Does Bank Competition Affect Financial Stability in Banking Sector: Some Empirical Evidences from India

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The paper analyses the relationship between bank competition and financial stability based on 55 major nationalised and private sector banks in India for the period 2007-08 to 2017-18. The paper hypothesizes that with rising degree of competition among credit institutions, risk taking activities (to capture new markets and improve profitability) will increase which may hamper financial stability of the banks. The study measures the competition in the banking sector by three indices (HHI, CR3, CR5, CR10 and GRS) and financial stability of individual banks by the scores of Solvency Risk (as measured by Individual Bank-level Non-Performing Loans or GNPLs) and Credit Risk (as measured by Bank-level Z-score or ZS). Based on the literature, we have taken into consideration the GRS index value as the best index to measure the market concentration in the market (Parida and Acharya: 2016). As the results, reveal, the GRS index varies in the range of 0.15-0.18, which indicate that the Indian banking sector is less concentrated but the index value is showing an upward trend, indicating that the level of competition is reducing. So, there is a need for RBI to look the trend carefully and try to foster regulation in the sector, which will push competition and bring efficiency in the sector. The study runs panel regressions where dependent variables are solvency risk and credit risk and independent variables are level of competition (based on market share of individual banks) (MS), size of the banks (total assets) (SIZE), Net Interest Margin (NIM), interest rate (IR), WPI inflation (WPI), GDP growth rate (GDP) and ownership structure (GOWN: Public or Private). The study finds that SIZE and GOWN have negative and significant impact on Credit Risk (Z Score / ZS), whereas all other variables (viz., NIM, MS, IR, WPI, GDP) have positive significant impact on Credit Risk (ZS). However, MS, IR and GDP have negative and significant impacts on Solvency Risk.

Keywords: Bank Competition, Solvency, Liquidity, Credit Risk
JEL Classification: G21, G28, L11, L16

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Section I
Introduction

The impact of bank competition on financial stability has been a focus of academic and policy debate over the last two decades and particularly in the post financial crises (Beck, 2008; Carletti, 2008; Careletti, 2010; Acharya and Richardson, 2009; Beck et al., 2010; OECD, 2011). In literature, it is quite evident that the degree of competition among credit institutions will increase the risk taking activities to acquire new market and improve profitability. Earlier studies also confirmed that greater concentration fosters financial fragility, whereas lower pricing power also induces bank risk exposure. In Indian context, the banks have achieved new heights by acquiring new customers, new business areas and also adopting better technology to acquire market in almost all business areas. However, in the post-crisis period, the asset quality (Gross NPA) of the Indian banks has deteriorated to 11.2 per cent from 2.2 per cent in FY08, profits contracted to – Rs 324 billion in FY18 from Rs 427 billion in FY08 and credit growth also stagnated at the historical low level of 4.5 per cent in FY17. This may be due to higher risk taking than their capacity, to remain intact in their business operations and profitability.

In this backdrop, now the question arises: (i) What is present state of competition in the Indian banking industry; and (ii) whether the financial stability of the banks has deteriorated due to increased level of competition? Further, Government has announced consolidation of PSBs to create 10 strong and big banks who can meet the credit needs of the economy. Apart from the PSBs consolidation, M&A are also taking place in private sector. With the merger and acquisitions (M&As), what will be the level of concentration in the Indian banking industry?. In this paper, we tried to answer these questions. The rest of the paper is organised as follows. Section II provides a review of the literature on competition and stability in the banking sector. Section III discusses the methodology, data set used and the estimated model. Section IV presents the empirical results and Section V are the conclusions.

Section II
Review of Literature

The debates on the relationship between banking competition and the overall stability of the financial system is emerged recently. In literature, there are primarily two views have emerged: competition-fragility and competition-stability. The competition-fragility view suggests a negative relationship between bank competition and financial stability, while the competition-stability view proposes a positive relationship. Many authors have tested these relationships in various countries and regions and have obtained contrasting results. In this section, we have reviewed some of the major studies that have explored the competition and stability relationship. We also have aimed to assess the various
competition indicators as well as the metrics to measure banking risk which have been used so far to understand this relationship. This study aimed to contribute to the existing debate on bank risk taking and degree of competition, concentration and also its effect across.

