Relationship between Financial Stability, Concentration and Competition in Indian Banking Sector

Pankaj Sinha*

Sakshi Sharma**

(Corresponding Author)

Abstract

Academic debate over the effect of competition on stability has lead to study the concept of the relationship of competition and riskiness of banks in detail. In this respect, Martinez-Miera-Repullo 2010 (MMR model) has even propagated the existence of a curvilinear relationship between stability and competition. We have tested this hypothesis on a sample of Indian banks using measures for both stability and riskiness of banks with the use of dynamic panel data models. We find evidence for the presence of a linear relationship between stability index (Z-Index) and competition. It may be pointed out that in the case of Indian banks, both concentration and competition work simultaneously to lend support to the competition-stability view. Increased concentration and increased competition may lead to greater loan portfolio riskiness but this is offset by an increase in overall stability of the banks. Recent talks of the merger of the small bank with larger banks may make the industry more concentrated which may increase the loan portfolio riskiness. Given the fact that banks have held higher capital and have used other means to mitigate the risks they eventually will have safer portfolios overall. Regulators should adopt a more cautious approach to evaluating and approving mergers of banks at the national level. The understanding of competition and concentration, and its impact on the riskiness of loan portfolios and stability of banks is important to formulate steps needed to be devised to foster competition within the industry. The study is a pioneering work with respect to banking sector competition and its effects in Indian Banking Industry.

Keywords:

Competition, H statistic, Concentration, Loan Portfolio Riskiness

INTRODUCTION

A primary objective of liberalizing an economy is to foster more competition, which was one of the various stringent measures introduced in the reforms of the 1990s. With the objective to increase competition, frequent measures were taken to introduce entry of foreign banks, increase private sector participation, etc. However, whether competition does affect banks' stability is an interesting ground for debate. Competition is regarded as a precondition to efficiency by providing a strong boost to efficiency. In this light, increased banking sector competition might result in more stability of banks. On the flipside, competition might also increase investments in riskier portfolios by banks to compensate for the decline in profit levels. In principle of banking supervision, banking competition may amplify the insolvency risk of financial institutions and, in turn, affect the stability of the entire banking system. As a result of competition, banks might invest in riskier loan portfolios and increase the credit risk in the form of non-performing loans which weakens their stability and eventually might even lead to bank failure. This is documented as the 'franchise value paradigm' wherein it has been argued that the controlled competition should motivate banks to protect franchise values by

* *Professor, Faculty of Management Studies, University of Delhi*

** *Assistant Professor, Shaheed Bhagat Singh College, University of Delhi*

investing in safety measures. This could be investing in riskier assets or maintaining low capital levels. Academic debate over this model began with the work of Boyd and De Nicolo (2005). They modelled that competition may lead to increased default risks and greater bank instability. Later, the risk shifting paradigm which was proposed as an argument to it, suggested that an increase in competition could lower loan rates decrease credit risk and increase financial stability (Boyd et al., 2006).

In the last decade, extensive empirical literature has explored the links between competition and stability in banking system as a whole. Empirical arguments built up on this relationship have given mixed results. In one of the views, as discussed above (the competition-fragility view), it has been stated that competitive banking systems are more stable because of the numerous lending opportunities, high profits, and charter values of indigenous banks makes them less interested in excessive risk taking (Keeley, 1990; Allen and Gale, 2000, 2004; Carletti, 2008). In the contrary view (competition-stability view), it has been contended that competition among banks leads to less stable banking systems. This is mainly because the market power of banks results in higher interest rates for customers making it more difficult for them to repay loans. In turn, it increases the possibility of loan default and increases the risk of bank portfolios and, consequently, makes the financial system less stable (Boyd and De Nicolo, 2005).

A similar conclusion between competition and fragility emerges also from the works by Rochet and Vives (2004) and Goldstein and Pauzner (2005), where increased deposit rates lead to more failures. Allen and Gale (2004) empirically test the relationship between competition and stability. The impact of consolidations and concentrations on stability and riskiness is also an open debate. Studies suggest that competition may have an adverse impact on stability; however, competition may also lead to more aggressive risk taking (Cerasi and Daltung (2000) and Keeley (1990)). Literature focuses on the impact of market structure on the bank's incentives to take the risk. Studies pointed out how competition will decrease the ability of banks to take the risk (e.g., Boot and Greenbaum, 1993, Allen and Gale, 2004). Particularly, a higher level of competition may induce banks to become cautious (Carletti, 2008). Recently, the work of Martinez-Miera and Repullo (MMR, 2010)[1] has been popularized, wherein their model identifies the risk-shifting effect in a more competitive banking set up. They hypothesize a non-linear relationship among banks' risk taking stability.

The objective of this study is to examine empirically the relationship between the degree of bank competition, bank concentration, riskiness of loan portfolio and stability. We try to explore the relationship between Indian Banks as propagated by franchise value and risk shifting models to extract whether this relationship is U-shaped and curvilinear or a linear relationship according to the risk shift and franchise value models Our analysis of the Indian banking system helps us to use the database to construct concentration measures as well as time to vary PRH-statistic as a measure of competition.

