Relationship of financial stability and risk with market structure and competition: evidence from Indian banking sector

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Abstract

Academic debate over the 'competition-fragility view' and 'competition-stability view', in context of the risk shift and franchise value paradigms has lead to study the concept and 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 non-linear relationship between stability and competition. We test these hypotheses on a sample of Indian banks using measures for stability and riskiness of banks. The paper investigates the impact of bank competition and impact of bank concentration on stability, as well as on the riskiness of their loan portfolios .We find evidence for the presence of non-linear relationship between stability index and competition. It may be pointed out that in case of Indian banks, both concentration and competition work simultaneously to support the competition-fragility view. Both increased concentration and decreased competition may lead to greater riskiness with greater instability. The study suggests that it is important to understand the tradeoff between competition and concentration, and their impact on riskiness of loan portfolios and stability of banks for formulating steps to foster competition within the industry.

1 Introduction

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 might eventually 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 investing in safety measures .This could be investing in riskier assets or maintaining low capital levels. Academic debate over this model begun with the work of Boyd and De Nicolo(2005).They modeled 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. In One of the views, as discussed above (the competition-fragility view) it has been stated that competitive banking systems are more stable because 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). On 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, 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 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 risk. Studies pointed out that how competition will decrease the ability of banks to take risk (e.g., Besanko and Thakor, 1993, Boot and Greenbaum, 1993, Allen and Gale, 2004. Particularly, a higher level of competition may induce banks to become cautious (Carletti,2007)Recently the work of Martinez-Miera and Repullo(MMR,2010) has been popularized wherein their model identify the risk shifting effect in a more competitive banking set up. They hypothesize a non linear relationship among bank risk taking stability.

The objective of this paper is to examine empirically the relationship between degree of bank competition, bank concentration , riskiness of loan portfolio and stability. We try to explore the relationship for Indian Banks as propagated by franchise value and risk shifting models to extract whether this relationship is U shaped and non-linear 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 time varying 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 across. 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 increased instability due to non-performing assets. Most studies study the relationship of either bank stability and competition or bank stability and foreign participation and ownership effects. However, in the present study we try to gauge all three relationships. The paper is organized as follows.Section 2 reviews the literature leading to the hypothesis development. Section 3 details the research methodology. Section 4 presents the empirical results. Finally, Section 5 concludes the study with policy implicat

ions.

2 Literature Review

In this section we highlight 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 understand this relationship. Seminal article by Keeley (1990) triggered the debate about competition and stability relationship.Demsetz(1996) show US banks with greater market power have 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 a market increases. The study is carried out for Italy.Jayaratne and Strahan (1998) show that the performance of US banks increased significantly with easy branch licensing and lifting up of barriers for operation of banks. The resultant increase in competition leads to a decline in profitability which counter the franchise value paradigm. However, Hannan and

Prager (1998) documented the evidence that increased branch licensing leads to reduced profitability. Shaffer(1998) find 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 less risks and avoid holding risky portfolios. They will behave more prudently by holding more equity capital.

Alternatively, as competition is 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 set up.one of the very major studies was by Beck et al. (2006), examining data from 69 countries over a 20 year period. The 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. Zhao et al.(2009) conclude that deregulation measures which aim at promoting competition in the early 90's lead to increased riskiness among Indian banks .Turk-Ariss(2010) assesses how various degrees of market power affect bank efficiency and the stability in banking systems of developing countries. In a similar study, Casu and Girardone (2009) study the link competition and efficiency for banking sectors of five EU countries. They use 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 Berger et.al (2009) use data of banks from 23 countries, they find mixed results and light support to the competition-stability relationships. Very recently, Martinez-Miera and Repullo(2010) point towards a non-linear 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(this is the margin effect).They suggest that the relationship between competition and stability may be be

non-linear 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 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 riskiness of banks to find empirical evidence in favor of 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 failures. De Nicoló and Loukoianova (2007) also found similar results when accounting for ownership of banks in the same equation.

3 Data

We use bank –level, balance sheet and income statement data for 68 Scheduled commercial banks , as obtained from data sources, CMIE Prowess, ACE Equity and Bloomberg.Data for all the public sector, private sector and foreign banks is obtained for a period of 15 years from 2000 to 2015. 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 undergo a merger were considered a collective unit after the merger, while considered as a separate entity before the merger took place. This forms an unbalanced panel 924 bank-year observations.

In this paper, we use various measures of competition and concentration to analyze the competition stability relationship and to find evidence in favor of 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 Panzer-Rosse statistic(PRH Statistic) using the non-linear estimation. 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.

3.1 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 ratio indicated as CR_5, and the HHI or Herfindahl and Hirschman Index for assets as well as loans.