A number of literature suggests that greater bank competition produces financial instability by decreasing the degree of market power in the sector, which consequently erodes profits and reduces assets value, supporting the competition-fragility view. Thus, banks are encouraged to take on more risks to increase their returns, deteriorating the quality of their portfolios (Marcus, 1984; Keeley, 1990 and Carletti and Hartmaan, 2002). There are various empirical studies that are supporting this relationship. Some of the studies are: Keeley (1990) finds that increased banking competition and deregulation in the US during the 1990s decreased monopoly rents and contributed to bank failures. Jayaratne and Strahan (1998) show that the performance of US banks increased significantly with easy branch licensing and lifting up of barriers for operation of banks. The resultant increase in competition leads to a decline in profitability which counter the franchise value paradigm. Hellmann, Murdock and Stiglitz (2000) concluded that the removal of interest rate ceilings, and thus generating more competitive prices, decreases franchise value and encourages moral hazard behaviour in banks. Bofondi and Gobbi (2006) found that a Italian bank's loan default rate increases as the number of banks in a market increases. Jimenez, Lopez and Saurina (2007) studied that the banking sector in Spain and the results indicate that greater banking competition is associated with a higher risk loan portfolios (increased non-performing loans). Berger, Klapper and Turk-Ariss (2008) has studied 23 developed nations and concluded in favour of the competition-fragility view, suggesting that higher market power reduces the risk exposure of banks. However, they also found that greater market power increases loan portfolio risks which could be interpreted as some evidence supporting the competition-stability view. Vives (2010) reviews the theoretical and empirical literature on the competition-stability relationship and argues that although competition is not a determinant of instability, it may exacerbate instability problems.

Some studies have argued in favour of a positive relationship between bank competition and financial stability. Beck, Demirguc-Kunt and Levine (2006) studied a group of 69 countries and the results indicate that the countries who are experiencing less market concentration are less likely to suffer a financial crisis. Boyd and De Nicolo (2005) suggest that greater market power in the loan markets increases bank risks since higher interest rates charged on consumers are harder to repay. This may exacerbate moral hazard problems and, at the same time, higher interest rates attract riskier borrowers due to adverse selection problems. Moreover, in highly concentrated markets, financial institutions may believe they are "too-big-to-fail" and this may lead to riskier investments (Berger et al., 2008). Empirically, there are several studies in the post-crisis period who have supported this hypothesis. Boyd, De Nicolo and
Prajnan (2006) and De Nicolò and Loukoianova (2006) both find an inverse relationship between higher market concentration and financial stability suggesting that the risk of bank failures increase in more concentrated markets. They estimate financial stability by the Z-index (an inverse measure of bank risks) and market concentration by the Herfindahl-Hirschman Index (HHI). Schaeck, Cihak and Wolfe (2006) study the banking sectors of a group of countries by applying a Logit model and duration analysis. Furthermore, they estimate the Rosse-Panzar H-statistic as a measure of competition. Their main findings argue that more competitive banking sectors have a lower likelihood of bank failure (they are more stable than in monopolistic systems).

Other studies have applied the Lerner index of competition and bank stability measures to examine the competition-stability relationship in banking. Berger et al. (2008) study a sample of over 8,000 banks in 23 countries by employing the Generalised Methods of Moments (GMM) dynamic panel data framework. They include measures of market concentration, Herfindahl-Hirschman Index, as well as the Lerner index of competition to account for market power. Moreover, they include the Z-index as a proxy for bank stability and non-performing loans over total loans as a measure of bank portfolio risks in order to test both the competition-stability and competition-fragility relationships respectively. Their main results indicate that banks with a higher degree of market power have less overall risks supportive of the competition-fragility hypothesis; on the other hand, they also find evidence of a positive relationship between competition and stability, implying that market power increases total loan risks. Turk-Ariss (2010) studies how the degree of market power affects both bank efficiency and financial stability in the banking sector for a group of emerging economies and applied three different specifications of the Lerner index of competition and uses a Z-index to proxy for financial stability. The results indicate that the increased market power results in greater bank stability, although with a significant loss in cost efficiency. Liu, Molyneux and Wilson (2013) analysed the competitive conditions in 11 EU countries for the period 2000-2008 in order to examine the competition-stability relationship in banking. They employ the Lerner index of competition and the Z-index in order to proxy for bank competition and bank stability respectively. Their results suggest that a non-linear relationship between competition and stability exists in European banking. More specifically, they find risk-shifting effects in highly concentrated markets, where an increase in banking competition lowers net interest margins (higher deposit rates and lower loan rates) and increases bank stability. However, they find that marginal effects exist in highly competitive markets, where increased competition reduces loan interest payments and the provisions for non-performing loans.

Liu, Molyneux, Nguyen, and Linh (2012) has introduced a variety of bank-specific risk indicators (the ratio of loan-loss provisions to total loans, loan-loss reserves to total loans, after-tax ROA volatility, and the natural logarithm of the Z-index) to investigate similar relationships for banks operating in South
East Asia (Indonesia, Malaysia, the Philippines and Vietnam) between 1998 and 2008. They find that competition measured using the Panzar Rosse H-statistic is inversely and significantly related to most risk indicators except the natural logarithm of the Z-index, which suggests that competition does not erode bank stability. The researchers also find that concentration is negatively associated with bank risk, whereas regulatory restrictions positively influence bank fragility.

In Indian context, Sinha and Sharma (2016) has investigated the impact of bank competition and impact of bank concentration on stability, as well as on the riskiness of their loan portfolios. They found the presence of non-linear relationship between stability index and competition. They also pointed out that in case of Indian banks, both concentration and competition work simultaneously to support the competition-fragility view. Both increased concentration and decreased competition may lead to greater riskiness with greater instability. They suggests that it is important to understand the trade-off between competition and concentration, and their impact on riskiness of loan portfolios and stability of banks for formulating steps to foster competition within the industry.