The study contributes to the existing debate on bank risk taking and degree of competition, concentration and also its effect on the financial stability of banks. The banking sector in India is characterized by the presence of Public, Private, and Foreign banks. The well developed and fundamentally strong system faces challenges in terms of increasing presence of foreign banks and private sector banks and increased instability due to non-performing assets.

Financial Sector Competition: Nature

Why competition is considered necessary and why is it so crucial in the financial sector? Firstly, the degree of competition matters and affects the production efficiency of services, secondly, it impacts the quality of financial products and, thirdly, it also affects financial innovation.Claessens and Laeven (2004) point out that empirical literature on the measurement of the degree of competition is still at a very nascent stage. Specific to this sector is the assessment of the impact of degree of competition on financial stability which has been documented empirically as well as theoretically long ago. It can act as a guide to the conduct of policy towards banks at the macroeconomic level. This invites ourinterest in the relationship between bank competition and stability.

Does Competition Induce Risk-taking Behaviour?

In general, competition is regarded as a means to boost the efficiency of banks by lowering the asymmetry in information. However, it may also force banks to indulge in a more risky behavior as they might want to

1 *According to the authors when banks charge lower rates, their borrowers have an incentive to choose safer investments, so they will become safer.Their paper shows that when this effect is taken into account, a U-shaped relationship between competition and the risk of bank failure generally obtains.For more details refer to : Martinez-Miera, D., &Repullo, R. (2010). Does competition reduce the risk of bank failure?. Review of Financial Studies, 23(10), 3638-3664.*

compensate declining profits due to competition. Taking up risks to compensate for profits may sometimes make the entire system less stable. The relationship between competition and riskiness takes a more complex role where the analysis captures competition on both sides of the bank balance sheet, i.e., deposit side as well as a lending side (Boyd and De Nicolo, 2005).

Relationship Between Competition, Concentration, and Riskiness

Competition, specifically in the banking sector, has been measured by two different approaches. One of the approaches, the structural approach relies upon the structure of banking market to conclude about the level of competition. It measures the number of banks in the market and calculates their relative market share implying that competition would depend upon the number and the size of banks in the existing market. In such a scenario, highly concentrated markets would be considered as less competitive. Early theorists analysed the relationship between concentration and riskiness of banks. Some were even of the view that banks operating in highly concentrated markets may be less risky and may prefer to avoid risk. A very early attempt on the degree of competition based upon market structure was the SCP paradigm which conceptualized the relationship between structures of bank market, their conduct and performance. The structure was mainly defined by concentration in the market, conduct indicated the way the firms behaved in the market, and performance highlighted efficiency. This hypothesis advocated that structure impacts the conduct of firms, for example, a lower concentration of firms would mean indulging in a more competitive conduct by them, which in turn affect efficiency. This approach, therefore, uses concentration as a measure of competition and infers that higher concentration would mean less competition. In this case, the degree of competition depends upon the number of banks and the size of banks in the market.

In this paper, we try to the gauge three relationships, one between the concentration of banking markets and stability, the second between competition and stability, and thirdly between concentration, competition and loan portfolio riskiness.

Literature Review

The literature review highlights the major studies which have explored the competition-stability relationship. We intentionally wish to assess the various competition measures as well as the riskiness measures which have been used so far to understand this relationship. The seminal article by Keeley (1990) triggered the debate about the competition and stability relationship. Demsetz (1996) showed that US banks with greater market power have the largest capital ratios and greater asset volatility. Bofondi and Gobbi (2006) found that a bank's loan default rate increases as the number of banks in market increases. The study was carried out forItaly. Jayaratne and Strahan (1998) show that the performance of US banks increased significantly with easy branch licensing and lifting up of barriers for the operation of banks. The resultant increase in competition leads to a decline in profitability which counters the franchise value paradigm. However, Hannan and Prager (1998) documented the evidence that increased branch licensing leads to reduced profitability. Shaffer (1998) finds that increased new entry marks greater competition in the loan market which, in turn, increases the loans losses due to degrees of asymmetries in the information. The above studies focused on a single country analysis.

As banks start gaining more and more market power they gain more franchise value. The franchise value represents the intangible capital and can only be nurtured if a bank survives. In such a situation, banks take fewer risks and avoid holding risky portfolios. They will behave more prudently by holding more equity capital. Alternatively, as competition decreases, it might be possible that banks riskiness increases. In such a case, banks possessing higher market power will earn more interest by increasing their interest rate due to a decrease in competition.

There have been numerous studies in a cross-country institutional setup. One of the very major studies was by Beck et al. (2006), who examined data from 69 countries over a 20-year period. They concluded that highly concentrated markets were related with greater risk of failures. Boyd and De Nicolo (2005), and Schaeck et al. (2006) argue that market power may make the banking system more fragile and unstable.Schaeck et al. (2006) by means of a logit model and duration analysis conclude that more competitive banking systems (measured using the Panzar and Rosse H-statistic) have a lower probability of bank failure, and hence are considered to be more stable than monopolistic systems. With respect to Indian banking studies, Zhao et al. (2009) conclude that deregulation measures, which aimed at promoting competition in the early 1990s, led to increased riskiness among Indian banks. Turk-Ariss (2010) assesses how various degrees of market power affect bank efficiency and the stability of the banking systems of developing

countries. In a similar study, Casu and Girardone (2009) study the link between competition and efficiency for banking sectors of five EU countries. They use the Granger Causality tests and find a positive causation running from market power to efficiency, however, no evidence was found for the opposite causation.