3.2 Measure of Competition

To measure the degree of competition we follow the reduced form revenue model as developed by Rosse and Panzer known as the PRH Statistic.

$$\ln TR_{it} = \beta'_0 + \beta'_1 \ln EE_{it} + \beta'_2 \ln CA_{it} + \beta'_3 \ln AL_{it} + \beta'_4 \ln PA_{it} + \beta'_5 \ln Asset_{it} + \beta'_6 \ln SA_{it} + \beta'_7 GDP_t + \varepsilon'_{it} \quad \text{Equation 1}$$

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

$$H = \beta'_1 + \beta'_2 + \beta'_3 \quad \text{Equation 2}$$

However, as suggested by Bikker and Haaf (2002), ignoring the market dynamics due to institutional and regulatory changes , linear 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 H by a continuous time curve model $e^{(\beta_4 * t)}$.Therefore, if time = 0 this will imply that H is constant over time. As pointed out by Molyneux et al. (1994), without the assumption of this gradual change the results may be improper. We therefore introduce a time varying model for estimation of PRH statistic on a year on year basis.

As mentioned in literature we allow for the non- linear estimation of PRH statistic which gives us yearly estimates for the same.

$$lnTR_{it} = \beta_0 + (\beta_1 \ln EE_{it} + \beta_2 ln\, CA_{it} + \beta_3 ln\, AL_{it}) * e^{(\beta_4 * t)} + \beta_5 ln\, PA_{it} + \beta_6 ln\, Asset_{it} + \beta_7 ln\, SA_{it} + \beta_8 ln\, GDPG_{it} + \varepsilon_{it} \quad \text{..Equation 3}$$

$$EE = \text{Ratio of the Employee Expenses to the total number of Employees}$$

$$CA = \text{Ratio of the Capital Expenses to Fixed Assets}$$

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

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

$$Asset = Total\ Assets$$

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

$$GDP = GDP\ Growth\ Rate\ of\ the\ country$$

$$\boldsymbol{H = (\beta_1 + \beta_2 + \beta_3) * e^{(\beta_4 * t)}} \qquad \textbf{Equation 4}$$

In the table below we present the estimates of PRH statistics for each of the years from 2000 to 2013.We however use the consolidated measure utilizing results from the non-linear regression estimates of each year(consolidating it into a single index),as a measure of the degree of competition for precisely estimating competition. We further use these estimates to model the competition-stability relationship.

Table 1: Yearly estimates of estimated PRH statistic

Year	PRH-Stat
2000	0.136641
2001	0.115403
2002	0.550474
2003	0.379444
2004	0.583852
2005	0.377043
2006	0.183406
2007	0.064245
2008	0.081895
2009	0.136443
2010	0.081643
2011	-0.454101
2012	0.074288
2013	0.173269
2014	0.066234

The coefficient of unit cost of funds comes out to be most significant in all the cases , and invariably the highest contributor to the H -statistic as well. It can also be seen that the H-statistic was higher for beginning of the period, 2000, than for the end of the period i.e 2014.This highlights the decline in the degree of competition over the period.

3.3 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 Chebishev[1] inequality we obtain a Z index inverse of which gives us the probability of book value insolvency (See Hannan Henweck (1956), Yayati and Micco (2007),Sinha et.al[2] (2011)).This will lead us to the estimation of Z-Index in the following manner

[1] Accounts that in all proabibility distributions all values are close to the mean

[2].The authors use Z-Index to evaluate riskiness of Indian Banks.

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

Where ROA_{it} and EQ_{it} are bank i's return over asset and equity respectively in period t. $\mu_{\text{ROA it}}$ and $\sigma^2_{\text{ROA it}}$ are the mean and the variance of the distribution of ROA_{it}. We estimate Z index for each bank and each year. As our estimate of variance and mean of ROA we use the three year estimation window.

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 index 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)

[3] The authors argue that an increase 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.

Table 2: Description of the variables used in the study.

Variable	Description	Source
Dependent variables		
NPLs	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 value higher is the stability	Author Constructed
Explanatory Variables		
PRH statistic	A yearly statistic computed from Panzar-Rosse Reduced form revenue equations, but through in a non- linear estimation technique.	Author Constructed
HHI Assets	A yearly indicator of bank concentration , computed as Herfindahl Assets Index	Author Constructed
HHI (Loans)	A yearly indicator of bank concentration , computed as Herfindahl Loans Index; higher value indicating higher concentration	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
Liquidity to asset ratio	A bank-level ratio of total liquidity to total assets	CMIE Prowess, 2015
GDP Growth	A yearly indicator business cycle effect , in terms of Gross Domestic Product growth	World Bank Database
Inflation (CPI)	Yearly CPI Inflation values	World Bank Database
Foreign ownership	Percentage of assets owned by foreign banks calculated as ratio of foreign bank assets to total bank assets.	Author Constructed

4 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:

$$Risk_{it} = f\left(Market\ Strucutre_{jt}, Market\ Strucutre_{jt}^{2}, Business\ cycle_{jt}, Bank\ Control\ Variables_{it}\right)$$

Equation 6

As a measure of measure of risk we use Z-index as well as NPA to total assets per bank per year.

where the *i* 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 natural logarithm of total assets. The business cycle effect is controlled using GDP and Inflation.

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.

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 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 loans as well HHI for asset. Thirdly, the time varying yealry PRH statistics(see table) estimated through reduced form revenue equations estimated through a non-linear regression model.

