 <$ H-stat < 1 indicates monopolistic competition. The estimation of H-stat is done for separate peer groups – small domestic banks, large domestic banks and foreign banks.

4. Descriptive statistics

Table II reports the mean values of the relevant variables, while Figures 1 and 2 show the trend in risk and competition indicators over the sample period 2000-2013 for all SCBs taken together. Mean values are calculated using weighted average, where relative asset share is taken as weight. The results show that mean weighted capital risk and mean weighted asset risk have remained fairly consistent for the entire sample period. Mean weighted market risk and mean weighted liquidity risk demonstrate a pattern of consistent increase and decrease, respectively, from the beginning till the end of the period. Mean weighted default risk declines drastically during 2008-2009, which is the peak financial crisis period, showing that the Indian banking sector was probably able to cushion the credit risk arising from bad loans in their overall portfolio. However, from 2011 to 2013, there has been a sharp increase in default risk, suggesting that the

Table II. Mean weighted risk and mean competition variables

Year	Mean weighted capital risk	Mean weighted default risk	Mean weighted market risk	Mean weighted liquidity risk	Mean weighted asset risk	Mean CR5a	Mean CR5d	Mean CR5l	Mean HHI	Mean H-stat
2000	0.010	0.136	0.070	0.144	0.004	0.548	0.556	0.568	0.095	0.461
2001	0.007	0.119	0.101	0.142	0.004	0.544	0.547	0.557	0.094	0.386
2002	0.008	0.114	0.135	0.140	0.006	0.696	0.630	0.626	0.159	0.881
2003	0.006	0.088	0.153	0.098	0.009	0.655	0.620	0.630	0.155	0.759
2004	0.006	0.071	0.153	0.097	0.008	0.621	0.626	0.624	0.120	0.698
2005	0.007	0.037	0.138	0.068	0.005	0.708	0.698	0.705	0.150	0.359
2006	0.004	0.031	0.100	0.090	0.006	0.723	0.734	0.720	0.139	0.571
2007	0.002	0.022	0.106	0.096	0.006	0.683	0.692	0.687	0.127	0.627
2008	0.003	0.021	0.118	0.099	0.006	0.655	0.657	0.650	0.133	0.547
2009	0.003	0.023	0.049	0.095	0.009	0.710	0.718	0.716	0.153	0.663
2010	0.004	0.025	0.068	0.091	0.009	0.686	0.702	0.696	0.136	0.428
2011	0.004	0.019	0.064	0.091	0.009	0.671	0.681	0.649	0.159	0.555
2012	0.000	0.114	0.060	0.074	0.007	0.635	0.700	0.632	0.135	0.198
2013	0.000	0.129	0.047	0.061	0.007	0.644	0.698	0.623	0.138	0.510

Notes: CR5a = assets of the five largest banks; CR5d = deposits of the five largest banks; CR5l = loans/advances of the five largest banks