The overall cross-country evidence yields a mixed results regarding the relationship between bank concentration, competition, and stability. Meanwhile, the findings do confirm that concentration and competition can co-exist and may influence financial stability through different channels.

Concentration measures have largely been used by researchers to proxy for market power or competition in the industry. A paper by Bikker and Haaf (2000) provides a theoretical characteristic of 10-market concentration measures and similarities between these concentration indices in operation. Measures of competition can be divided into structural and non-structural ones. In structural approaches concentration ratios take a central position in order to describe the market structure, forging a natural link between concentration and competition. The impact of market concentration on market performance has its roots in both the oligopoly theory and the structure-conduct-performance (SCP) paradigm. Non-structural approaches to measuring competition do not depend on concentration. In another study by Ginevicius and Cirba (2009), has examined effectiveness of the additive measures to assess market concentration most effectively. They suggested a new measure that is the GRS index, which termed as most accurate measure of concentration in literature. Mishra, Mohit and Parimal (2011), and Parida and Acharya (2016) has examined the accuracy of the conventional additive measures of market concentration by using the criteria as suggested by Ginevicius and Cirba (2009) in relation to the Indian Manufacturing Sector and the Indian Insurance Sector respectively. Both the studies has concluded that the GRS Index of Ginevicius and Cirba (2009) is a more accurate measure of market concentration. The Herfindahl-Hirschman Index, the most widely used measure of market
concentration, deviates far from accuracy. Hence, examining market concentration on the basis of the conventional indices may result in misleading conclusions and hence guide policy formulations in wrong directions.

Section III
Data Analysis and Methodology

In this study, we investigate the level competition in the Indian banking industry in the post-financial crisis period (2007-08 to 2017-18). The post-crisis period has chosen as the Indian banks' balance sheet has increased in a robust manner during this period. To do the analysis, a sample of 55 major public sector, private sector and foreign banks has been selected, based on their balance sheet figures as published by RBI. The selected 55 banks represents around 99 per cent of the banking industry in terms of assets as of end-March 2018 and are listed in the Annexure 1.

Measuring Concentration
To measure competition in a market, it is a well-accepted practice to use the concentration ratios mainly due to their ability to capture structural features of the market. In industrial economics, concentration ratio is a measure of the total output produced in an industry by a given number of firms in the industry. This ratio reflects the changes in market concentration as a result of the entry or exit of a company into the market or caused by a merger. In literature, there are mainly two approaches to measure competition in any market economies are: (a) Structural Approach and (b) Non-Structural Approach.

The concentration ratios are often used in structural models to explain the competitive behaviour in the insurance and banking industry. In general, the concentration indices (CI) exhibiting the following form:

$$ CR_k = \sum_{i=1}^{n} W_i S_i $$

(1)

Here, $S_i$ is the market share of the firm/company, $w_i$ is the weight attached to the market share and $n$ is the number of firms/companies in the industry.

Before going ahead, a theoretical foundation of the various market concentration indices is needed. So, the mathematical formulae and the basic properties of each of the measures are discussed below (Bikker and Haaf; 2000).

The K-Concentration Ratio (CRk)
In empirical literature, k-concentration coefficient is being used mainly due to its simplicity and limited data requirements. The ratio is defined as the sum of market shares of $n$ largest insurer in the market and it takes the form:
Where $S_i$ is the market share of insurer $i$ and $k$ is the number of banks in the industry ($i = 1, 2, \ldots, k$). Under this method, the concentration ratio gives equal emphasis to all the $k$ leading banks and neglects the effect of many small companies in the market. There is no general rule determining the optimal value of $k$. However, in the empirical analysis, $k$ is generally determined to be 3, 4 or 5. The ratio ranges between 0 and 1. It approaches zero if there is an infinite number of very small insurance companies in the system and it equals 1 if there is a single insurer in the market. If the industry consists of $k$ equally sized insurance companies, then $CR_k = \sum_{i=1}^{k} S_i = \sum_{i=1}^{k} 1 = k/n$, which is a decreasing function of the number of insurance companies in the market.

The Herfindahl-Hirschman Index (HHI) stresses the importance of larger firms by assigning them a greater weightage than smaller firms, and it incorporates each firm individually so that random cut-offs and insensitivity to the share distribution are avoided. This index ranges between 0 to 1 (0 to 10,000, if market shares are expressed in terms of percent rather than fractions). The values of 0 and 1 represent perfect competition and monopoly respectively. Usually, a value in the range 0 to 0.10 indicates highly competitive market (non-concentration), a value within 0.10 to 0.20 indicates that there is no adverse effect on competition. However, the value above 0.20 is a concern and needs to increase competition further in the industry.
In empirical literature and also in practice, HHI is the most common measure to measure concentration in the industry, largely due to its simplicity. While the flip side of HHI is that it assigns higher weight to the bigger firms and smaller weights to the smaller firms. This not only raises the importance of the larger firms in the index, it is also reduces the effects of the smaller firms even if they are very large in number, giving a distorted measure of market concentration.