In a major study by Berger et al. (2009), using data from banks from 23 countries, authors find mixed results and weak support to the competition–stability relationships. Very recently a study by Martinez-Miera and Repullo (2010), points towards a curvilinear relationship between competition and stability. They suggest, from their empirical work, that increased competition may decrease the default rate of borrowers (risk-shift effect), along with a decline in the interest payment from good loans these interest payment from performing loans may act as a cushion against loan losses (the margin effect). They suggest that the relationship between competition and stability may be curvilinear leading to a U-shaped curve when one is plotted against the other. It was further argued that in highly concentrated or lesser competitive markets, risk-shifting effect dominates and greater competition will reduce the riskiness of banks. Similarly, in markets which are highly competitive, margin effect will be prevalent and an increased competition will wear away the franchise value, thereby encouraging risk taking.

Concentration measures have largely been used by researchers to proxy for market power or competition in the industry. Boyd et al. (2006) use various measures of the riskiness of banks to find empirical evidence in favour of the risk shifting theory. They use HHI (Herfindahl-Hirschman-Index) as a measure of bank competition. They found an inverse and significant relationship between bank stability and HHI, implying that market with greater concentration will lead to greater risk of failures. De Nicoló and Loukoianova (2007) also found similar results when accounting for ownership of banks in the same equation.

It may be pointed out at this stage that the two arguments about the effect of competition on risk may always not produce contradictory results. Even if market power makes banks to invest in riskier loan portfolios, the overall risks of the banks need not necessarily increase. They may use other risk mitigating methods to protect their higher franchise value and increase their overall stability. Specifically, they can trim down the higher risk exposure through more equity capital, and a reduced interest rate risk and risk-mitigating techniques. Thus, even if the bank charges higher rates for business loans and has a more risky loan portfolio, the bank may still be stable overall. This argument was suggested by Berger et al. (2009). Against this backdrop, we consider it important to include two dependent variables, one capturing the overall banking stability and one for the loan portfolio risk. It may also be highlighted that using two dependent variables may also distinguish whether one or both the theories are operating at the same time or not.

OBJECTIVES OF THE STUDY

On the basis of literature that has been studied, the following objectives are investigated

1) To find any significant relationship between various measures of concentration & Z - Index (Financial Stability)

2) To find any significant relationship between various measure of competition and Z - Index and loan portfolio riskiness.

DATA COLLECTION AND METHODOLOGY

We use bank level balance sheet and income statement data for 68 Scheduled commercial banks, as obtained from data sources, CMIE Prowess and Bloomberg. Data for all the public sector, private sector, and foreign banks is obtained for a period of 15 years from 2000 to 2014. In the process of collecting the data, banks with incomplete information were dropped from the panel. Banks with only three or more than three years consecutive observations were considered, while banks which underwent a merger were considered as a collective unit after the merger, while being considered as a separate entity before the merger took place. This forms an unbalanced panel of 924 bank-year observations.

In this study, we use measures of competition (PRH) and concentration to analyse the competition-stability relationship and to find evidence with respect to the MMR model, risk shifting or franchise value paradigm. We use two standard measures of bank concentration, HHI and CR (5) as in Jiménez et al. (2013). We also construct the yearly estimates of PRH or Panzar-Rosse statistic (PRH Statistic) by computing time varying PRH-statistics. This would give us yearly value for the degree of competition in the Indian banking industry. The computation of this statistic requires exhaustive bank-specific information and has been discussed in the coming sections.

Measures of Concentration

As evidenced from previous literature, we use the k-firm concentration ratio (CR k) for assets. In this case, we use 5 bank concentration ratios indicated as CR5 and the HHI or Herfindahl and Hirschman Index for assets. To have a glimpse of ideas of the market structure, particularly the concentration, we use both HHI and CR measurement techniques, where the value of k depends on the arbitrary decision of the researcher. The mathematical formula of HHI is:

$$HHI = \sum_{i=1}^{n} MS_i^2$$

where MS represent market share of the firm i in the market and n is the number of firms.

Measure of Competition

To measure the degree of competition we follow the reduced form revenue model as developed by Rosse and Panzar(1982) known as the PRH Statistic. The estimation of this statistic is done in the following manner:

$$\ln TR_{it} = \beta'_0 + \beta'_1 \ln EE_{it} + \beta'_2 \ln CA_{it} + \beta'_3 \ln AL_{it} + \beta'_4 \ln PA_{it} + \beta'_5 \ln Asset_{it} + \beta'_6 \ln SA_{it} + \beta'_7 GDP_t + \varepsilon'_{it}$$

(Equation 1)

In the above model, competition will be estimated using the sum of factor price elasticities of each of the bank-specific factors. Therefore, PRH will be computed as:

$$H = \beta'_1 + \beta'_2 + \beta'_3$$

(Equation 2)

However, as suggested by Bikker and Haaf (2002), ignoring the market dynamics due to institutional and regulatory changes, estimation without accounting for the market dynamics may lead to imprecise estimations of PRH statistic. This, in turn, could lead to incorrect inferences drawn on the nature of competition. Hence, we multiply the elasticities of PRH by a continuous time curve mode. Therefore, as pointed out Molyneux et al. (1994), without the assumption of this gradual change, the results may be improper. To estimate PRH statistic on a yearly basis we use the panel EGLS estimation. As we assume the correlation of a time series of bank revenues with its past and future values, Estimated Generalized Least-Squares (EGLS) procedure is followed. The estimation is done with the cross section weights, as it also checks for the presence of cross-section heteroskedasticity.