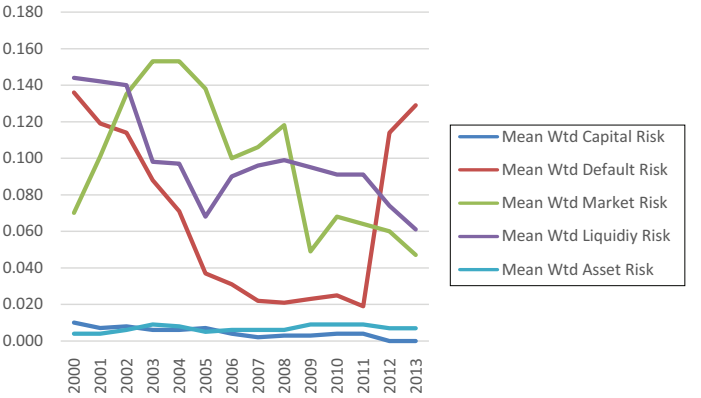

Figure 1.
Trends in mean weighted risk variables

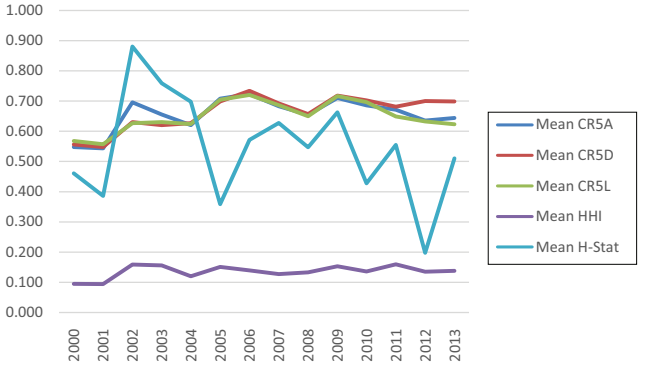

Figure 2.
Trends in competition variables

proportion of bad loans has increased considerably. With respect to the competition variables, the mean CR5 values for assets, deposits and loans and the mean HHI values have remained considerably stable for the whole sample period. However, the mean H-stat value, which is an indicator of banks' reaction to changes in input prices, has shown wide fluctuations. It displays a pattern of sharp rises and falls. The periods of sharp rise indicate an increase in banking market competition, while those of fall indicate a decrease in the degree of competition.

It is instructive to go beyond the graphs and compare some of our concentration and competition estimates with those in previous studies. For instance, Anzoategui *et al.* (2010) report H-stat of 0.683 for the period 2002-2008, and we find that our estimated H-stat is very close at 0.634 for the same period which supports the validity of our estimates. CR5 is calculated based on the top five banks relative to the rest of the sample and hence the composition of the sample is very important. Accordingly, we find that our CR5 estimates differ from Anzoategui *et al.* (2010), as the samples are very different. While Anzoategui *et al.* consider 169 banks to arrive at a CR5 of 37 per cent (Table I), we have fewer (35) banks in our sample giving us a lower average CR5 of 68 per cent during the same period. Comparing our estimates with Schaeck *et al.* (2009), we find that our H-stat of 0.634 (for 2000-2013) is higher than Schaeck *et al.*'s estimate of 0.25 (for 1998-2005). This is possibly because competitive conditions in India improved

significantly after banking sector reforms were launched in the early 1990s. New banks started operations in 1996 and a program of partial privatisation of public sector banks was started in 1994 (Sarkar and Sensarma, 2010). Our H-stat estimate reflects the increase in competition resulting from these policy changes.

Table III provides the broad descriptive statistics (means and standard deviations) of the variables mentioned in Table I across four categories – all banks, large domestic banks, small domestic banks and foreign banks. In terms of risk indicators, foreign banks tend to exhibit higher values of mean and standard deviation as compared to the other categories. For the concentration variables, the statistics indicate that foreign banks tend to have a higher mean except for H-stat, which measures competition. However, the standard deviation is higher for small domestic banks, indicating greater variation. With respect to control variables, foreign banks exhibit a higher mean value of ROA, while small and large domestic banks and all SCBs together exhibit a higher mean value of size. The mean and standard deviations of annual GDP growth rate are the same for all categories, as it is a bank-invariant variable.

Table IV shows results from tests of differences in the means of the relevant variables using the *t*-test (two-tailed, unequal variances). With respect to the first categorisation for comparison, that is, small domestic banks vs large domestic banks, we find that for risk indicators, the difference between means is significant for market risk and asset risk. Differences between the two bank groups for all the competition variables are significant, while among the control variables, only size difference is significant, indicating greater variation. For the second categorisation, that is, foreign banks vs

Variable	All banks No. of observation: 751 Mean	SD	Large domestic banks No. of observation: 253 Mean	SD	Small domestic banks No. of observation: 244 Mean	SD	Foreign banks No. of observation: 254 Mean	SD
Risk variables								
Capital risk	1.243	7.865	0.011	0.022	0.014	0.028	3.673	13.255
Default risk	0.113	0.327	0.071	0.075	0.079	0.082	0.187	0.547
Market risk	0.280	0.320	0.100	0.159	0.220	0.283	0.518	0.330
Liquidity risk	1.168	8.116	0.105	0.059	0.111	0.070	3.264	13.782
Asset risk	0.206	1.300	0.011	0.004	0.012	0.007	0.593	2.196
Competition variables								
CR5 assets	0.643	0.160	0.585	0.041	0.502	0.088	0.838	0.075
CR5 deposits	0.646	0.156	0.572	0.040	0.526	0.106	0.834	0.070
CR5 Loans/Advances	0.637	0.143	0.589	0.040	0.507	0.083	0.809	0.063
HHI	0.131	0.057	0.119	0.012	0.079	0.018	0.194	0.049
H-statistic	0.549	0.249	0.643	0.217	0.462	0.241	0.541	0.255
Control variables								
ROAs	0.135	1.222	0.008	0.004	0.008	0.008	0.384	2.082
Size	5.995	1.107	6.881	0.400	6.020	0.588	5.089	1.206
GDP growth	6.937	2.022	6.993	2.021	6.994	2.023	6.828	2.027

