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Does Bank Competition Enhance or Hinder Financial Stability? Evidence from Indian Banking

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Abstract: The primary purpose of this paper is to empirically investigate the impact of bank competition on financial stability in India. We use a dynamic panel model to examine whether an increase in bank competition hindrances financial stability of commercial banks in India over the period 1996 to 2016. Findings reveal that in India, a higher degree of bank competition is positively associated with the prevalence of non-performing loans. Additionally, the positive impact of the Lerner index on Z-score lends support to competition-fragility hypothesis. However, we argue that both the views of competition-stability and competition-fragility can coexist in a single banking system like India.

Key words: Bank competition, Competition-Stability, Competition-Fragility, Financial Stability.

JEL Classification: G21, F30, G38.

1. Introduction

Studies on the relationship between bank competition and financial stability have drawn a great deal of attention of academics, policymakers, and regulators for several reasons. One of the reasons that can be extended in this regard is the global financial crisis of 2007-2008. Economists and policymakers view that with the fiercer competition, many banks have failed to sustain their profitability and capital requirements, which has subsequently led to the incidence of crisis.

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Steps towards the process of bank deregulation, bank branching, and removal of activity restrictions are supposed to have enhanced the degree of bank competition with a significant impact on financial depth (Rice and Strahan, 2010; Owen and Pereira, 2018; Khan et al., 2018; Li, 2019a; Li, 2019b), growth (de Guevara and Maudos, 2011), performance (Ibrahim, 2019; Ashraf, Hassan, Putnam, and Turunen-Red. 2019) and efficiency (Bertrand et al., 2007; Arrawatia et al., 2015). As far as the effect of competition on stability is concerned, Keeley (1990) and Beck et al., (2013) have argued about the unintended consequences of competition on increasing instability. Allen and Gale (2004) theoretically viewed higher bank competition to be conducive for efficiency but not for stability. However, despite perceiving competition as a precondition for financial development, growth, technological innovation, and efficiency, there has been no broad consensus whether an increase in competitiveness leads to greater stability in the financial system of emerging and developing economies.

In emerging economies, the trade-off between bank competition and financial stability holds relevance owing to two reasons. First, bank deregulation in developing economies since the early 1980s and post-1990s has accelerated bank competition to a large extent. Increased bank competition encouraged the big banks from advanced economies to operate in developing economies with high-profit margin. The competitive pressures and the resulting regulatory failures, in turn, propelled the banking sector in emerging countries to boost the consolidation process to retain the market power. To maintain market power, banks in developing countries considered the policy of higher interest rate. The higher interest rate charged on borrowers contributes to the financial instability in the banking system (Noman et al., 2017). Second, competition has a vital role to play in reinforcing economic development through its involvement in mobilizing and investing much of society's savings. In this regard, attempts have been made to find an optimal level of competition that ensures both efficiency and stability. However, the question, whether an increase in bank competition is good or bad for banking stability has called for an open debate in empirical research (Keeley, 1990; Allen and Gale, 2004; Berger et al., 2004; Martinez-Miera and Repullo, 2010; Wagner, 2010; Tarazi and Soedarmano, 2016; Sunarmo, 2018, Mulyaningsih, Daly andMiranti 2016 Beck et al., 2013).

Theories make ambiguous predictions about the role of competition on stability. Existing literature has relied upon two widely used hypotheses. According to the traditional "competition – fragility" view, increased competition in a banking market erodes market power, and lower market power results adversely on profit margins for banks. This competitive drive provides incentives to banking organizations to take more risks and hence causes banking failure and instability (Demsetz et al., 1996; Hellman et al., 2000; Carletti and Hartmann, 2003; Li, 2019c). On the contrary, under the framework of "competition-stability" approach, higher market power in the loan market is associated with higher bank risks. Banks that exercise higher monopoly power tend to charge higher interest rates on loans. Such conduct of banks

discourages borrowers to repay the loans on time and exacerbate the problem of moral hazard and adverse selection. However, there is literature that claims that both approaches need not necessarily yield opposing predictions regarding the effect of competition on stability. Martinez-Miera and Repullo, (2010) and Hakenes and Schnabel (2011) assert that the impact of bank competition on financial stability is non-linear or inverted U-shaped. Hence, both the views can coexist, and the relationship between the two can go either direction depending upon the market structure and competition measures[1].

India provides a fertile ground to undertake the study on competition stability trade-off as the banking sector in India since the 1990s has witnessed several structural changes through the process of liberalization and bank deregulation. In India, banking sector reforms were primarily initiated in two phases following the recommendations of the Narasimhan Committee (Government of India, 1991; 1998). The reforms measures taken during first-generation banking sector reforms (1992 to 1998) allowed the new private sector banks to operate and compete with domestic banks. These reforms measures also presumed that the structural changes would lead to an increase in the competitive pressure in the Indian banking system and will ensure both efficiency and stability (Reddy, 2000; Mohan, 2005). Sensarma and Jayadev (2007) argued that the competitive pressures as faced by the state-owned banks had increased substantially in India with the entry of newer banks, and this observation is well supported with the evidence of the declining trend of Herfindahl- Hirschman-Index (HHI). Besides, the banking system in India, over the years, has also experienced the process of consolidation following the wave of mergers and acquisition (M&Q). The process of M&A post 1998s has made the banking system in India (Rakshit and Bardhan, 2019). Given the instances of competition and concentration, this study attempts to first assess the competitive conduct of Indian commercial banks over the last two decades and raises concerns about its implications for banking stability. Findings reveal that in India, a higher degree of bank competition is associated with the growing problem of nonperforming loans, indicating its positive impact on riskier loan portfolios and lending support to the "competition-fragility' view.

The contribution of this paper can be summarized as follows. First, this paper is the first piece of research that looks into the effect of bank competition on financial stability using the sample of 70 Indian commercial banks from 1996 to 2016. The dataset allows us to examine the effect of pre and post-financial crisis on banking stability and the implications of banking sector reforms in India. Second, this paper not only tests the validity of one hypothesis against another rather investigates the relative importance of the relationship in terms of a bank-specific, regulatory and

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[1] For additional insights, we refer to Dell' Ariccia and Marquez (2004), Hauswald and Marquez (2006), Dick and Lehnert (2010).

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institutional framework in which banks operate. Third, this study provides empirical evidence about the relationship between competition and stability across different ownership groups. Finally, this paper uses both structural and non-structural measures of bank competition and several indicators of stability to reach a broad conclusion about competition-stability nexus in a single country context like India.

The remainder of the paper is structured as follows. Section 2 provides a brief overview of the Indian banking system and the state of bank competition and financial stability. Section 3 discusses the previous literature. Section 4 outlines the econometric methodology employed and data sources. Section 5 discusses the results and section 7 concludes the paper.

2. Bank Competition and Financial Stability in India

One of the targets of financial sector reforms in India was to enhance bank competition, improve higher efficiency, and promote stability. The banking sector in India is encompassed by a wide spectrum of banks of different size classes and varied ownership categories[2]. However, there has been an increased concern about the quality of assets owned by public sector banks. Currently, RBI's Financial Stability Report (2017) also acknowledged that Indian banking system has been facing risk in the post-recession period and the risk turns out to be higher in case of accumulating non-performing assets (NPAs). Prasad and Ghosh (2007) and Rakshit and Bardhan (2019) examine the competitiveness of Indian banking and assert that the banking system in India is characterized by competition conditions, and the degree of competition has been increasing since the financial sector deregulations Increased competition and deregulation measures have raised concerns about its implications for ensuring financial stability (Sarkar and Sensarma, 2016). In this regard, an important question arises, whether should the issue of competition be pursued as a goal for financial stability?