**GRS Index**

The GRS Index suggested by Ginevicius and Cirba (2009) is an attempt to overcome the weighting problem and thereby to provide a more accurate measure of market concentration. In this index, the weights to different firms are assigned in such a way that (i) the value of the index ranges from 0 to 1, i.e., $0 \leq \text{GRS} \leq 1$, (ii) if all firms in the industry have equal market share, i.e., if $s_i = \frac{1}{n}$, $\text{GRS} = \frac{1}{n}$, and (iii) it gives a more accurate measure of market concentration. Accordingly, the index is defined as,

$$\text{GRS} = \sum_{i=1}^{n} \left( \frac{n^2s_i^2 + 0.3s_i^2}{n^2 + 0.3ns_i^2} \right)$$

Where, $s_i$ stands for market share of the largest firm in the industry.

Among the different approaches to measure the concentration in an industry, the choice of the concentration index is mainly dependent on the policymakers/researchers’ perception of the relative influence on competition attached to large and small firms or companies. The HHI and the $K$-concentration ratio appear most frequently, both in theory and practice, due to their simple structure and the limited data requirement. By following the Ginevicius and Cirba (2009) criterion, Parida and Acharya (2016) found that the GRS index is the most accurate index to measure concentration in the life insurance sector in India. A study by Mishra and Rao (2014) also concluded that the GRS index is the best index to measure the market concentration in case of the Indian manufacturing sector. In this study, we also used GRS index to measure the level of concentration in the Indian banking industry.

**Statement of the Model**

The empirical work analyses the effects of bank competition on the stability of financial intermediaries at the institution-level. The stability of a bank can be evaluated with regard to different sources of risk: the solvency risk, and the credit risk of the asset portfolio. This classification is useful in order to reconcile those views which seem to be contradictory but which, in fact, refer to distinct types of bank risk. Moreover, this can also be helpful for policy purposes in order to provide more case-specific recommendations, based on the peculiarities of specific banking systems, and on the types of risk under
consideration. In the baseline specification, we estimate the following panel regression:

\[
\text{Bank Risk} = f(\text{Competition, Bank Controls, Regulatory Controls, Macro Controls})
\] (5)

For each type of bank risk (solvency, and credit), we should estimate different specifications for panel regressions. However, we have not considered the liquidity risk in this study, due to the high variation in the individual banks data.

**Solvency Risk:** defines the risk that a bank cannot meet maturing obligations because it has a negative net worth; that is, the value of its assets is smaller than the amount of its liabilities. This may happen when a bank suffers some losses from its assets because of the write-offs on securities, loans, or other bank activities, but then the capital base of the institution is not sufficient to cover those losses. In such a case, the bank unable to meet its obligations defaults. In order to avoid such risk, banks need to keep an adequate buffer of capital, so that in case of losses, the bank can reduce capital accordingly and remain solvent. The indicator of bank solvency we use the Z-score which is widely used in the literature as a stability indicator (see, for instance, Boyd and Runkle, 1993; Lepetit et al., 2008; Laeven and Levine, 2009). Using accounting information on asset returns, its volatility and leverage, the Z-score is calculated as follows:

\[
Z_{it} = \frac{\text{ROA}_{it} + Eit/TA_{it}}{\sigma(\text{ROA})_{it}}
\] (6)

Where ROA is the return on assets, E/TA is the equity to total assets ratio, and \(\sigma(\text{ROA})\) is the standard deviation of return on assets.

The Z-score is inversely related to the probability of a bank's insolvency. A bank becomes insolvent when its asset value drops below its debt and the Z-score shows the number of standard deviations that a bank's return has to fall below its expected value to deplete equity and make the bank insolvent. Thus, in order to study the relationship between competition and solvency and to formulate our hypotheses for the empirical analysis, we need to investigate whether, and how, price competition may affect these two components of bank solvency.

**Credit Risk:** is the risk that a borrower will not be able to repay the debt to a bank. Given the main focus of banking activity on credit provision, we analyse the effects of price competition on the quality of bank lending, by investigating the credit risk of the loans extended to customers. In general, an increase in price competition implies a decrease in the lending rates charged by banks to
borrowers. However, this may affect the credit risk of the loan portfolio in two different ways. In one case, corresponding to the argument in Boyd and De Nicolò (2005), the reduction in lending rates may improve the credit conditions for borrowers by making it easier for them to repay bank loans and then by reducing the probability of default on bank credit. If this improvement in credit quality is extended to the whole portfolio of a bank, then an increase in price competition may reduce the average credit risk of the loan portfolio. In the other case, the decrease in lending rates may contract the profit margins from the provision of credit, thereby potentially reducing the franchise value of the financial intermediary. As a consequence, if managers are interested in increasing bank profitability, banks may increase risk-taking by extending more credit also to riskier borrowers, with a consequent rise in the average credit risk of the loan portfolio.