As mentioned, we allow for the Estimated Generalized Least Square Function of PRH statistic which gives us yearly estimates for the same.

$$lnTR_{it} = \beta_0 + (\beta_1 \ln EE_{it} + \beta_2 ln\, CA_{it} + \beta_3 ln\, AL_{it}) * e^{(\beta_4) Time} + \beta_5 ln\, PA_{it} + \beta_6 ln\, Asset_{it} + \beta_7 ln\, SA_{it} + \beta_8 ln\, GDPG_{it} + \varepsilon_{it}$$

(Equation 3)

EE= Ratio of the Employee Expenses to the total number of Employees

CA=Ratio of the Capital Expenses to Fixed Assets

AL= Ratio of the Annual Interest Expenses to the Total Loanable Funds

PA=Ratio of the Net Provisions for Non-Performing Assets to the Total Asset

TA=Total Assets

SA=Ratio of the Sum of Shareholder's Capital and Reserves to the Total Assets

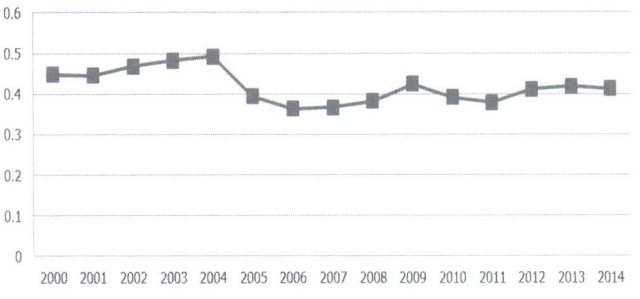
GDP=GDP Growth Rate

$$H = (\beta_1 + \beta_2 + \beta_3) * e^{(\beta_4) t}$$

(Equation 4)

In the Figure (5.1) below, estimates of PRH statistics for each of the years from 2000 to 2014 are presented. PRH statistic is estimated from 2000 to 2014 and the elasticities of PRH statistic are multiplied by continuous time varying function.Time series estimates of PRH statistic were obtained by EGLS regression with a continuous time varying PRH. White diagonal standard errors and covariance matrix is used to assess any heteroscedasticity among the sample banks.

Figure 1: Figure showing the variation of H statistic over the years.



The coefficient of the unit cost of funds comes out to be most significant in all the cases and, invariably, the highest contributor to the PRH-statistic as well. It can also be seen

that the H-statistic was higher for the beginning of the period, i.e., 2000 than for the end of the period, i.e., 2014. This highlights the decline in the degree of competition over the period (confirms to previous paper's hypothesis as well).

Measure of Bank Stability and Riskiness

As a measure of the default risk or bankruptcy risk, we calculate the Z-index for each of the banks over the 15-period horizon. It measures the probability that loss in a particular year will be greater than the equity capital of banks. Normalizing the returns and the bank's equity by bank's assets and utilizing Chebyshev inequality, we obtain a Z-Index inverse of which gives us the probability of book value insolvency (See HannanHenweck, 1956; Yayati and Micco, 2007; Sinha et al.[2] 2009). This will lead us to the estimation of Z-Index in the following manner:

$$Z - Index = \frac{\mu_{ROA_{it}} + \frac{EQ_{it}}{A_{it}}}{\sigma^2_{ROA_{it}}} \qquad \text{(Equation 5)}$$

Where and are bank i's return over asset and equity respectively in period t.and are the mean and the variance of the distribution of .We estimate Z-Index for each bank and each year and as the estimate of variance and mean of ROA a three year estimation window is used.

A smaller value of Z-index is associated with greater riskiness implying lesser return on assets, greater volatility in returns, lower capitalization or higher leverage. Z-Index may, therefore, be considered as a composite score, based on all the three factors of riskiness. Indian banks face an increasing pressure due to the riskiness of their loan portfolio. As a measure to gauge this riskiness, we include non-performing assets to total assets ratio[3] (Berger et al., 2009)