In India, discussions on financial stability, in separation, have received little attention from policymakers and monetary authorities but an attempt to investigate the impact of competition on stability has remained unexplored. Ghosh (2011) had constructed a simple index to account the banking fragility in India and identified several factors that exert an effect on stability. Mishra et al. (2013) analyze banking stability as a precondition to financial stability. However, both the studies while analyzing financial stability did not consider the dynamic aspects of macroeconomic

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[2] The banking system in India comprises of commercial, cooperative and regional rural banks. As of March 2017, the Indian banking system consists of 27 public, 21 private and 49 foreign sector banks. The public sector banks alone constitute around 67 per cent of total banking assets, whereas private and foreign banks jointly report 25 per cent.

indicators with competition and financial stability measures. Thus, ensuring the stability of the Indian financial system has become a research focus for academics and policymakers. The Financial Stability Report also stresses that the Indian banking sector, despite facing global uncertainties has maintained its macroeconomic stability due to sound domestic policies and structural reforms. It is to be mentioned that the profitability of the scheduled commercial banks (SCB) declined significantly due to the sharp rise in gross non-performing loan and advances (GNPAs) to 7.6 per cent from 5.6 per cent between September 2015 and March 2016.

However, as India is increasingly getting connected with rest of the world, it gives the signal that if financial system anywhere in the world is jeopardized, it will make the financial stability in India also vulnerable. The reason for choosing the Indian banking system is twofold. First, one of the primary objectives of financial sector deregulations in India was to foster the competitiveness of commercial banks to ensure efficiency and stability. Second, the empirical evidence whether the changing competitive atmosphere has induced more risk (instability) appears to be inadequate in Indian banking.

3. Literature Review

Over the decades, numerous studies have examined the determinants of bank competition and the impact of competition on stability across developed and emerging countries. The banking industry which is considered as the most important part of financial intermediation may transfer instability to other sectors through interbank market lending and payment mechanisms. Such mechanism of banks can lead to a situation in which increased competition might affect financial system fragility, which in turn motivated the policymakers and regulators to design policies that safeguard the stability in a banking system (Berger et al., 2009). A detailed discussion on competition-stability nexus was initially recognized in the seminal work by Keeley (1990) who identified that higher degree of bank competition in the U.S. market has significantly reduced the market power of banks in the 1980s and the eroded monopoly subsequently increased bank failures. Allen and Gale (2000) demonstrate how competitive conditions in a banking industry influence financial stability through the effect of contagion. They argue that as banks under perfect competition are considered to be price takers, they are reluctant to extend liquidity assets to the distressed and troubled banks. The troubled banks, therefore, fall gradually with negative effects for the entire banking industry. Boot and Thakor (2000) investigate that big and large banks can build credit reputation by financing fewer high-quality credit investments and can optimize the returns from those projects, and such process leads to banking soundness.

The advocates of competition-fragility approach postulate that higher level of bank concentration fosters greater stability in the financial sector as higher profits act as a cushion against banks risk-taking behaviour. The charter value hypothesis propounded by Marcus (1984) and Keeley (1990) views that in competitive banking environments, competition drives banks to take on more risks due to the condition of charter values and such drives of banks result in higher fragility. Beck et al. (2013) analyze the role of bank competition in affecting the risk-taking approach for a large sample of banks. Findings confirm that an increase in competition contributes to banking fragility in those economies where activity restrictions are higher on banking operations. Fu et al., (2014) assess the risk-taking behaviour of 14 Asia Pacific economies in the light of a competitive banking system. The study uses Z- index and probability of bankruptcy as indicators of measuring risk-taking behaviour of banks. Results obtained reveal that higher concentration in banking impairs stability and surges financial fragility by taking greater risks. Boyd et al., (2004) study the existing relationship between competition and stability and present a case where the probability of failure is positively associated with higher degree of market power. Employing a large sample of banks across 63 countries spanning over 1997 to 2010, Anginer et al., (2014) examine the linkage between competition and systematic risk-taking pattern of banks. The study found that increased competition has caused more diversified risks thus making the system fragile. Contrary to the competition-fragility approach, competition-stability approach underlines that financial instability increases as the degree of competition fall. Using Z-score as an indicator of stability and Boone indicator as a measure of bank competition, Schaeck and Cihak (2014) investigate the effect of bank competition on stability. The results indicate that higher competition leads to financial stability, but the effect is stronger especially for the healthy banks.

A large volume of literature has used several risk indicators, competition measures and different sample periods while examining the impact of competition on stability. These studies have found mixed and inconclusive results about competition-stability and competition-fragility hypotheses[3]. Cross-country studies have shown that concentrated banking systems are less prone to a systematic banking crisis as opposed to competitive banking systems (Beck et al., 2006; Schaeck et al., 2009). Martinez-Miera and Repullo, (2010) and Hakenes and Schnabel (2011) assert that the impact of bank competition on financial stability is non-linear or inverted U-shaped. Hence, both the views can coexist, and the relationship between the two can go either direction depending upon the other bank-specific factors and competition indicators used.

While the above literature cited, mostly pertained to developed and advanced economies such as the U.S. and Europe, there has been very few literature that address the issue of competition and stability simultaneously in emerging market economies. Yeyati and Micco (2003) investigate the competitive conditions and its potential im-

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[3]   For details, see Beck (2008)

plications for risk-taking in eight Latin American countries. Results obtained reveal a positive association between bank competition and banking sector fragility. Zhang et al., (2013), use 1001 bank-year observations and study the interlinkages among efficiency, competition, and risk across BRICS economies over the period 2003-2010. Amidu and Wolfe (2013) explore the possible association between competition and risks with regard to the impact of competition on risks and diversification for 55 developing countries over the period 200-2007. Results indicate that competition enhances stability as diversification of banks increases. Arayal and Pino (2014) find positive relationship between competition and stability in Chile. Soedarmono and Tarazi (2014) find that the banking industry in the Asia Pacific region witnesses lowers loan growth and higher instability due to lesser competition. Liu et al., (2012) examine the effect of competition on stability for four Asian economies (Indonesia, Malaysia, Philippines and Vietnam) and find that bank competition for these countries does not cause instability. Azmi et al., (2019) explained the intricacies in the nexus between competition and stability by introducing the aspect of diversification for 14 dual banking economies (conventional as well as Islamic banking). Findings indicate that there is no difference in the impact of competition and diversification on stability in these 14 economies over the period 2005 to 2016. Rizvi et al., (2019) investigated the role of Islamic banking in the Indonesian banking industry and found that bank competition positively adds to stability and profitability. Although the cross-country evidence on the role of competition appears to be sufficient, the literature on the same turns out to be inadequate for a single country set-up[4].