Table III.
Descriptive statistics

Comparison categories	Small domestic banks vs large domestic banks	Foreign banks vs small domestic banks	Foreign banks vs large domestic banks
		t statistics	
Risk variables			
Capital risk	1.115	4.400***	4.403***
Default risk	1.075	3.115***	3.340***
Market risk	5.761***	10.847***	18.177***
Liquidity risk	1.154	3.645***	3.653***
Asset risk	1.997**	4.218***	4.226***
Competition variables			
CR5 assets	−13.461***	45.688***	46.981***
CR5 deposits	−6.312***	38.288***	52.134***
CR5 Loans/Advances	−13.860***	45.407***	46.891***
HHI	−28.639***	34.898***	23.519***
H-statistic	−8.801***	3.562***	−4.845***
Control variables			
ROAs	−0.247	2.878***	2.877***
Size	−17.706***	−11.011***	−21.924***

Table IV.
Test of means (*t*-statistics)

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.10\%$

small domestic banks, the table shows that all the competition, risk and control variables are significant with respect to differences in their means. For the third comparison category, that is, foreign banks vs large domestic banks, the results are the same as for Category 2.

Table V demonstrates the degree of correlation amongst the dependent and explanatory variables used in the multiple regression analysis. The main highlights of the table are as follows. Size is negatively correlated with all the risk variables. This means that as banks grow, they become more prone to risks. Size is also negatively correlated with all the competition indicators, suggesting that the larger the bank, the lower the chances of it facing intense competition from banks which are not at par. Similarly, negative correlation is observed between size and ROA, indicating that big banks can have lower profitability. However, size has a positive correlation with the annual GDP growth rate, meaning that a robust economic environment improves the performance of large banks. The second prominent variable affecting risk negatively is the annual GDP growth rate. It is negatively correlated with all risk indicators, showing that during a low economic cycle, banks are subject to higher risk. Among the competition indicators, except H-stat, GDP growth has a positive correlation with all the other variables. This indicates that a good business environment provides banks with the incentive to perform better, thus increasing competition. It displays a negative correlation with ROA, indicating that a not-so-stable economic cycle leads to lower returns for banks.

5. Estimation results

We now report the results of our main regression as specified in equation (1). We use panel regression methods and the choice between FE and RE models is driven by the

Table V. Correlation statistics

Variables	Capr	Dr	Mr	Lr	Ar	Cr5a	Cr5d	Cr5l	HHI	H-stat	ROA	Size	GDPG
Capr	1												
Dr	0.173	1											
Mr	0.246	0.175	1										
Lr	0.641	0.088	0.227	1									
Ar	0.873	0.140	0.218	0.591	1								
Cr5a	0.252	0.095	0.451	0.208	0.242	1							
Cr5d	0.156	0.068	0.403	0.113	0.145	0.954	1						
Cr5l	0.180	0.080	0.405	0.128	0.167	0.976	0.970	1					
HHI	0.315	0.095	0.400	0.248	0.301	0.938	0.858	0.874	1				
H-statistic	0.156	0.002	0.078	0.154	0.159	0.118	−0.059	0.035	0.238	1			
ROA	0.724	0.061	0.171	0.619	0.800	0.170	0.103	0.120	0.214	0.109	1		
Size	−0.512	−0.293	−0.574	−0.411	−0.485	−0.386	−0.299	−0.312	−0.368	−0.065	−0.350	1	
GDPG	−0.181	−0.172	−0.115	−0.128	−0.171	0.117	0.170	0.180	0.005	−0.052	−0.125	0.244	1

Notes: Capr = Capital risk; Dr = Default risk; Mr = Market risk; Lr = Liquidity risk; Ar = Asset risk

outcome of Hausman tests. When the Hausman test favours the FE model, we present the relevant estimates along with the *F*-test statistic to measure goodness of fit of the model. In case of the RE model, the *F*-test is not available and hence we present the Wald-test statistic to assess the model fit. We structure the discussion of the effect of concentration (measured by the five-bank concentration ratio based on loans and the HHI) and competition (measured by H-stat) on each type of risk.