Table 1: Description of the variables used in the paper

Variable	Description	Source
Dependent variables		
NPAs	The bank-level ratio of non-performing assets to total loans; higher the value riskier the loan portfolio	CMIE, Prowess
Z-Index	The bank-level Z-Index; higher the value higher is the stability	Author Constructed
Explanatory Variables		
PRH statistic	A yearly statistic computed from Panzar-Rosse Reduced form revenue model and panel EGLS estimation technique.	Author Constructed
HHI Assets	A yearly indicator of bank concentration computed as Herfindahl Assets Index	Author Constructed
CR5	An indicator of bank concentration, calculated by taking a sample of top 5 banks in terms of asset size	Author Constructed
Bank Size	Natural Logarithm of total assets	CMIE Prowess, 2015
Loan to Asset	Bank level indicator of total loans to total assets	CMIE Prowess, 2015
Capital to assets	Bank level indicator of total equity capital to total assets	CMIE Prowess, 2015
NNII	A bank-specific indicator, Net Non Interest Income	CMIE, Prowess
GDP Growth	A yearly indicator of business cycle effect, in terms of Gross Domestic Product growth	World Bank Database

Model Description

To test the various hypothesis under the MMR, risk shifting and franchise value paradigm, we examine the effect of bank competition on bank risk. The estimation takes the following general form:

$$Risk_{it} = f(MarketStrucutre_{jt}, MarketStrucutre_{jt}^2, Businesscycle_{jt}, BankControlVariables_{it}) \qquad \text{(Equation 6)}$$

As a measure of risk we use the Z-index as well as NPA to total assets per bank per year, where thei subscript refers to a bank and the t subscript refers to the year. The model examines the relationship between bank competition and bank riskiness. We control for bank-specific characteristics using equity ratios and the natural logarithm of total assets. The business cycle effect is controlled using GDP.

The dependent variable is the bank riskiness Z-index and the NPA ratio. To account for the persistence, in the dependent variable, we include a lagged dependent variable among the explanatory variables. Bank specific factors, loan to total assets, total size and liquidity to total assets are included among other explanatory factors to account for bank-specific fixed effects.

2 *The authors use Z-Score to evaluate riskiness of Indian Banks.*

3 *The authors argue that an increased riskiness of loan portfolio may not always imply increase in overall riskiness of banks. Therefore, they use alternative measures such as Z-Index to gauge overall riskiness of banks.*

Our primary objective is to capture the relationship between bank riskiness and competition. As a structure variable in our estimation, we use various measures which could potentially capture the structure of the Indian banking market. Firstly, we use CR5 which is the k-th bank concentration ratio of top 5 banks assets, second, Herfindahl-Hirschman Index (HHI) for the asset is used. Thirdly, the PRH statistic estimated through GLS (see graph) estimation of reduced form revenue equations . We also include the squared term of the structure variable in our model to address the MMR model hypothesis that the relationship between the structure of banking market and riskiness is curvilinear. It might be possible that bank-specific characteristics, loan ratio and size, might be correlated to bank stability and riskiness. In such a scenario, presence of lagged dependent variable along with the presence of endogenous factors, OLS estimation would give biased results. To overcome this, we use Arellano Bond (1991) GMM estimation technique. We use lags of the bank-specific and market structure variables as instruments, and the validity of these instruments is tested using the Hansen J-statistic. We also test for the presence of autocorrelation. As stated, there should be no second order autocorrelation in the residuals.

The econometric models takes the following form

$$Z\,index_{it} = \alpha_{it} + \beta_1 Zscore_{it-1} + \delta_1 Structure_t + \delta_2 Structure_t^2 + \gamma_1 Size_{it} + \gamma_2 Loan\,ratio_{it} + \gamma_3 NNII_{it} + \emptyset_1 GDPG_t + \varepsilon_{it}$$

(Equation 7)

$Z\ index_{it}$, is the riskiness of bank i in year t,

$Size_{it}$ is the natural logarithm of the total assets, is the $ratio_{it}$ of loans to total assets of bank i in year t, $NHII_{it}$ is the ratio of net non-interest income of the bank i in year to total assets.

$$PRisk_{it} = \alpha'_{it} + \beta'_1 PRisk_{it-1} + \delta'_1 Hstat_t + \delta'_2 Hstat_t^2 + \gamma'_1 Size_{it} + \gamma'_2 Loan\,ratio_{it} + \gamma'_3 NNII_{it} + \emptyset'_1 GDPG_t + \varepsilon'_{it}$$

(Equation 8)

For loan portfolio risk, computed as mentioned above, we use Non-performing loan ratio and as a measure of financial stability we use the bank level Z-Indexes. We include squared structure term in our main equations to address the hypothesis of the curvilinear relationship between market power and stability. Miera and Repullo (MMR 2010) suggested that, in a lower competitive environment, a risk-shifting effect is responsible for more failures when interest rates increase. However, the study also assumes that this effect would also be present when the bank managers face a tough competition, as the problem of adverse selection will increase with competition. As understood, at the lower level of competition, the probability of adverse selection is very low. Somehow, being on the path illuminated by Miera and Repullo(MMR 2010), the present study assumes the relation between competition and stability can be curvilinear, that is, as the competition increases, the stability of bank first declines or increases but shifts its direction beyond a certain point.

ANALYSIS

Descriptive statistics

The descriptive statistics of the independent factors have been given below in Table 3.