In the Indian context, there is no existing empirical literature that examines the impact of bank competition on the risk-taking behaviour of banks. Some literature focus on the competition measurement of Indian banking, but these studies pay no attention to the risk-taking the behaviour of banks in India.[5] Zhao et al., (2009) evaluate the impact of reforms on risk-taking in India. This paper attempts to fill the gap by investigating the trade-off between competition and stability in one of the emerging economies such as India. Unlike other studies, this paper focuses on both pre and post-crisis period to capture the variation in the competition –stability relationship. Finally, the application of both structural and non-structural measures of bank competition and a wide variety of stability indicators provides us with better insights about competition and stability nexus for India.

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[4] See Liu and Wilson (2013) for Japan, Jimenez et al., (2013) for Spain, Kick and Prieto (2013) for Germany and Yuan (2006) for China.

[5] See Prasad and Ghosh (2007), Zhao et al., (2010), Das and Kumbhakar (2016), Rakshit and Bardhan (2019) for an overall assessment of bank competition in India.

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4. Empirical Model and Data

To examine the nonlinear relationship between competition and financial stability, we employ the dynamic panel data model as suggested by Berger et al., (2009) and Martinez-Miera and Repullo (2008). We apply DPD estimations techniques, namely the GMM estimator proposed by Arellano and Bond, (1991); Arellano and Bover, (1995)[6]. There are several advantages of using a dynamic panel model over a static panel model. First, The dynamic panel data model is designed for short (small T) and wide panel (large N) and this model is suitable to fit a linear equation with one dynamic dependent variable, additional controls and fixed effects. Second, DPD model takes into account some important modelling concerns such as fixed effect and endogeneity of some regressors while avoiding dynamic panel bias. Following the works of Jimenez et al., (2013) and Lee et al., (2014), we specify the following general form of our equation to capture the time persistence effect of bank competition on financial stability.

$$FinancialStability_{it} = f(BankCompetition_{it}, Competition_{it,}^2, MarketStructure_{it},$$
$$bankcontrols_{it}, macroeconomicfactors_{it} BusinessEnvironemnt_{it}) \tag{1}$$

The specific GMM regression model takes the following form

$$Y_{it} = \beta Y_{it-1} + \gamma X_{it} + \delta M_{it} + \vartheta Z_{it} + \rho K_{it} + \mu + u_{it} \tag{2}$$

we use three dependent variables such as Z-index as an inverse measure of overall bank risk, the ratio of non-performing loans to total loans (NPLs)to denote the loan portfolio risk and equity to total assets (E/TA) for the bank's capitalizations level. X represents the competition indicators. We have three competition measures namely, Lerner index, efficiency adjusted Lerner index and Boone indicator. M denotes the market structure variables such as CR3 and HHI. Z and K denote the vector of bank-specific and macroeconomic determinants. The subscripts *i* and *t* denote the number of cross-sectional and time dimension of the panel model. Where $\mu_i \square$ IID $(0, \sigma_v^2)$ and independent of $\mu_{it} \square$ IID $(0, \sigma_\mu^2)$.

Extant literature estimates both difference GMM and system GMM in the DPD model. However, in our study, we estimate only two-step system GMM as it provides more reliable and robust results when variables under consideration are close to a random walk (Roodman, 2009). One of the advantages of system GMM over difference GMM is that system GMM is more preferable for unbalanced panel data. In order to show the robustness of the model, we apply Windmeijar (2005) to report the corrected standard errors.

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[6]   As shown in other empirical literature, a simple panel data model cannot be applied in our analysis due to the possible correlations between the unobserved crossed and time specific effects and the regression (Baltagi, 2008). Application of panel data model would provide us biased and inconsistent results.

4.1. Bank Competition Measures

The approaches of measuring bank competition can broadly be classified into structural and non-structural approaches. Two widely applied structural measures are Herfindahl- Hirschman Index (HHI) and concentration ratios of banks. Following Leon (2014), we calculate HHI and CR3 as follows

$$CR_3 = \sum_{i=1}^{3} S_i \, where \, s_1 \geq \; \ldots\ldots \, \ldots \geq s_k \geq s_N \quad \forall \; N \geq K \tag{3}$$

where S_i is the share of the three largest banks, when banks are ranked according to the descending order. Here, we calculate based on the bank's total assets. N denotes the total number of banks.

The HHI is defined as follows

$$HHI = \sum_{i=1}^{N} S_i^2 \; \forall_i = 1 \, 2 \, ,,, N \tag{4}$$

where N is the total number of firms in the market.

The non-structural approach of bank competition is the Lerner Index, efficiency adjusted Lerner index, and Boone indicator. The main advantages of these techniques are its simplicity and straight forward interpretations. The definitions of these measures of bank competition are as follows

Lerner Index: This index has been used as a proxy to bank competition. It captures the ability of the bank's market power by calculating the difference between price and marginal cost as a percentage of price. We can construct the Lerner index for the individual bank at each time as follows:

$$Lerner_{it} = (P_{TAit} - MC_{TAit}) \, / \, P_{TAit} \tag{5}$$

where, P_{TAit} denotes the output price of bank i. Price of the output is defined as the price of total assets proxied by the ratio of total revenues to total assets. MC_{TAit} is the marginal cost of total assets for bank i at time t. Following Berger et al., (2009) and Beck et al., 2013), we derive the MC_{TAit} from the following translog cost function

$$\ln Cost_{it} = \beta_0 + \beta_1 \ln Q_{it} + \frac{\beta_2}{2} ln Q_{it}^2 + \sum_{k=1}^{3} \gamma_{kt} \ln W_{k,it} + \sum_{k=1}^{3} \varphi_k \ln Q_{it} \ln W_{k,it}$$

$$+ \sum_{k=1}^{3} \sum_{j=1}^{3} \ln W_{k,it} \; ln W_{J,it} + \varepsilon_{it} \tag{6}$$

where Q_{it} represents total earning assets for bank i at time t. $W_{k,it}$ are the three input prices $W_{1,it}$, $W_{2,it}$, and $W_{3,it}$ indicate the input prices of labour, capital and funds respectively, and are calculated as the ratio of personnel expenses to a number of employees, ratio of capital expenditure to total fixed assets and ratio of total interest expenses to total customer deposits. Marginal cost is then estimated as :

$$MC_{TAit} = \frac{Cost_{it}}{Q_{it}} \left[\beta_1 + \beta_2 \ln Q_{it} + \sum_{k=1}^{3} \varphi_k \ln W_{k,it} \right] \tag{7}$$

Adjusted Lerner Index: According to Koetter et al. (2012), conventional Lerner index does not reflect the true extent of bank competition as the index concerns cost aspect of a firm. Efficiency adjusted Lerner index takes into account both the aspect of profit efficiency and cost-efficiency. The efficiency-adjusted Lerner index can be computed as follows:

$$\text{Efficiency adjusted } Lerner_{it} = \frac{\pi_i + tc_i - mc_i * q_i}{\pi_i + tc_i} \tag{8}$$

where, π_i is the profit of firm i, tc, mc, and q are total cost, marginal cost and total output of firm i respectively.