These two effects may not be mutually exclusive since they concern two distinct aspects of credit risk determination. In the first case, price competition directly affects the risk from the borrower's side, by reducing the adverse selection problems in the credit market between lenders and borrowers. In the second case, price competition has an effect on the amount of risk that the lender is willing to take, in order to achieve a given target for bank profitability.

Moreover, if banks are able to screen and differentiate borrowers with respect to their credit risk, we may also expect that market power may be used by some banks to exercise price discrimination across loan applicants on the basis of their creditworthiness. As a consequence, banks with large market power would be able to charge different lending rates as a function of the borrower's credit risk, while banks with limited market power would be constrained to apply low lending rates to all applicants. In such a case, high-risk borrowers would have an incentive to get credit from banks with little market power because they apply lower interest rates. This could also explain why banks with large market power may have an advantage in terms of the credit quality of their loan portfolio.

The credit risk is the risk related to the quality of bank assets and it mainly includes the credit risk of the loans extended by the bank and of the securities held on balance sheet. Provided that the major component of on balance sheet assets is given by loans, a good measure for the asset portfolio risk is the Non-Performing Loans (NPLs) ratio, which is taken from RBI.

**Control Variables:** The degree of competition in the banking market can be analysed through different measures that are related to three different concepts: price competition, market contestability, and market concentration. In particular, we use as key explanatory variables in our analysis. We measure competition at the bank level by computing the market share of the individual banks, which may be representative of the banks' position in terms of market concentration. The rationale for that is the structural distinction between
market power and market concentration; for instance, Claessens and Laeven (2004) have shown that even if market concentration may be a good indicator for market structure, highly concentrated markets can also be quite competitive, either because banks price loans and deposits as in a competitive setting or because the market is open to new entrants.

Following Schaeck and Cihak (2008), Laeven and Levine (2009) and Uhde and Heimeshoff (2009), we also include a range of bank-specific variables. A bank’s asset size (SIZE) is defined as the logarithm of its total assets. The net interest margin (NIM) is employed to track the profitability of a bank’s investing and lending activities. Further, GDP and WPI inflation has been taken as control variables to see the macroeconomic impact on financial stability of the banks.

Further, to examine the impact of ownership structure on financial stability, we have used dummy variable, where 1 is assigned for Government-owned and 0 is for private and foreign banks.

The notes on our dependent, explanatory and instrumental variables are presented in Table 1.

Table 1
Description of the Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variables</strong></td>
<td></td>
</tr>
<tr>
<td>Credit Risk (GNPLs)</td>
<td>Individual Bank-level NPLs</td>
</tr>
<tr>
<td>Solvency Risk (ZS)</td>
<td>Bank-level Z-score</td>
</tr>
<tr>
<td><strong>Independent variable</strong></td>
<td></td>
</tr>
<tr>
<td>SIZE</td>
<td>Natural logarithm of Total Assets</td>
</tr>
<tr>
<td>NIM</td>
<td>Bank’s net interest income as a share of its total earning assets</td>
</tr>
<tr>
<td>MS</td>
<td>Bank Level Market Share (Measure of Competition)</td>
</tr>
<tr>
<td>IR</td>
<td>Interest rate (credit)</td>
</tr>
<tr>
<td>WPI</td>
<td>Rate of inflation</td>
</tr>
<tr>
<td>GDP</td>
<td>Nominal GDP growth rate</td>
</tr>
<tr>
<td>GOWN</td>
<td>Measure of ownership: 1 if Government-owned; 0 otherwise</td>
</tr>
</tbody>
</table>

We have formulated the following two panel regression models to examine the financial stability of the Indian banking sector by using the variables listed in Table 4.

\[
GNPL_{it} = \alpha + \beta_1 SIZE_{it} + \beta_2 NIM_{it} + \beta_3 MS_{it} + \beta_4 IR_{it} + \beta_5 WPI_{it} + \beta_6 GDP_{it} + \beta_7 GOWN_{it} + \epsilon_{it} + \nu_{it} \quad (7)
\]
\[ ZSCORE_i = \alpha + \beta_1 \text{SIZE}_i + \beta_2 \text{NIM}_i + \beta_3 \text{IR}_i + \beta_4 \text{WPI}_i + \beta_5 \text{RGDP}_i + \beta_6 \text{GOWN}_i + U_{it} + V_{it} \]  

(8)

Where, \( \beta_1 \ldots \beta_6 \) are coefficients and \( U_{it}, V_{it} \) are the two error terms.