Table 2: Descriptive statistics of variables used in the paper

	Summary Statistics				
Variables	**Mean**	**Median**	**Maximum**	**Minimum**	**Std. Dev.**
Capital to asset ratio	0.1543	0.1164	0.2801	0.0000	0.0761
NPA	2.4252	1.2300	36.0400	0.0000	3.2225
Z-Index	6.1276	14.3640	133.8090	-6.1742	9.1477
LnTA (size)	12.3401	12.4509	16.7029	6.5144	1.7174
RoA	1.0975	1.0100	9.6400	-3.5600	1.0475
HHI (Assets)	640.26	579.1	901.1	516.9	129.67
CR5	0.4141	0.4040	0.4780	0.3770	0.0351
PRH statistic	0.418	0.413	0.040	0.363	0.491
GDP	7.0021	7.2863	10.2600	3.8040	2.1882

The descriptive statistics reveal some interesting trends. The mean for capital to asset ratio is around 15% which is well above the adequacy ratio requirement. There is a huge gap between the non-performing loan ratios among banks. This clearly indicates for the cross-sectional heterogeneity which exists among banks. The mean of the time varying PRH statistics comes to about 0.418 which indicates a monopolistic competition, similar to non-time varying estimates (Sinha and Sakshi (2018). The concentration ratios of the top 5 banks are around 41% which indicates a moderate degree of penetration in the Indian banking market. The cross-correlation matrix (see Table 3) shows no cross correlation among the independent factors used in the model. This clearly indicates that there is no multicollinearity among the variables used in the study.

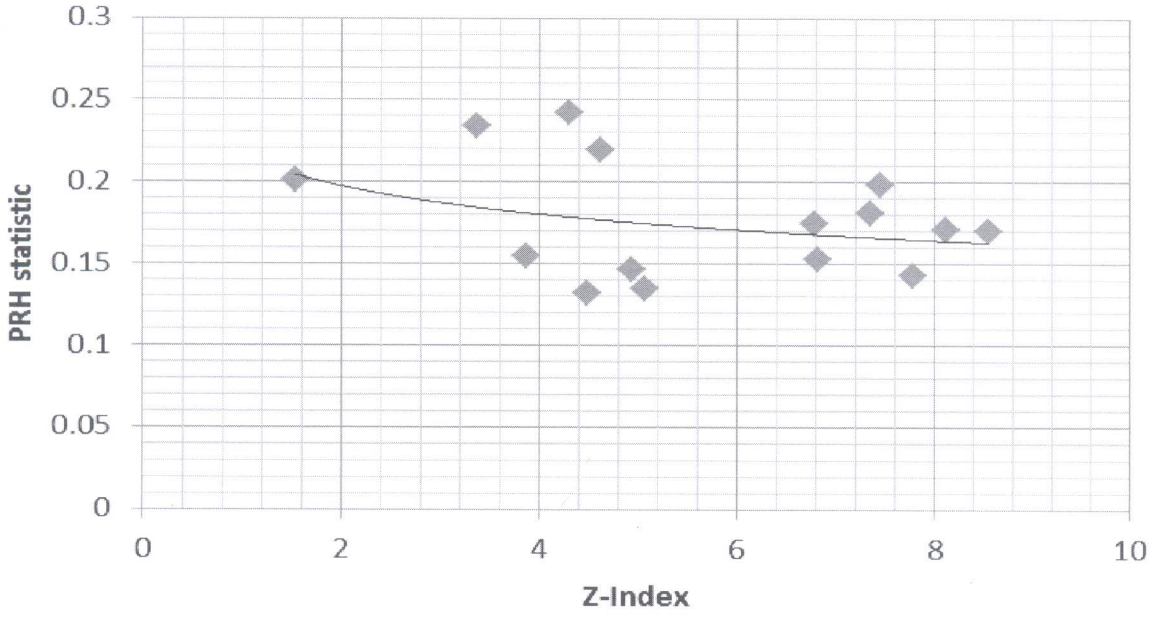
Table 3: Cross-Correlation Matrix

	CR5	HHI_ ASSET	PRH statistic	ROA	Loan to asset ratio	LnTA (size)	Z-Index	NPA	Capital to asset
Capital to Asset	0.0171	0.0153	0.0135	0.2531	0.1887	-0.4552	-0.1205	-0.0204	1.0000
NPA	0.4874	0.4979	0.2827	-0.2151	0.1308	-0.2027	-0.1010	1.0000	
Z-Index	-0.1621	-0.1365	-0.1304	0.0613	-0.0665	0.2271	1.0000		
LnTA(size)	-0.4156	-0.3931	-0.2340	-0.1706	-0.3202	1.0000			
Loan to asset ratio	0.1482	0.1357	0.0825	0.0250	1.0000				
ROA	-0.1026	-0.104	-0.0251	1.0000					
PRH statistic	0.4679	0.4116	1.0000						
HHI_ASSET	0.9800	1.0000							
CR5	1.0000								

Econometric results

Our empirical methodology proceeds in three steps. In the first step, we estimate the yearly estimates of PRH statistic (measure of competition) using the generalized least squares estimation specification as in baseline equation. We also compute the CR5, HHI for assets separately for each year. In the second step, we hypothesize the relationship of market structure parameters with riskiness of banks as per the baseline specification in equation 6. To this end, we test the relationship between stability and the market concentration variables, and also between the degree of competition and stability. Table 4, Table 5 and Table 6, present the GMM estimation results for stability and riskiness against concentration and competition based measures. The validity of the instruments used in the models is satisfactory as shown by Hansen J-test. Additionally, since the models are estimated using first difference, we might get significant first order serial correlation. But the estimates show the presence of insignificant second order serial correlation in the residuals, in the absence of which inconsistency in the results would be implied.