Boone Indicator: Boone indicator (Profit elasticity) measures market power as an estimate of the percentage decrease in profits resulting from one per cent increase in marginal cost, formally, defined as:

$$\text{Profit elasticity} = \frac{\partial \ln \pi_i}{\partial \ln mc_i} \tag{9}$$

Since profit and marginal cost are negatively related, profit elasticity indicated by (3) should be negative. The implicit idea behind estimating this index is that efficient firms are rewarded more in a highly competitive market.

4.2. Stability Measures: The Z-Score

Following Laeven and Levine, (2009); and Demirguc-Kunt and Huizinga, (2010), we use the Z-score as an inverse measure of overall bank risk. This measure of stability is constructed based on profitability, leverage, and returns volatility of banks. The Z-score measures the distance from the insolvency and is calculated as

$$Z_{i,t} = \frac{ROA_{i,t} + \left(\frac{E}{A}\right)_{i,t}}{\sigma(ROA)_{i,t}} \tag{10}$$

where ROA_i is the period-average return on assets for bank i, E/TA represents the period-average-to-total-assets ratio for bank i, and σROA_i denotes the standard deviation of return on assets. In addition, we also employ two additional measures of bank

stability such as the bank-level ratio of nonperforming loans to total loans; a higher value indicates a riskier loan portfolio. Second, the ratio of equity to total assets has been used as a measure of bank capitalization. A higher ratio indicates a lower bank risk. The details of the variable's definition are presented in Table 1.

Table 1: Variable Definitions

Variable	Definitions	Source
Dependent Variables		
NPLs	The bank-level ratio of non-performing loans to total loans. The higher value of NPLs indicate a riskier loan portfolio	RBI, IBA
Equity to total assets	It denotes the bank-level capitalisation and measured as the ratio of equity to total assets. A higher value indicates lower bank risk	RBI
Z-index	This Z-index is an inverse proxy for the firms' probability of failure. A larger value indicates a higher bank stability and less overall bank risk.	RBI, OC
Independent Variables		
Lerner Index	A bank-level indicator to measure the degree of bank competition, This is calculated as mark-up of price over marginal cost	RBI, OC
Adjusted Lerner	Details has been mentioned in the methodology section	RBI, OC
Boone Indicator	Details has been mentioned in the methodology section	RBI, OC
HHI Deposits	An aggregate indicator of bank concentration, measured by the Herfindahl-Hirchman Deposits Index, with lower values indicating greater market concentration.	RBI, OC
HHI Loans	An aggregate indicator of bank concentration, measured by the Herfindahl-Hirchman Loans Index, with lower values indicating greater market concentration.	RBI, OC
HHI	$\sum_{i=1}^{n} s^i$, is the sum of squared market share of all banks.	RBI, OC
CR3	Percentage of market share in banking sector's total assets held by the three largest banks	RBI
Control variables		
Bank Size	The logarithm value of total assets	RBI
Assets Composition	Loans to total assets and fixed assets to total assets ratio are used to measure assets composition	RBI
Diversifications	Ratio of non-interest operating income to total revenue	RBI
Inefficiency	Ratio of non-interest expenses to total revenue	RBI
Growth	Annual growth rate of real GDP with Base, 2004-05)	SOI
Inflation	Annual CPI rate	SOI
Banking Freedom	An index that ranges from (1) to (5), with higher values indicating fewer restrictions.	Djankov et al., (2017)
Legal rights index	An index measuring the degree to which collateral and bankruptcy laws facilitate lending. The index ranges from 0 to 10 with higher scores indicating that collateral and bankruptcy laws are better designed to expand access to credit	Heritage Foundation

Notes: RBI denotes Reserve Bank of India, IBA denotes Indian Banking Association, CMIE denotes Centre for Monitoring Indian Economy, OC indicates Author's own calculation.

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4.3. Other Control Variables

We also include a set of bank-specific and macroeconomic variables. The logarithm value of total assets was used to define the bank's size. Loans to assets and fixed assets to total assets were used as a measure of asset composition (Beck et al., 2013). The asset composition provides us the indication about the quality of output. Diversification has been measured by non-interest income to total revenues. Turning to macroeconomic factors, we include log value of GDP per capita and inflation rate. The stability of a financial system is also affected by the rate of inflation (Woodford, 2012; Karim, Al-Habshi, and Abduh, 2016). To examine the impact of inflation on financial stability, we consider rate of inflation as a macroeconomic indicator. Finally, to take account of business environment, we add banking freedom and legal rights index as two variables into our empirical analysis.

4.4. Data and Variables Sources

Data were obtained from *Statistical Tables Relating to Banks in India*, an annual publication of Reserve Bank of India, which provides annual financial statements of individual banks. For the empirical analysis, we select 26 public, 19 private and 25 foreign sector banks for which data are available from 1996 to 2016. However, while choosing the sample of 70 banks, issues related to merger and acquisitions (M&A's) have been taken into account. We have further gone through all M&A to make sure that both banks do not appear post-merger separately in the sample. The process described so far yields an unbalanced panel with 1470 observations, corresponding to 70 commercial banks. Information on macroeconomic variables has been collected from CMIE, States of India (SOI). The macroeconomic variables have been used with the aim to control for variations in economic development. We include the index of legal rights and banking freedom as control variables. Information on the index of legal rights is extracted from Djankov et al., (2007), while Heritage Foundation provides data for banking freedom. See Table 7 for the descriptive statistics of the variables used.

5. Results and Discussions

5.1. Bank Competition Results

First, we present the results of bank competition for different ownership groups and for the banking sector as a whole during 1996-2016. Table 2 shows the average estimates of market power (inverse of bank competition) for the different ownership group. Since the ownership group consists of banks of different size classes; we assign different weights to banks based on their market shares. The average estimates of Lerner index for the entire banking sector are around 0.22 to 0.36 over the sample period.

Table 2: Average Estimates of various Measures of Market Power: 1996-2016

Years	Public Banks			Private Banks			Foreign Banks			All Banks		
	LI	ALI	BI	LI	ALI	BI	LI	ALI	BI	LI	ALI	BI
1996	0.182	0.067	-0.118	0.287	0.191	-0.139	0.362	0.244	-0.014	0.257	0.158	-0.138
1997	0.226	0.116	-0.127	0.270	0.186	-0.138	0.366	0.246	-0.169	0.279	0.168	-0.138
1998	0.206	0.148	-0.136	0.282	0.121	-0.089	0.344	0.198	-0.136	0.281	0.175	-0.129
1999	0.189	0.111	-0.127	0.243	0.154	-0.132	0.290	0.167	-0.145	0.240	0.140	-0.133
2000	0.206	0.129	-0.129	0.278	0.114	-0.087	0.267	0.139	-0.138	0.247	0.144	-0.132
2001	0.201	0.116	-0.127	0.220	0.166	-0.134	0.280	0.123	-0.140	0.232	0.132	-0.134
2002	0.232	0.150	-0.132	0.320	0.187	-0.138	0.327	0.221	-0.149	0.218	0.182	-0.139
2003	0.297	0.185	-0.137	0.280	0.201	-0.140	0.323	0.236	-0.155	0.302	0.211	-0.145
2004	0.339	0.220	-0.144	0.312	0.221	-0.144	0.419	0.240	-0.160	0.361	0.228	-0.149
2005	0.323	0.202	-0.145	0.278	0.111	-0.130	0.366	0.257	-0.145	0.326	0.188	-0.143
2006	0.296	0.186	-0.137	0.288	0.169	-0.136	0.365	0.173	-0.148	0.319	0.177	-0.141
2007	0.289	0.196	-0.139	0.300	0.187	-0.138	0.390	0.300	-0.169	0.329	0.231	-0.149
2008	0.257	0.197	-0.143	0.287	0.194	-0.139	0.409	0.347	-0.180	0.322	0.247	-0.153
2009	0.288	0.183	-0.137	0.231	0.187	-0.138	0.474	0.359	-0.192	0.339	0.247	-0.157
2010	0.273	0.190	-0.138	0.292	0.185	-0.138	0.451	0.281	-0.168	0.343	0.221	-0.149
2011	0.287	0.194	-0.139	0.282	0.202	-0.141	0.462	0.237	-0.184	0.353	0.212	-0.155
2012	0.265	0.171	-0.135	0.213	0.185	-0.138	0.446	0.346	-0.190	0.318	0.237	-0.155
2013	0.248	0.157	-0.132	0.201	0.185	-0.137	0.443	0.366	-0.164	0.306	0.239	-0.145
2014	0.238	0.126	-0.128	0.244	0.171	-0.136	0.406	0.198	-0.154	0.275	0.164	-0.139
2015	0.235	0.125	-0.128	0.243	0.168	-0.135	0.408	0.239	-0.154	0.296	0.177	-0.139
2016	0.252	0.149	-0.118	0.262	0.154	-0.127	0.413	0.238	-0.156	0.294	0.146	-0.136