In panel data analysis, generally two approaches namely Fixed Effect (FE) model and Random Effect (RE) model, followed. The FE model allows the intercept in the regression model to differ cross-sectionally, while all the slope estimates are fixed both cross-sectionally and over time. Under fixed effects model, the error term \( U_{it} \), can be decomposed into an individual specific effect, \( U_{it} \) and the ‘remainder disturbance’, \( V_{it} \), that varies over time and across sections (capturing everything that is left unexplained about \( Y_{it} \)). Here, \( U_{it} \) encapsulates all of the variables that affect \( Y_{it} \) cross-sectionally but don't vary over time (equation 8).

An alternative to the FE model is the RE model, which provides for different intercept terms for each unit of cross-section but these intercepts remain constant over time. In RE model, the relationships between explanatory and dependent variables assumed to be same both cross-sectionally and temporally. Under the RE model, the intercepts for each cross-sectional unit are assumed to arise from a common intercept \( \mu \) (which is the same for all cross-sectional units and over time), plus a random variable that varies cross-sectionally but is constant over time. To identify which model (FE/RE) best suites to our data, the Hausman test statistic would be tested.

Section IV

Empirical Results and Discussions

Measuring Competition

There are an enormous academic writings on the aspect of competition in the banking sector of different countries. To our knowledge, there are a few number of studies available who have measured market power of Indian commercial banks. Prasad and Ghosh (2005) estimated the Panzar and Rosse (1987) H-statistic of Indian banks in the period 1997-2004 for 64 banks and in turn found monopolistic competition equilibrium. In another study by Datta (2013) analysed the degree of competition in Indian commercial banking sector for the period 1996-97 to 2004-05, by using the model containing first order condition for profit maximization, coupled with cost function and inverse demand function. The study supports that the competitive environment of Indian banking sector has improved during the regime of ongoing liberalization and competition has become more severe in during 2003-04 to 2004-05.

The cross country empirical evidence supports that in concentrated markets banks charge higher rates on small business loans and pay lower rates on retail deposits (Berger and Hannan, 1989, 1997; Hannan1991). Researchers found that in more concentrated markets deposit rates are sticky or slow to
respond to changes in open market interest rates, and the sticky character is greater with respect to increases than decreases, consistent with market power (Hannan and Berger, 1991; Neumark and Sharpe, 1992; Jackson, 1997).

In Indian context, it is widely perceived that competition in the Indian banking sector has increased since the inception of the financial sector reforms in 1992. In a speech by Rajan (2014) at the Annual day of Competition Commission of India (CCI) highlighted that there is enough competition in the Indian banking sector and also suggested that the best approach to increase efficiency and competition in the PSBs, without sacrificing their "public" character. This study examined the competition in the Indian banking sector in the post-reform period by using five-concentration indices, say CR3, CR5, CR10, HHI and GRS index. We have used five-type concentration indices to have a broader and clear picture of the competition in the banking industry. The results are highlighted in the Table 2.

<table>
<thead>
<tr>
<th>Year</th>
<th>HHI</th>
<th>CR3</th>
<th>CR5</th>
<th>CR10</th>
<th>GRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY05</td>
<td>0.059</td>
<td>0.309</td>
<td>0.407</td>
<td>0.562</td>
<td>0.181</td>
</tr>
<tr>
<td>FY06</td>
<td>0.056</td>
<td>0.312</td>
<td>0.408</td>
<td>0.562</td>
<td>0.166</td>
</tr>
<tr>
<td>FY07</td>
<td>0.054</td>
<td>0.308</td>
<td>0.403</td>
<td>0.560</td>
<td>0.158</td>
</tr>
<tr>
<td>FY08</td>
<td>0.052</td>
<td>0.295</td>
<td>0.386</td>
<td>0.548</td>
<td>0.158</td>
</tr>
<tr>
<td>FY09</td>
<td>0.057</td>
<td>0.295</td>
<td>0.390</td>
<td>0.565</td>
<td>0.177</td>
</tr>
<tr>
<td>FY10</td>
<td>0.054</td>
<td>0.278</td>
<td>0.375</td>
<td>0.562</td>
<td>0.170</td>
</tr>
<tr>
<td>FY11</td>
<td>0.054</td>
<td>0.280</td>
<td>0.383</td>
<td>0.568</td>
<td>0.168</td>
</tr>
<tr>
<td>FY12</td>
<td>0.053</td>
<td>0.283</td>
<td>0.380</td>
<td>0.565</td>
<td>0.164</td>
</tr>
<tr>
<td>FY13</td>
<td>0.053</td>
<td>0.282</td>
<td>0.377</td>
<td>0.562</td>
<td>0.167</td>
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<td>FY14</td>
<td>0.055</td>
<td>0.289</td>
<td>0.389</td>
<td>0.573</td>
<td>0.169</td>
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<tr>
<td>FY15</td>
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<td>0.289</td>
<td>0.390</td>
<td>0.580</td>
<td>0.169</td>
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<tr>
<td>FY16</td>
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<td>0.287</td>
<td>0.389</td>
<td>0.581</td>
<td>0.175</td>
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<tr>
<td>FY17</td>
<td>0.060</td>
<td>0.304</td>
<td>0.405</td>
<td>0.595</td>
<td>0.185</td>
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<tr>
<td>FY18</td>
<td>0.063</td>
<td>0.309</td>
<td>0.413</td>
<td>0.599</td>
<td>0.189</td>
</tr>
</tbody>
</table>