Figure 2: showing the relationship between Z index (mean values) and PRH yearly estimates



The Figure 2 illustrated above shows that the relationship between Z-index and PRH estimates (squared) is unclear. Therefore, we quantify the relationship using a econometric panel data models.

Table 4: Estimations showing relationship between Z-index(stability) and market structure variable (HHI(assets)) and (CR(5))

Market Concentration variable: HHI (Assets) Model (I)			Market concentration variable CR (5) – Model II		
Variables	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*	
Z index(-1)	0.288115*** *(0.001404)*	0.28941*** *(0.00138)*	0.296599*** *(0.0017)*	0.295916*** *(0.001819)*	
Constant	0.002616 *(0.035744)*	-0.2442 (0.03586)	-0.049766 *(0.025592)*	-0.042002 *(0.026797)*	
Size	2.931177*** *(0.132953)*	2.96591*** (0.134708)	2.85816*** *(0.089708)*	2.894912*** *(0.93218)*	
Loan to Assets	-4.470759** *(0.37738)*	-4.62848*** (0.350909)	-4.272912** *(0.472353)*	-4.425056*** *(0.498827)*	
Market Concentration	0.015886*** *(0.000238)*		41.73654*** *(1.124935)*	-	
Market Concentration (squared)		0.00001*** *(0.0000)*		53.15231*** *(1.309459)*	
GDP	0.113387*** 0.002635	24	0.048857*** *(0.002272)*	0.063226*** (0.002432)	
NNII	24.20956* *(7.374614)*	25	19.61618* *(11.50883)*	19.69912 (11.97747)	
Post-estimation results					
J-statistic	62.54726	26	27	60.52334	28
Prob (J-statistic)	0.351473	29	30	0.420609	31
Test order	**m-Statistic**	**Prob.**	**Test order**	**m-Statistic**	**Prob.**
AR(1)	-3.235463	0.0012	AR(1)	-2.6939	0.0071
AR(2)	-0.886783	0.3752	AR(2)	-1.15663	0.2474

J – Statistic-The test for over-identifying restrictions in GMM dynamic model estimation.
AR(1)Arellano-Bond test that average auto covariance in residuals of order 1 is 0 (H0: no autocorrelation).
AR(2) Arellano-Bond test that average auto covariance in residuals of order 2 is 0 (H0: no autocorrelation).
*, **, *** denote significance at 10%, 5%and 1% respectively

Table 5: GMM estimations showing relationship between loan portfolio riskiness and market competition measure PRH-Statistic

Dependent : Loan Portfolio riskiness	Coefficient		Coefficient		
PRisk(-1)	0.355244 *(0.001799)***	32	33	34	35
Constant	-0.273527 *(0.00562)*	36	37	38	39
Size	0.733764 *(0.021709)***	40	41	42	43
Loan to Assets	3.219529 *(0.047649)***	44	45	46	47
Competition (PRH)	12.91905 *(0.146653)***	48	49	50	51
Competition (sqauared)	52	53	14.60788*** (0.164945)	55	56
GDP	-0.164083*** *(0.002241)*	57	58	59	60
NNII	-44.63092*** *(0.457312)*	61	62	63	64
J-statistic	61.55153	65	J-statistic	61.45578	66
Prob (J-statistic)	0.384842	67	Prob (J-statistic)	0.38812	68
AR(1)	-1.506919	0.1318	AR(1)	-1.50936	0.1312
AR(2)	1.310649	0.1912	AR(2)	1.325174	0.1851

J – Statistic-The test for over-identifying restrictions in GMM dynamic model estimation.
AR(1)Arellano-Bond test that average auto covariance in residuals of order 1 is 0 (H0: no autocorrelation).
AR(2) Arellano-Bond test that average auto covariance in residuals of order 2 is 0 (H0: no autocorrelation).
*, **, *** denote significance at 10%, 5%and 1% respectively.

Table 6: GMM estimations showing relationship between Z-index and market competition

Dependent Variable : Stability (Z index)	Coefficient	69 Coefficient 70			
1 Z-Index(-1)	0.296593* *(0.001598)*	72	73	74	75
Constant	-0.2632 *(0.01582)*	76	77	78	79
Size	2.516658*** *(0.060445)*	80	81	82	83
Loan to Assets	-3.25738*** *(0.392753)*	84	85	86	87
Competition (PRH)	1.987086** *(0.229057)*	88	89	90	91
Competition (squared)	92	93	1.700035*** *(0.258206)*	94	95
GDP	-0.0218 *(0.001559)*	96	97	98	99
NNII	19.7302*** *(8.662521)*	100	101	102	103
J-statistic	62.35073	104	105	106	107
Prob (J-statistic)	0.35795	108	109	110	111
AR(1)	-2.68113	*0.0073*	AR(1)	-2.68378	*0.0073*
AR(2)	-1.20495	*0.2282*	AR(2)	-1.19976	*0.2302*

J –Statistic-The test for over-identifying restrictions in GMM dynamic model estimation.
AR(1)Arellano-Bond test that average autocovariance in residuals of order 1 is 0 (H0: no autocorrelation).
AR(2) Arellano-Bond test that average autocovariance in residuals of order 2 is 0 (H0: no autocorrelation).
*, **,*** denote significance at 10%, 5%and 1% respectively.