Notes: LI denotes Lerner Index, ALI denotes Adjusted Lerner Index, BI denotes Boone Indicator. Each column reports yearly average estimates of the bank level Lerner indices (weighted by market share) for all ownership groups over the period 1996-2016. Higher values indicate increased market power; lower values indicate increased degree of competition. In each case, averages for each year are obtained from the bank-level estimates of market power using Lerner index, adjusted Lerner index and profit elasticity (Boone indicator) respectively.

For public sector banks, this average estimate ranges between 0.18 to 0.33, while in case of private and foreign banks, the average estimates of Lerner index appear to be comparatively higher. Lerner index for private and foreign banks ranges between 0.20 to 0.32, and 0.26 to 0.46 respectively. These estimated results suggest the implications of financial sector reforms initiated in Indian banking system in two major rounds. It is noticed that during first-generation reform (1992-1998), there has been a decrease in market power of Indian banks as indicated by the smaller values of both Lerner index and adjusted Lerner index. However, during second-generation reforms post-1999, Indian banking system has witnessed the process of consolidation through mergers and acquisitions and implementation of many structural reforms (Prasad and Ghosh, 2007). The process of M&A in Indian banking post-1999 became stronger and in most cases, mergers happened due to restructuring of weak banks (Sensarma and Jayadev, 2007). This observation is empirically documented by the gradual increase in the estimates of market power both in aggregate level as well as across different ownership groups. The increase in estimates of Lerner index indicates the consolidation of Indian banks during 1999-2011. As far as Boone indicator measure of bank competition is concerned, we find results in contrast to our expectations. According to this indicator, foreign banks appear to be relatively more competitive than public and private sector banks. This observation lends support to the argument that financial globalization across both developing and developed economies and gradual penetration of foreign banks in local market help foreign banks to be more competitive (Claessens et al., 2009).

5.2. Competition and stability Results

In Table 3, we present the results that show the impact of bank competition and market structure on financial stability. First, we test for the presence of the heteroskedasticity in our data set with the help of the Breush-Pagan/Godfrey/ Cook-Weisberg statistic. We also run different tests to check the validity and relevance of the instruments. Using Hansen's J test and first stage F-test, we see both the relevance and the validity of the instruments of the degree of market power. The results show the presence of heteroskedasticity in our estimated models, and therefore, the use of GMM estimator is justified for all models.

In our empirical analysis, we use three indicators of financial stability measures. In Table 3, model (1-3) explains the effect of bank competition on NPLs. Similarly, model (4-6) shows the results of the competition on the bank's capitalization ratio and model (7-9) exhibits the impact of competition on Z-index. All the models include Lerner index, HHI-deposits index, or HHI-loan index as inverse measures of bank competition. The coefficients of lagged dependent variables in all the estimated models are positive and statistically significant at 1% level indicating the persistent of the indicators over time. In model 1 to 3, the negative and statistically significant coefficient of Lerner index at 1% implies that as banks exercise higher market power, they exert a negative effect on NPL.

Table 3: Dependent variables: Nonperforming Loans to Total Loans, Equity to Total Assets and Z-index

	Nonperforming loans to Total Loans			Equity to total Assets			Z-Score		
	Model (1) Lerner Index	Model (2) HHI Deposits	Model (3) HHI Loans	Model (4) Lerner Index	Model (5) HHI Deposits	Model (6) HHI Loans	Model (7) Lerner Index	Model (8) HHI Deposits	Model (9) HHI Loans
Lagged NPA/ EQ to TA / Z-score	0.65***	0.67***	0.70****	0.74***	0.85***	0.88***	0.73***	0.88***	0.77***
	(0.0971)	(0.0963)	(0.0684)	(0.0939)	(0.0641)	(0.0606)	(0.0848)	(0.0937)	(0.0836)
Degree of Market Power	-9.78***	-3.39***	-4.44***	2.31***	-0.55***	-1.07***	2.20***	-1.46***	-0.96***
	(4.2512)	(3.6894)	(6.0489)	(1.1052)	(1.4382)	(1.1331)	(.3424)	(2.5580)	(2.5869)
Market Power Squared	7.99***	560.1***	651.2***	-1.65***	16.1	76.7***	-1.57***	191.6***	42.6***
	(4.9035)	(4.1390)	(621.19)	(0.9775)	(177.3)	(123.27)	(1.2078)	(350.9)	(159.85)
Inflection Points	0.17	0.21	0.15	0.74	0.05	0.06	0.70	0.02	0.01
Loans to Assets	-0.22***	-0.28***	-0.24***	-0.09***	-0.08***	-0.06***	-0.12***	-0.16***	-0.11***
	(0.1637)	(0.1879)	(0.1811)	(0.0652)	(0.0667)	(0.0645)	(0.0789)	(0.1065)	(0.1148)
Fixed Assets to Total Assets	0.03***	-0.06	-0.007***	0.016***	-0.005	-0.005***	0.017***	-0.008***	-0.008
	(0.0740)	(0.0440)	(0.0450)	(0.0235)	(0.0055)	(0.0046)	(0.0232)	(0.007)	(0.0068)
Bank Size	0.02***	0.05***	0.06****	-0.04***	-0.03***	-0.02***	-0.05***	-0.01***	-0.05***
	(0.0419)	(0.0337)	(0.0359)	(0.0225)	(0.0280)	(0.0232)	(0.0267)	(0.0368)	(0.0259)
Legal Rights	-0.01***	0.01***	0.01***	0.01***	0.01**	0.01***	0.01***	0.007***	0.005***
	(0.0173)	(0.0167)	(0.0168)	(0.0077)	(0.0085)	(0.0085)	(0.0084)	(0.008)	(0.008)
Log (GDPpc)	-0.37***	-0.22***	-0.29***	-0.08***	-0.11***	-0.09***	-0.06***	-0.03***	-0.06***
	(0.0941)	(0.1139)	(0.0951)	(0.0646)	(0.0571)	(0.0565)	(0.06568)	(0.0524)	(0.3598)
Number of Banks	70	70	70	70	70	70	70	70	70
Number of Instruments	69	69	69	69	69	69	69	69	69
First Stage F-test	36.03 (0.00)	78.45 (0.00)	73.04 (0.00)	14.32(0.00)	36.46(0.00)	176.86(0.00)	248.38(0.00)	158.95(0.00)	158.07(0)
Heteroskedasticity Test	589.56	458.35	658.59	3590.56	132.82	262.23	80.41	220.24	230.76
Hansen's J x²	61.06(0.43)	62.06(0.40)	58.76(0.52)	64.85(0.31)	64.41(0.23)	32.11 (0.25)	61.55 (0.42)	61.03 (0.43)	59.26(0.0)
AR(1) P-value	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
AR(2) P-value	0.31	0.39	0.43	0.06	0.06	0.06	0.05	0.08	0.28