Source: Computed; ^ based on Total Business

The HHI index value over the years is in the range 0 to 0.10, indicates a highly competitive market (non-concentration) but the trend shows that the concentration in the market is increasing in the post-crisis period. The CR index indicate that the top three-banks in the sector hold around 30 per cent
of the market, top five banks holds around 40 per cent and the top ten banks holds 60 per cent of the market in terms of total business. All the three CR indices indicates a similar trend that the concentration in the sector is increasing though slowly. Further, the GRS index also shows the same increasing trend. As both HHI and CR indices faced with a number of challenges, we have taken into consideration the GRS number, which is also termed as best index to measure the market concentration in the market (Parida and Acharya;2016). As the GRS index varies in the range of 0.15-0.18, which indicate that the Indian banking sector is less concentrated but the index value is showing an upward trend, indicating that the level of competition is reducing. So, there is a need for RBI to look at the trend carefully and try to foster regulation in the sector, which will push competition and bring efficiency in the sector.

**Panel Regression Results**

Before empirically testing the model, we have tried to find out the structure of each variable through summary statistics and their degree of relationship with each other. Total number of observation in the data set is 605, as the study considered 55-banks for the period of 11-year, starting 2007-08 to 2017-18. The arithmetic mean and standard deviation of GNPL is 4.0 and 4.1 respectively which indicate that the dependent variable has low variation in the study period. In the similar lines, the independent variables have low variations. The dependent variable ZS varies from negative 49 per cent to 307 per cent, showing a very high standard deviation of 46. This is mainly as banks varies from small to large.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
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<tr>
<td>GNPL</td>
<td>605</td>
<td>4.0</td>
<td>4.1</td>
<td>0.0</td>
<td>28.8</td>
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<tr>
<td>ZS</td>
<td>605</td>
<td>33.3</td>
<td>46.0</td>
<td>-48.8</td>
<td>307.5</td>
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<tr>
<td>NIM</td>
<td>605</td>
<td>2.8</td>
<td>0.8</td>
<td>0.6</td>
<td>6.3</td>
</tr>
<tr>
<td>MS</td>
<td>605</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.2</td>
</tr>
<tr>
<td>IR</td>
<td>605</td>
<td>8.4</td>
<td>0.8</td>
<td>6.8</td>
<td>9.3</td>
</tr>
<tr>
<td>WPI</td>
<td>605</td>
<td>4.7</td>
<td>3.9</td>
<td>-3.6</td>
<td>9.6</td>
</tr>
<tr>
<td>GDP</td>
<td>605</td>
<td>13.5</td>
<td>2.8</td>
<td>10.0</td>
<td>19.6</td>
</tr>
<tr>
<td>SIZE</td>
<td>605</td>
<td>13.4</td>
<td>1.5</td>
<td>8.4</td>
<td>17.1</td>
</tr>
</tbody>
</table>

To examine the possibility of high correlation among the independent variables, the Pearson's correlation coefficient was estimated (results not reported). We have further checked that there is no multi-collinearity in the models among fiscal variables as the values of correlation do not exceed from cut point of 0.5. However, there is a slightly higher correlation among GDP and WPI, Size and Market share, which is expected.
Table 4
The Panel OLS Results: Fixed Effects (FE) Vs Random Effects Models

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>FE Model Results</th>
<th>Random Effects Model Results</th>
</tr>
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<tr>
<td></td>
<td>GNPLs</td>
<td>ZS</td>
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<tr>
<td>Regressor</td>
<td>Model-1</td>
<td>Model-2</td>
</tr>
<tr>
<td>C</td>
<td>16.27</td>
<td>38.12</td>
</tr>
<tr>
<td></td>
<td>(2.62)</td>
<td>(1.48)</td>
</tr>
<tr>
<td>SIZE</td>
<td>0.73</td>
<td>-5.61*</td>
</tr>
<tr>
<td></td>
<td>(1.85)</td>
<td>(-3.41)</td>
</tr>
<tr>
<td>NIM</td>
<td>-0.12</td>
<td>4.88*</td>
</tr>
<tr>
<td></td>
<td>(-0.37)</td>
<td>(3.61)</td>
</tr>
<tr>
<td>MS</td>
<td>-19.53*</td>
<td>465.12*</td>
</tr>
<tr>
<td></td>
<td>(-4.03)</td>
<td>(2.67)</td>
</tr>
<tr>
<td>IR</td>
<td>-1.92*</td>
<td>4.37*</td>
</tr>
<tr>
<td></td>
<td>(-7.70)</td>
<td>(4.23)</td>
</tr>
<tr>
<td>WPI</td>
<td>0.001</td>
<td>0.63*</td>
</tr>
<tr>
<td></td>
<td>(0.18)</td>
<td>(2.57)</td>
</tr>
<tr>
<td>GDP</td>
<td>-0.20*</td>
<td>0.66**</td>
</tr>
<tr>
<td></td>
<td>(-2.66)</td>
<td>(2.25)</td>
</tr>
<tr>
<td>GOWN</td>
<td>-</td>
<td>-</td>
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<tr>
<td></td>
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<td></td>
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<tr>
<td>R²</td>
<td>Within: 0.31</td>
<td>Within: 0.34</td>
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<tr>
<td></td>
<td>Between: 0.01</td>
<td>Between: 0.01</td>
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<tr>
<td></td>
<td>Overall: 0.03</td>
<td>Overall: 0.03</td>
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<tr>
<td>F Test/Wald Chi2</td>
<td>36.69</td>
<td>42.16</td>
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<tr>
<td>Prob&gt;F/ Chi2</td>
<td>0.0000</td>
<td>0.0000</td>
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</table>