DISCUSSION OF THE RESULTS

The first column using HHI (assets) as a measure of concentration shows that the coefficient of the linear term is significant and positive. It remains same when the alternative measures of market concentration are used, be it CR5.The coefficient of squared structure term is again positive and significant which indicates a significant positive relationship between stability and HHI.A comparable analysis CR5 also points towards a positive relationship between market power(concentration) and stability. We also find sufficient evidence to conclude that higher concentration is associated with higher values of Z-Index. A possible reason for this might be the erosion of franchise values which increases bank's propensity to indulge in greater risk management practices, or increased returns which thereby increases stability. The results are comparable and consistent among all the concentration measures.

In Table 6, we have used the PRH statistics (as a measure of competition) to map the relationship between riskiness of loan portfolio and degree of competition (PRH). The results show a statistically significant positive relationship between linear competition term, and a significant positive relationship between squared competition term and stability. It may be noted that increasing competition increases the riskiness of the loan portfolios. The results indicate that increased competition leads to increased loan portfolio riskiness, however, this is offset by an increase in overall stability (see Table 7 column 1). It implies an increase in overall bank stability as measured by Z-index because of increased competition. In accordance with arguments by Berger (2009), that even if competition in banking leads to riskier loan portfolios or the increase in the competition level leads to increased riskiness of the bank portfolios, the overall riskiness of banks may or may not increase. This highlights that banks might be using other risk mitigating strategies to reduce their overall risk despite aggravated loan portfolio riskiness.

Coming to the results pertaining to stability (Z-Index) and concentration,it is found that stability of banks increases with increasing degree of concentration, thereby indicating that higher market power would increase stability. It may be pointed out that Boyd and De Nicolo (2005; 2006) predict that if interest rates are high, it is more likely that the loans will become bad assets and the risk will shift from borrower to lender making them more unstable. Consequently, the risk of these loans defaults increases the bank failure likelihood. In case greater competition leads to lower loan rates being charged, it could reduce the probability of default thereby increasing stability (risk-shifting effect). Liu et al. (2010) noted that risk-shifting effect is more dominant in more concentrated banking markets.

The results of Z-index with PRH statistics point towards a linear relationship between competition and stability. This may be due to the fact that when banks compete in the same marketplace, in the presence of higher competition they lose their market shares. Therefore, more competition will erode away their franchise value and lead them to become risky (as they tend to take more risks). Additionally, as pointed out by Allen and Gale (2004), when the degree of competition among banks increases, banks have the least incentive to carefully screen their borrowers which, in turn, increases their riskiness. Another issue which affects fragility in a highly competitive set up is the inter-bank market. Banks which operate in a competitive set up are price takers. They will have to charge lower interest rates to protect their market shares which would decrease their returns. However, banks assess the potential threat situations and follow stringent risk mitigating strategies to counter increased loan portfolio riskiness.

Finally, we briefly discuss the results pertaining to our control variables. Firstly, as we would expect banks with a greater loan to asset ratios have greater riskiness. This is indeed understood from the relationship of the greater loan to asset ratios to greater non-performing assets. With respect to GDP, we find a significant negative relationship between GDP growth riskiness of loan portfolios. However, when we replace our riskiness measure with Z-index, as a measure of stability, we find that this relationship again becomes significantly negative. Larger size in terms of assets contributes to greater stability as well as increased riskiness

CONCLUSIONS AND POLICY IMPLICATIONS

The results highlight that higher concentration may lead to the higher riskiness of loan portfolio. However, this increased riskiness is offset by an increase in overall stability. The results are a consequence of the risk mitigation strategies which are so exploitatively used by Indian banks and their managers. Evidently, it may be noted that increasing concentration or decreasing competition leads to the greater riskiness of the loans portfolios. Our results also support the presence of a linear relationship between competition and stability.

With respect to stability as measured by Z-Index, we find a significant positive relationship between stability and concentration, while this relationship is positive for competition as well.

Finally, it may be pointed out that in the case of Indian banks, both concentration and competition work simultaneously to lend support to the competition-stability view. Increased concentration and increased competition may lead to the greater riskiness of loan portfolio, but also stability at the same time. Recent talks of the merger of the small bank with larger banks may make the industry more concentrated which may increase the loan portfolio riskiness. Given the fact that banks have held higher capital and have used other means to mitigate the risks they eventually had safer portfolios overall. Regulators should adopt a more cautious approach to evaluating and approving mergers of banks at the national level. The study also highlights the importance of risk management by banks. The understanding of this trade-off between competition and concentration, and its impact on the riskiness of loan portfolios and stability of banks is important to formulate, and devise steps to foster competition within the industry.

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