Note: Model 1, 2 and 3 shows the effect of bank competition on NPLs. Model 4, 5, and 6 exhibits the effect of competition on equity to total assets and model 7, 8, and 9 demonstrates the effect of competition on Z-index. Table 3 shoes the GMM-regression with standard errors.Columns in table report estimated coefficients of each model. Figures in parentheses represent values of t-statistics. Equations estimated using system generalized method of moments. '*' indicates statistically significant at 10% level of significance, '**'denotes statistically significant at 5% level and '***'denotes statistical significance at 1% level. The first stage F statistic tests the relevance of the instrumental variables, while rejecting the hypothesis implies that variables are not exogenous. The Hansen J statistic tests the validity of the instruments used and the rejection implies that the instruments are not valid. Standard robust standard errors are reported in the parentheses.

The higher degree of bank competition by reducing the interest rates margins encourages borrowers to invest the credit in risky projects resulting in a higher proportion of impaired loans to total loans in India. This negative effect of competition as reflected in the market power on NPLs supports the competition-stability view in Indian banking.

Similarly, when we use HHI- deposit and HHI- loan indices, we observe that the linear coefficients are negative and significant, whereas the quadratic coefficients turned out to be positive and significant. For instance, in model 1, the inflection point is 0.17, which is approximately the 4th percentile of the Lerner index distribution, implying that more than 95% of data are lies above the inflection points. A comparative analysis of the results using the HHI deposits and loans also indicates the negative and significant relationship between market power and the ratio of nonperforming loans to total loans. The findings imply that in India, a higher level of market power reduces the problem of NPLs. Our results are consistent with "competition-stability" view of Boyd and De Nicolo (2005). The findings indicate that higher competition in Indian banking results in riskier loan portfolios. The results are consistent across the three different proxies of bank competition.

We further investigate the effect of competition on stability using equity to total assets as a proxy for financial stability in model 4 to 6. The positive and significant coefficient of Lerner index in the model (4) indicates that banks with higher market power enable the banks to hold more equity capital to absorb the losses resulting from their high loan portfolio risks, which in turn helps the banks to be financially stable. However, this effect is not consistent across all models. In the case of HHI deposits and HHI loans, we find negative and significant coefficients of competition measures on equity to total capital. Considering the higher amount of non-performing loans, the International Monetary Fund (IMF) has advised India to increase the capitalization base of some banks, particularly the public sector banks (The Economic Times, April 11, 2019). Therefore, as far as bank's capitalization is concerned, we find mixed results supporting the case of both competition-stability and competition fragility views.

Model 7 to 9 of Table 3 presents the effect of bank competition on banking stability using Z-index as an inverse proxy of overall risk. Findings show that the coefficient of the Lerner index is positive and has a significant effect on Z-index in model (7). This implies that any increase in the level of market power or decrease in the level of competition increases the stability of Indian banking. A higher value for the Z-index arises from higher earnings or more capital and gives surge in greater financial stability. On the other hand, a greater variation in the earnings reduces the z-index and thereby increases bank's overall risks (Beck et al., 2013). The positive coefficient of Lerner index lends support in favour of "competition fragility" view that an increase in the level of bank competition is likely to erode the franchise value of banks and motivates banks to increase the risk exposure. On the other hand, the negative coefficients of HHI in the loan and deposit markets indicate that a higher degree of market power negatively affects financial stability in Indian banking and this finding lends support to compe-

tition-fragility approach. This finding is in line with the existing literature of Rakshit and Bardhan (2019).

The quadratic term of competition measures in model 1 to 9 gives us an indication of the non-linearity between competition and stability in India from 1996 to 2016. Following Berger et al., (2013) and Tabak et al., (2012), we find the non-linear relationship in the Indian case. Model (4) and (7) demonstrates a negative and significant sign of the linear term of Lerner index. This suggests that the relationship between competition and stability is non-linear and inverted U-shaped. We further calculated the inflection points for all the models and compare the dataset to understand the relationship between the two aspects. The inflection point in the model (7) is highest and at +0.70, which is approximately 75th percentile, indicating that 75% of the data in the Lerner index distribution lies below the inflection point. This finding of us is in line with Noman (2017).

As far as the control variables are concerned, as expected banks with a larger percentage of loans to total loans have lower capitalizations and higher NPLs. The larger banks in India which are mostly public sector banks suffer from higher NPLs. However, large banks appear to be more stable. This is because large banks are less sensitive to credit risks. The business environment which is captured by the banking freedom index and legal right index also gives predicted results for the case of the Indian financial sector. The positive and significant relationship between banking freedom and Z-index validates the necessity of business environment for a well-functioning financial system.

As far as the ownership effect is concerned, as observed earlier, the coefficients of lagged Z-score, equity to total assets, and NPL are positive and statistically significant. In table 4, the coefficient of Lerner index in case of public sector banks implies a positive impact of market power on banking soundness. This observation lends support to competition-fragility view. However, the effect is not uniform in case of private and foreign banks, and hence, the findings provide support to both competition-stability and competition-fragility approach. While considering the impact of market power on Z-score, we do not find any significant effect of market power on stability measures in case of foreign banks. Public sector banks in India by lowering the level of competition can reduce the problem of growing non-performing loans. The negative and significant effect of Lerner index on NPL suggests that higher market power in public sector banks reduces the problem of impaired loans. This finding finally lends support to the "competition-stability' views. Since foreign banks in India are less prone to the problem of non-performing assets, we observe no significant impact of the Lerner index on NPL. In order to examine the effect of the financial crisis on stability, we group the data into sub-periods i.e. 1996 to 2008 and 2009 to 2016 and run the regression. We do not find any significant differences in the results before and post the financial crisis, and, hence, we conclude that crisis had no significant impact on Indian financial sector stability[7].

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[7] For the sake of brevity, results on the impact of financial crisis (pre and post) on stability has not been reported. The results are available on request.