5.1 Default risk

Table VI, in Models (1) and (2), presents the estimation results for the effect of concentration on default risk. We find that in Model (1), the CR5 for loans has a positive coefficient of 0.204 that is statistically significant at the 10 per cent level. This shows that banks with large market shares in the loan market could be more vulnerable to the problem of bad loans. This evidence favours the insight of the BDN model (Boyd and De Nicolo, 2005) that suggests that competition in the loan market can actually help because the consequent fall in interest rates would lead to lower credit risks. The coefficient of HHI in Model (2) is also positive, but not statistically significant. With respect to the control variables, we observe that both size and annual GDP growth have negative and statistically significant coefficients, indicating that a large scale of operations and upswings in the business cycle cause default risk to decline. Large banks have better risk-management expertise, which may explain the lower proportion of NPAs in their overall portfolio. Robust GDP growth improves the financial health of borrowers and, hence, leads to lower defaults. Table VIII shows the effect of competition (measured by H-stat) on default risk. The coefficient of H-stat is not statistically significant while the signs and significances of the control variables are unchanged.

5.2 Market risk

Within Table VI, Models (3) and (4) illustrate the results for market risk as the dependent variable. We find that the concentration variable of CR5 (loans) has a positive coefficient of 0.522 which is statistically significant at the 1 per cent level. Therefore, the larger the market share of banks in the loan market, the greater is the market risk they are exposed to. This indicates that banks have to access short-term debt from other banks to keep protecting their market share. Our finding for market risk is in line with the BDN model that suggests that concentration can lead to greater risks. However, the other measure of concentration, the HHI does not show a significant coefficient. Size is the only control variable with a significant coefficient. The negative sign of the coefficient suggests that as banks grow larger, their dependence on borrowings and exposure to interest-rate volatility makes them more vulnerable to market risk. Table VIII shows the effect of competition on market risk (Model 2) where we observe a positive coefficient for H-stat that is significant at the 10 per cent level. This indicates that higher competition leads to increased reliance on inter-bank borrowings, thereby increasing the vulnerability to interest-rate fluctuations. This result contradicts our previous finding with CR5 in Table VI, where we concluded that concentration leads to higher market risk. This is a puzzle for us, but we prefer to go by the result for CR5, which had a lower probability of type-I error as the level of significance was 1 per cent. The roles of the control variables are unchanged.

Table VI. Concentration and risk (default risk, market risk and asset risk)

Regressors	Default risk (Gross NPAs/gross advances) (1)	(2)	Market risk (Inter-bank borrowings/ total borrowings) (3)	(4)	Asset risk (Loan loss provisions/ total assets) (5)	(6)
Concentration variables						
CR5 (loans and advances)	0.204* (0.123)		0.522*** (0.103)		1.440*** (0.465)	
HHI		0.147 (0.245)		0.072 (0.291)		3.578*** (0.824)
Control variables						
Size	−0.083*** (0.014)	−0.081*** (0.014)	−0.131*** (0.012)	−0.121*** (0.017)	−0.628*** (0.051)	−0.566*** (0.050)
ROA	−0.006 (0.007)	−0.005 (0.007)	−0.005 (0.007)	−0.002 (0.008)	0.636*** (0.025)	0.633*** (0.025)
GDP growth	−0.013*** (0.004)	−0.010*** (0.003)	−0.006 (0.004)	−0.001 (0.004)	−0.012 (0.013)	0.000 (0.012)
Intercept	0.588 (0.106)	0.667 (0.961)	0.778 (0.098)	1.009 (0.116)	3.058 (0.358)	3.048 (0.328)
FE/RE	RE	RE	RE	FE	FE	FE
R^2 (within)	0.069	0.066	0.092	0.087	0.669	0.673
F-statistic				15.29***	322.30***	329.19***
Wald test	59.90***	57.32***	174.43***			