Hausman Test Statistic: H0: Random Effects Model is Appropriate
H1: Fixed Effects Model is Appropriate

<table>
<thead>
<tr>
<th>Chi²</th>
<th>Prob. &gt;Chi²</th>
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<tbody>
<tr>
<td>19.00</td>
<td>4.91</td>
</tr>
<tr>
<td>0.0000</td>
<td>0.17</td>
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</tbody>
</table>

Note: Figures in (#) implies t-statistics for FE and z-statistics for RE model, Wald Chi2 for RE model; * Significant at 1 per cent level, ** at 5 per cent level, *** at 10 per cent level.

Under FE model, there are two variables, i.e. 'MS', GDP and IR', is significant in Model 1, while 'Size', 'MS', 'IR' and 'GDP' are significant in Model 2. The results of the two random effects (RE) models are presented in Table 4. In both the RE models, the IR and GDP are significant. To choose the appropriate model, the Hausman (1978) specification test is employed and the results prefer fixed effects (FE) to random effects in Model 1 and RE to FE in Model 2.

In FE Model 1, only the variables MS, IR and GDP are significant. The results indicate that Market Share (MS) has a negative relationship with the NPA,
which indicate that the larger banks have low credit risk. The other variable interest rate (IR) has a negative relationship with the Gross NPA of the banks, which is contract to our expected results. In theory, during the rising interest rate scenario the asset quality (NPA) deteriorates. The third significant variable GDP has a negative relationship with GNPA, which means with a better economic growth asset quality of the banks improve. The other variables like ‘SIZE and NIM has expected signs but insignificant. The control variable WPI inflation coefficient is around zero and also insignificant. In RE model 2, all the variables are significant at 1 per cent level but a very few variables has the same sign as expected. The study finds that SIZE and GOWN have negative and significant impact on Credit Risk (Z Score/ZS), whereas all other variables (viz., NIM, MS, IR, WPI, GDP) have positive significant impact on credit risk (ZS). However, MS, IR and GDP have negative and significant impacts on solvency risk.

Section V

Conclusion

This paper analyses the relationship between bank competition and financial stability for banks in India. The results indicate that the Indian banking system is less concentrated but the index value is showing an upward trend, indicating that the level of competition is reducing. So, there is a need for RBI to look at the trend carefully and try to foster regulation in the sector, which will push competition and bring efficiency in the sector. Further, we have investigated how the nexus between competition and stability works for the banks in India. In particular, we provide two main contributions with respect to the previous literature. First, we explore whether and how competition may affect stability with regard to three different types of bank risk at the institution level-solvency, and credit risk-and we show that the heterogeneous effects observed in the existing literature may be explained in terms of different types of risk. Second, we examine how bank regulation and bank supervision may shape, or change, the impact of competition on different sources of bank risk.

The empirical results suggest that the effects of bank competition on stability may differ depending on the type of risk. The study runs panel regressions of 55 major nationalised and private sector banks in India for the period 2007-08 to 2017-18. In the model, the dependent variables are solvency risk and credit risk and independent variables are level of competition (based on market share of individual banks) (MS), size of the banks (total assets) (SIZE), Net Interest Margin (NIM), interest rate (IR), WPI inflation (WPI), GDP growth rate (GDP) and ownership structure (GOWN: Public or Private). The study finds that SIZE and GOWN have negative and significant impact on Credit Risk (Z Score/ZS), whereas all other variables (viz., NIM, MS, IR, WPI, GDP) have positive significant impact on credit risk (ZS). However, MS, IR and GDP have negative and significant impacts on solvency risk.
References


## Annexure 1

<table>
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<tr>
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<th>S. No.</th>
<th>Name of the Bank</th>
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<td>31.</td>
<td>KARNATAKA BANK LTD</td>
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<td>ANDHRA BANK</td>
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<td>AXIS BANK</td>
<td>33.</td>
<td>KOTAK MAHINDRA BANK LTD</td>
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<td>6.</td>
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<td>37.</td>
<td>PUNJAB AND SIND BANK</td>
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