Table 4: Ownership Results

	Public Sector Banks			Private Sector Banks			Foreign Banks		
	Z-Score	Equity to Assets	NPA	Z-Score	Equity to Assets	NPA	Z-Score	Equity to Assets	NPA
Lagged Z-score	0.47*** (0.2702)			0.45*** (0.3853)			0.37*** (0.2308)		
Lagged equity to assets		0.57*** (0.1024)			0.45*** (0.2211)			0.51*** (0.2579)	
Lagged NPA			0.62*** (0.0982)			0.50*** (0.1293)			0.76*** (0.1526)
Lerner Index	1.64** (0.3982)	1.07** (0.9153)	-1.57* (3.289)	4.09** (0.6686)	-3.59 (0.2548)	-6.29 (15.88)	-0.26 (0.5362)	0.94 (2.564)	-0.44 (4.156)
Lerner Index Square	-1.30** (1.5750)	-0.64 (0.8516)	1.95 (5.421)	-7.85* (7.551)	4.79 (4.9108)	9.52 (26.25)	0.62 (1.7639)	-0.35 (2.370)	4.40** (4.949)
Loan to Total Assets	0.08 (0.2517)	0.05 (0.1211)	-0.45 (0.6318)	-0.119 (0.3381)	-0.24** (0.2173)	-0.055 (0.6112)	0.036 (0.1086)	0.10** (0.1145)	-0.19 (0.4675)
Fixed Assets to Total	0.008** (0.0061)	0.006** (0.004)	-0.007 (0.0205)	0.021 (0.0266)	-0.01 (0.0183)	-0.06 (0.2215)	-0.02 (0.1192)	-0.09** (0.1296)	0.16** (0.2090)
Size	-0.002 (0.0401)	-0.006 (0.0288)	0.03 (0.1155)	0.016 (0.1604)	0.11* (0.1275)	-0.05 (0.1877)	-0.059 (0.0940)	-0.08** (0.0602)	-0.08 (0.1652)
Log (GDPpc)	0.05*** (0.0477)	0.04** (0.044)	-0.33* (0.0954)	0.11 (0.1169)	0.02 (0.0815)	-0.81*** (0.2977)	-0.14*** (0.1045)	-0.19*** (0.1317)	-0.35** (0.2994)
Legal Right	0.01*** (0.0067)	0.009*** (0.0062)	0.04*** (0.0223)	0.005* (0.0181)	-0.009 (0.0127)	-0.06*** (0.0386)	0.013*** (0.01278)	0.005* (0.0189)	-0.03** (0.0425)
Number of Banks	26	26	26	19	19	19	25	25	25
First Stage F test	11.63 (0.00)	31.57 (0.00)	107.6 (0.0)	46.08	11.98 (0.04)	39.60 (0.00)	3.81(0.003)	3.32 (0.009)	15.69 (0.00)
Hansen Test (P Value)	13.08 (0.34)	15.87 (0.93)	19.21 (0.86)	9.62 (0.99)	9.92 (0.99)	9.42 (0.99)	13.59 (0.96)	15.05 (0.95)	-2.06 (0.04)
AR(1) (P-value)	-1.59 (0.112)	-1.41 (0.015)	-3.36 (0.001)	-1.13 (0.26)	-1.36 (0.017)	10.09 (1.00)	-2.00 (0.046)	-1.94 (0.05)	0.72 (0.49)
AR(2) (p-value)	0.96 (0.338)	0.82 (0.41)	-0.78 (0.43)	0.46 (0.64)	0.36 (0.72)	3.09 (0.21)	1.38 (0.166)	1.61 (0.107)	1.58 (0.56)

Note: Columns in table report estimated coefficients of each model. Figures in parentheses represent values of t-statistics. Equations estimated using system generalized method of moments. '*' indicates statistically significant at 10% level of significance, '**'denotes statistically significant at 5% level and '***'denotes statistical significance at 1% level. The first stage F statistic tests the relevance of the instrumental variables, while rejecting the hypothesis implies that variables are not exogenous. The Hansen J statistic tests the validity of the instruments used and the rejection implies that the instruments are not valid. Standard robust standard errors are reported in the parentheses.

Robustness Tests

We run a number of robustness tests on our main results. In order to do so, we change the nature of competition variables along with few bank-specific characteristics. In addition to the Lerner index, we introduce two new measures of bank competition namely efficiency adjusted Lerner index and Boone indicator. In table 5, in the model (1) and (2) we replace the Lerner index by efficiency adjusted Lerner index and Boone indicator and investigate the impact of these competition measures on loan risk portfolio (NPLs) and overall bank risk (inverse of Z-index). In model (1), we find that like Lerner index, efficiency adjusted Lerner index also exerts a negative impact on NPL indicating the case where higher market power makes a system stable, whereas the positive value of Lerner index on Z-score gives us the same explanations as before. This finding provides supports for banking fragility view. In table 6, keeping the stability measures fixed, we add few explanatory variables to the regression model. Findings suggest that while diversification plays a significant role in determining the overall banking soundness, inefficiency deteriorates the stability of a financial system. Apart from that, we do not observe any significant change in the results.

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Table 5: Robustness Test

	Model (1) Adjusted Lerner	Model (2) Boone Indicator	Model (3) Adjusted Lerner	Model (4) Boone Indicator
Lagged NPA	0.51*** (0.1302)	0.67*** (0.1028)		
Lagged Z-index			0.71*** (0.0973)	0.77*** (0.0990)
Degree of Market Power	-2.72*** (5.0124)	-14.76*** (0.7656)	1.29*** (0.8719)	-6.57*** (5.1939)
Degree of Market Power Squared	-0.002 (1.6101)	-82.46*** (124.89)	-0.32*** (0.3479)	-9.13*** (10.19)
Loans to Assets	-0.37*** (0.1722)	-0.26*** (0.1601)	-0.015*** (0.0286)	0.004*** (0.0334)
Fixed Assets to Total Assets	0.104*** (0.1047)	0.09*** (0.0674)	0.010*** (0.0112)	0.010*** (0.009)
Bank Size	-0.003 (0.0538)	-0.03*** (0.0473)	-0.02*** (0.0149)	-0.02*** (0.0133)
Legal Rights	0.003 (0.0143)	0.001 (0.0124)	0.003*** (0.0066)	0.004*** (0.0073)
Log (GDPpc)	-0.35*** (0.1083)	-0.43*** (0.1077)	-0.074*** (0.0676)	-0.06*** (0.0681)
Constant	-6.71*** (2.6753)	-2.87*** (3.067)	-0.23*** (0.4037)	-0.69*** (0.007)
Number of Banks	70	70	70	70
Number of Instruments	69	69	69	69
First Stage F-test	21.09	44.40	121.98	112.93
P-value	0.00	0.00	0.00	0.00
Hansen's J x^2	57.71	27.26	25.14	26.49
P-value	0.523	0.748	0.835	0.782
AR(1) P-value	-3.27 (0.001)	-3.30 (0.001)	-2.31 (0.021)	-2.50 (0.012)
AR(2) P-value	0.06 (0.951)	0.56 (0.576)	1.96 (0.050)	2.23 (0.026)

Note : Model 1 and 2 shows the impact of efficiency adjusted Lerner index and Boone indicator as alternative measures of bank competition on banking stability as indicated by NPA. Model 3 and 4 explains the impact of adjusted Lerner index and Boone indicator on Z- index. Columns in table report estimated coefficients of each model. Figures in parentheses represent values of t-statistics. Equations estimated using system generalized method of moments. '*' indicates statistically significant at 10% level of significance, '**'denotes statistically significant at 5% level and '***'denotes statistical significance at 1% level. The first stage F statistic tests the relevance of the instrumental variables, while rejecting the hypothesis implies that variables are not exogenous. The Hansen J statistic tests the validity of the instruments used and the rejection implies that the instruments are not valid. Standard robust standard errors are reported in the parentheses.