Notes: $^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.10\%$

5.3 Asset risk

Moving to the regressions for asset risk in Models (5) and (6), we observe that both the CR5 and the HHI variables have positive coefficients that are statistically significant at the 1 per cent level. These results suggest that banks with a higher market share in lending have to hold more loan loss provisions against their total assets. As loan loss provision in Indian banks is computed from a backward-looking formula based on the quality of existing assets, this is an indication that banks with higher market power carry more stressed assets on their balance sheet. Once again this supports the prediction of the BDN model that concentration in the loan market will lead to greater risk-taking. Size has a negative and significant coefficient, suggesting that big banks tend to keep a higher proportion of loan loss provisions. ROA enters the equation positively and significantly, indicating that the more profitable the bank, the higher its asset risk. Overall, the above findings lend support to the competition–stability view, which suggests that concentration can exacerbate risk-taking, while competition helps to reduce risks. In Table VIII, Model (3) shows the effect of competition on asset risk. We do not find any statistically significant role of competition, while the roles of the control variables remain unchanged.

5.4 Capital risk

Table VII presents the results for capital risk and liquidity risk, measured by the protection or buffer that banks have from these risks. In Models (1) and (2), we observe that CR5 for loans has a coefficient of 12.518 that is significant at the 1 per cent level. The HHI also has a positive coefficient of 26.397 that is significant at the 1 per cent level. These results mean that banks in highly concentrated market segments hold more capital. In other words, banks with higher market power are safer from an equity-risk perspective, as they hold more capital. While this may be because of higher regulatory capital requirements imposed by the banking regulator, it also supports the competition–fragility view that banks with higher market power protect themselves with higher capital or other risk-management measures (Berger *et al.*, 2008). Our finding

	Capital buffer (Equity/total assets)		Liquidity buffer (Liquid assets/total assets)	
Regressors	(1)	(2)	(3)	(4)
Concentration variables				
CR5 (loans and advances)	12.518*** (2.807)		−1.034 (4.141)	
HHI		26.397*** (4.976)		9.249 (7.379)
Control variables				
Size	−3.977*** (0.311)	−3.485*** (0.306)	−4.205*** (0.458)	−4.147*** (0.454)
ROA	3.275*** (0.153)	3.266*** (0.152)	3.190*** (0.226)	3.148*** (0.226)
GDP growth	−0.128 (0.080)	−0.012 (0.074)	0.190* (0.118)	0.174 (0.110)
Intercept	17.575 (2.162)	18.321 (1.981)	25.293 (3.190)	23.186 (2.938)
FE/RE	FE	FE	FE	FE
R^2 (within)	0.627	0.632	0.429	0.431
F-statistic	269.00***	274.38***	120.19***	120.85***

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$%

Table VII.
Concentration and risk (capital risk and liquidity risk)

is in line with the prediction of the CVH model which says that banks with higher market power will tend to protect their charter value by taking lower risks. Among the control variables, size has a negative and significant relationship with capital risk, while ROA displays a positive and significant relationship. This suggests that large banks are more prone to capital risk and banks with higher profits are more stable. The annual GDP growth rate has a negative and significant coefficient, implying that during an upswing of the business cycle, banks can be more prone to capital risk. Moving to the role of competition (Table VIII), we do not find a statistically significant coefficient for H-stat even though the control variables play similar roles as in the concentration regressions.

5.5 Liquidity risk

Models (3) and (4) in Table VII examine how competition variables affect liquidity risk. However, neither CR5 nor HHI show statistically significant coefficients. With respect to bank-specific controls, size enters the equation negatively and significantly, suggesting that large banks can face difficulties in meeting their liabilities when they fall due, making them prone to liquidity risk. In the long run, the inability to keep sufficient amount of liquid assets can lead to financial distress and insolvency. ROA enters the equation positively and significantly, suggesting that banks which generate high profits tend to have lower liquidity risk. The annual GDP growth rate has a positive and significant coefficient, thus indicating that a good business cycle promotes stability. In summation, while concentration does not seem to affect liquidity risk, our results for capital risk confirm the findings of Berger *et al.* (2008) that concentration encourages banks to protect themselves through higher equity capital. As for the effect of competition, Table VIII does not reveal a statistically significant coefficient for H-stat, while size and ROA have similar signs and significances as before.

5.6 Robustness checks

Finally, we carry out some robustness checks for the above results. In Tables IX and X, we re-estimate the risk-concentration relationship with two alternative measures of CR5 based on deposits and assets. In all cases, our previous results get repeated. For instance, the coefficient of CR5 based on deposits is positive and significant for default risk, market risk, asset risk and capital risk. This confirms that higher concentration not only exacerbates default risk, market risk and asset risk but also leads to banks holding higher equity. The coefficient of CR5 based on assets is positive and significant for market risk, asset risk and capital risk as before. Interestingly, for the first time, the coefficient of CR5 turns out to be positive and significant for liquidity risk, suggesting that as banks' market share grows, they are also able to hold more liquid assets to meet their liabilities, as and when they fall due. This reduces their vulnerability to liquidity risk. This further confirms our previous results and the findings of Berger *et al.* (2008) that banks with higher market power are able to protect themselves using various risk-mitigation strategies[2].

6. Conclusions and recommendations

We test the competition–stability liaison for the Indian SCB sector for the period from 1999-2000 to 2012-2013. Five types of risks, that is, default risk, asset risk, market risk, capital risk and liquidity risk, are analysed to see how concentration affects them. The relationship turns out to be more nuanced than straightforward. We find that, on the one hand, concentration affects default risk, asset risk and market risk positively, indicating

Table VIII.
Competition and risk (All five types of risk)

Regressors	Default risk (Gross NPAs/gross advances) (1)	Market risk (Inter-bank borrowings/ total borrowings) (2)	Asset risk (Loan loss provisions/ total assets) (3)	Capital buffer (Equity/ total assets) (4)	Liquidity buffer (Liquid assets/ total assets) (5)
Competition variable					
H-stat	−0.023 (0.033)	0.060* (0.035)	0.008 (0.106)	−0.188 (0.650)	0.661 (0.944)
Control variables					
Size	−0.085*** (0.014)	−0.133*** (0.013)	−0.596*** (0.053)	−3.744*** (0.327)	−4.121*** (0.475)
ROA	−0.005 (0.007)	−0.003 (0.008)	0.646*** (0.025)	3.363*** (0.154)	3.185*** (0.224)
GDP growth	−0.010*** (0.003)	0.000 (0.004)	0.002 (0.012)	0.003 (0.076)	0.176 (0.110)
Intercept	0.721 (0.094)	1.033 (0.084)	3.675 (0.336)	23.323 (2.076)	23.866 (2.973)
FE/RE	RE	RE	FE	FE	FE
R^2 (within)	0.066	0.091	0.664	0.616	0.430
F-statistic			315.18***	256.11***	120.38***
Wald test	57.50***	136.28***			

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.10\%$

Table IX. Robustness check for default risk, market risk, asset risk

Regressors	Default risk (Gross NPAs/gross advances) (1)	(2)	Market risk (Inter-bank borrowings/total borrowings) (3)	(4)	Asset risk (Loan loss provisions/total assets) (5)	(6)
Concentration variables						
CR5 (deposits)	0.193* (0.111)		0.483*** (0.091)		1.902*** (0.430)	
CR5 (assets)		0.066 (0.109)		0.526*** (0.091)		1.651*** (0.397)
Control variables						
Size	−0.087*** (0.014)	−0.081*** (0.014)	−0.138*** (0.012)	−0.122*** (0.012)	−0.689*** (0.054)	−0.591*** (0.050)
ROA	−0.006 (0.007)	−0.005 (0.007)	−0.005 (0.007)	−0.006 (0.007)	0.627*** (0.025)	0.633*** (0.025)
GDP growth	−0.012*** (0.004)	−0.011*** (0.004)	−0.005 (0.004)	−0.006 (0.004)	−0.013 (0.012)	−0.012 (0.012)
Intercept	0.612 (0.097)	0.650 (0.111)	0.829 (0.091)	0.714 (0.101)	3.127 (0.319)	2.691 (0.379)
FE/RE	RE	RE	RE	RE	FE	FE
R^2 (within)	0.070	0.066	0.094	0.096	0.674	0.672
F-statistic		57.35***			329.73***	328.03***
Wald test	60.20***		177.64***	185.95***		