Table 6: Robustness Test

	Z-score		Equity to Total Assets	
	Model (1)	Model (2)	Model (3)	Model (4)
Lagged Z-score	0.78*** (0.0503)	0.73*** (0.0865)		
Lagged equity to assets			0.87*** (0.0395)	0.87*** (0.0813)
Lerner Index	0.007*** (0.0160)	-0.007*** (0.0254)	0.02*** (0.0139)	-0.002*** (0.0183)
Lerner Index Sq	0.29*** (0.2795)	0.23*** (0.3026)	-0.008 (0.1932)	0.10*** (0.2606)
Diversification	0.007*** (0.0416)	0.004*** (0.0373)	0.001*** (0.0416)	0.01*** (0.0313)
ROA	11.29*** (2.657)	11.95*** (3.2160)	7.33*** (2.1330)	7.99*** (2.4013)
Loan to Total Assets	-0.05*** (0.0744)	-0.06*** (0.0723)	-0.04*** (0.0554)	-0.07*** (0.0839)
Inefficiency	-0.05*** (0.1550)	-0.04*** (0.0620)	0.024 (0.1447)	-0.05 (0.0565)
HHI	-0.17*** (0.1204)	-0.23*** (0.2436)	-0.18*** (0.1418)	-0.11*** (0.2168)
CR3		-0.26*** (0.0723)		-0.17*** (0.3693)
GDP	0.04*** (0.0483)	0.10*** (0.0620)	0.01*** (0.0352)	0.01*** (0.0489)
Inflation	-0.01*** (0.0613)	-0.04*** (0.0761)	-0.04*** (0.0432)	-0.08*** (0.0703)
Banking Freedom	0.13*** (0.2900)	0.19*** (0.3218)	0.14*** (0.2730)	0.23*** (0.3786)
Constant	-0.65*** (0.7299)	-1.20*** (1.0865)	-1.09*** (0.6185)	-1.67*** (0.4589)
Number of Banks	70	70	70	70
Instruments	69	69	69	69
Test of Heteroscedasticity	90.67	174.00	201.24	238.71
P-value	0.00	0.00	0.00	0.00
First Stage F test	79.73	129.94	61.91	136.36
P-value	0.00	0.00	0.00	0.00
Hansen Test	60.62	56.34	54.89	53.84
P Value	0.34	0.38	0.51	0.48
AR(1)	0.17	0.23	0.04	0.06
AR(2)	0.350	0.34	0.59	0.47

Note: Model 1 and 2 explains the effect of Lerner index and Lerner index squared on Z- score. Model 3 and 4 explains the effect of Lerner index and Lerner index squared on equity to assets. Columns in table report estimated coefficients of each model. Figures in parentheses represent values of t-statistics. Equations estimated using system generalized method of moments. '*' indicates statistically significant at 10% level of significance, '**'denotes statistically significant at 5% level and '***'denotes statistical significance at 1% level. The first stage F statistic tests the relevance of the instrumental variables, while rejecting the hypothesis implies that variables are not exogenous. The Hansen J statistic tests the validity of the instruments used and the rejection implies that the instruments are not valid. Standard robust standard errors are reported in the parentheses.

6. Conclusions and Policy Implications

The main objective of this study is to investigate whether the degree of bank competition enhances or hinders the financial stability of Indian commercial banks. We examine the competition-stability relationship for 70 Indian commercial banks during the period 1996 to 2016 using the dynamic panel model. To accomplish this study, we combine two strands of literature into a broad framework. The competition-stability relationship principally requires two sets of indicators along with several bank-specific and macroeconomic characteristics. To measure the financial stability, we use nonperforming loans to total assets to proxy loan portfolio risk, equity to total assets as a proxy for bank capitalization and Z-index as a proxy for overall banking soundness. On the other hand, we employ both structural (HHI and CR3) and non-structural (Lerner index, efficiency adjusted Lerner index, and Boone indicator) approach to measure bank competition. The estimated indices of bank competition measures suggest that since the inception of financial sector reforms in India, the competitive conduct of Indian commercial banking has been increasing gradually.

The empirical findings on the competition-stability relationship suggest that Lerner index has a negative impact on NPLs, indicating that higher market power reduces the incidence of growing problem of nonperforming loans in India. This implies that more market power in the loan market may result in lesser bank risk as the higher interest rates charged to the customers will prevent the borrowers from investing in risky projects. The findings of different ownerships enable us to argue that the two strands of literature need not necessarily yield opposite predictions regarding the impact of bank competition on financial stability. Both the views of Competition-stability and competition-fragility can coexist in a single banking system. The results also clarify a non-linear and inverted U-shaped relationship between competition and stability in India supporting the neutral views of Martinez-Miera and Repullo (2008).

The findings of the study also recommend a few policy implications for Indian banking to enhance stability and suggestions for the successful implementation of the competition policies. Since a concentrated banking system adversely impacts the financial stability, appropriate policy measures should be directed towards fostering competition. Competition policies have larger effects on regional stabilizing and efficiency of the banking system. Therefore, it appears that RBI should undertake certain policies for enhancing bank competition across different ownership groups such that the banking system, as a whole, remains competitive as well as contestable. Policies should also aim at mitigating higher prevalence of non-performing assets in Indian banks particularly public-sector banks such that competitiveness remains unaffected.

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Table 7: Descriptive Statistics

Variables	Obs	Mean	Std. Dev	Min	Max
Lerner Index	1425	0.3156	0.1428	0.073	0.9432
Adjusted Lerner Index	1431	0.1869	0.344	0.002	0.56
Boone Indicator	1431	-143	0.039	-0.014	-0.0245
Z-Score	1470	1.7853	7.1458	4.37659	190.58
Nonperforming Loans to Total Loans	1442	0.0378	0.0936	-0.0636	2.6153
Equity to Assets	1433	0.1523	0.5721	-0.1419	14.33
HHI Deposits	1470	0.0647	0.0104	0.0526	0.0821
HHI Loans	1470	0.066	0.0114	0.0544	0.0917
Loans to Assets	1422	0.6642	2.7057	0.002	50.035
Fixed Assets to Assets	1433	0.5695	2.9833	0	57.78
Size = Log of Total Assets	1431	9.255	2.332	3.403	14.63
HHI	1470	0.0681	0.0136	0.0521	0.0902
CR3	1470	0.2847	0.0222	0.2513	0.3286
Diversification	1458	0.1709	0.1580	-0.3914	1.931
Inefficiency	1440	0.2501	0.2019	0	3.0264
Inflation	1470	0.0704	0.0289	0.0377	0.1317
Log of GDP per capita	1470	0.0700	0.0180	0.0388	0.0957
Legal Rights	1470	2.571	2.3219	0	6
Banking Freedom	1470	33.80	4.857	30	40