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Regressors	Capital buffer (Equity/total assets) (1)	(2)	Liquidity buffer (Liquid assets/total assets) (3)	(4)
Concentration variables				
CR5 (deposits)	14.954*** (2.587)		4.574 (3.853)	
CR5 (assets)		11.495*** (2.404)		6.658* (3.546)
Control variables				
Size	−4.436*** (0.327)	−3.666*** (0.304)	−4.448*** (0.487)	−4.200*** (0.449)
ROA	3.212*** (0.153)	3.275*** (0.153)	3.136*** (0.227)	3.131*** (0.225)
GDP growth	−0.126** (0.077)	−0.103 (0.077)	0.140 (0.115)	0.118 (0.115)
Intercept	18.635 (1.921)	16.108 (2.294)	23.492 (2.860)	20.823 (3.383)
FE/RE	FE	FE	FE	FE
R^2 (within)	0.635	0.629	0.430	0.432
F-statistic	277.80***	270.94***	120.78***	121.71***

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Table X.
Robustness check for capital risk, liquidity risk

that increased competition can help to reduce some types of risks faced by banks. On the other hand, concentration has positive relationships with capital and liquidity ratios, suggesting that increase in competition may lead to deterioration of the safety buffers of banks.

The evidence from this paper has important implications for banking sector policy. Our results suggest that infusing more competition in the banking sector ameliorates the risks in banks' asset books. Default risk (measured by NPA ratio) and asset risk (measured by loan loss provisions ratio) appear to come down. Moreover, greater competition leads to lower market risk in the form of less reliance on inter-bank borrowings. These are signs of greater financial stability, quite in line with the competition–stability view in the literature or the theoretical work of Boyd and De Nicolo (2005). A specific policy implication is that any competition inducing policy such as foreign bank entry, liberalisation of branch expansion norms and privatisation of state owned banks may lead to greater financial stability. However, we also find that competition can lead to worsening of capital and liquidity ratios of banks. It means that whenever a competition related policy is implemented (including mergers or restructuring) in the banking sector, the banking regulator should be cognisant of the pressures on capital and liquidity buffers of banks. This could be especially important in countries where the competition authority and the banking regulator are separate entities. While in India both functions are under the purview of the RBI, in many other economies such as the European Union, the UK and even emerging countries (like Mexico and Russia), banking regulation is separate from competition policy. Therefore, in face of similar evidence as in this paper, any review of competition policy has to be carefully coordinated with supervisory efforts and macro-prudential policy to derive the benefits of greater competition in the banking industry.

Particularly in India, in recent years, the RBI has been trying to open up the banking sector to new entrants. It has recently allowed an infrastructure finance company and a microfinance institution to acquire banking licenses. A number of payments banks have been allowed to set up to leverage technology for providing low-cost banking services.

The RBI is currently reviewing applications for setting up small finance banks. As the RBI is India's banking regulator and monetary policy authority, it would do well to calibrate its bank licensing policy with macro-prudential efforts because of the close relationship between competition and risks evidenced above.

This study has certain limitations. We did not go into the causes of the change in competitive conditions in the banking sector which could range from new bank entry, branch de-licensing policies, privatisation of state owned banks, consolidation, etc. We did not analyse the roles of the changing regulatory environment and institutional conditions on risk. Finally, we did not examine the impact of competition on other performance indicators of banks such as efficiency and profitability. These issues can be taken up in future research.

Notes

1. Saha and Sensarma (2013) showed that the results of Boyd and De Nicoló (2005) are conditional upon credit risk not exceeding a critical level.
2. We tried another specification that includes peer group dummy variables, with and without the size variable included. Most of our previously reported results remained qualitatively unchanged. However, at the same time, we lost significance of HHI for capital and asset risks. We also lost significance of CR5 for default risk and H-stat for market risk.

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