We also include the squared term of the structure variable in our model to address the MMR model hypothesis that the relationship between structure of banking market and riskiness is not linear. It might be possible that bank specific characteristics loan ratio, size and liquidity might be correlated to bank riskiness and NPA ratio. In such a scenario presence of lagged dependent variable alongwith 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 model takes the following form:

$$Z-index_{it} = \alpha_{it} + \beta_1 Z-index_{it-1} + \delta_1 Structure_t + \delta_2 Structure_t^2 + \gamma_1 Size_{it} + \gamma_2 Loan\ ratio_{it} + \gamma_3 Liquidity_{it} + \emptyset_1 GDPG_t + \emptyset_2 Inflation_t + \eta_i + \varepsilon_{it} \quad \text{Equation 7}$$

$Z-index_{it}$, is the riskiness of bank i in year t, $Size_{it}$ is the natural logarithm of the total assets, $Loan\ ratio_{it}$ is the ratio of loans to total assets of bank i in year t, $Liquidity_{it}$ is the ratio of liquid assets of bank i in year t to total assets.

As a structure variable we use CR5 Concentration ratio, HHI for loans, HHI for assets and loans

$$Risk_{it} = \alpha'_{it} + \beta'_1 Risk_{it-1} + \delta'_1 Hstat_t + \delta'_2 Hstat_t^2 + \gamma'_1 Size_{it} + \gamma'_2 Loan\ ratio_{it} + \gamma'_3 Liquidity_{it} + \emptyset'_1 GDPG_t + \emptyset'_2 Inflation_t + \eta'_i + \varepsilon'_{it} \quad \text{Equation 8}$$

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 MMR model, of the non linear relationship between market power and stability. η_i accounts for the unobservable bank-specific effects and ε_{it} for the idiosyncratic error. As an evidence of in favor of risk shifting effect, we would obtain positive and significant signs for δ_1 and δ_2 .If we obtain negative and significant sign for δ_1 andδ_2, it would imply the presence of the franchise value effect. However, if we obtain significant values for both δ_1 and δ_2 with opposite signs it would still imply a non-linear relationship but would be a direct evidence for MMR model.

5 Analysis

5.1 Descriptive statistics

The descriptive statistics of the independent

Table 3: Descriptive statistics

Summary Variables					
Capital to	0.1543	0.1164	0.2801	0.0000	0.0761
Liquidity to	0.1566	0.1248	0.9801	0.0000	0.1046
NPA	2.4252	1.2300	36.0400	-	3.2225
Z-Index	26.1276	14.3640	133.8090	-	9.1477
LnTA(size)	12.3401	12.4509	16.7029	6.5144	1.7174
RoA	1.0975	1.0100	9.6400	-	1.0475
HHI(Assets)	0.0640	0.0579	0.0901	0.0516	0.0130
CR5	0.4141	0.4040	0.4780	0.3770	0.0351
PRH Statisitc	0.1725	0.1364	0.5839	-	0.2362
GDP	7.0021	7.2863	10.2600	3.8040	2.1882
Inflation	6.8155	6.3532	11.9923	3.6848	2.8443

The descriptive statistics reveal some interesting

Table 4 : Cross Correlation Matrix

Capital to	1.0000			
Liquidity	0.6282	1.0000		
NPA	-	0.0870	1.0000	-

CR5	HHI_LOAN	HHI_ASSE	PRH	ROA	Loan to	LnTA(size)	Z-
0.0171	0.0270	0.0153	0.0135	0.2531	0.1887	-	-
0.2203	0.0188	0.2109	0.0998	0.2876	0.1556	-	-
0.4874	0.0159	0.4979	0.2827	-	0.1308	-	-
-	-	-	-	0.0613	-	0.2271	1.0000
-	-	-	-	-	-	1.0000	
0.1482	-	0.1357	0.0825	0.0250	1.0000		
-	0.0065	-	-	1.0000			
0.4679	0.4007	0.4116	1.0000				
0.9800	0.0502	1.0000					
0.0445	1.0000						
1.0000							

5.2 Econometric results

Our empirical methodology proceeds in three steps. In the first step we estimate the non-linear yearly estimates of PRH statistic using the specification as in $\boldsymbol{lnTRit} = \boldsymbol{\beta_0} + (\boldsymbol{\beta_1} \ln \boldsymbol{EE_{it}} + \boldsymbol{\beta_2 ln\, CA_{it}} + \boldsymbol{\beta_3\, ln\, AL_{it}}) * \boldsymbol{e^{(\beta_4 * t)}} + \boldsymbol{\beta_5 ln\, PA_{it}} + \boldsymbol{\beta_6 ln\, Asset_{it}} + \boldsymbol{\beta_7 ln\, SA_{it}} + \boldsymbol{\beta_8 ln\, GDPG_{it}} + \boldsymbol{\varepsilon_{it}}$

..Equation 3. We also compute the CR5, HHI for loans and assets separately for each year. In the second step, we hypothesize the relationship of market structure parameters with riskiness banks as per our baseline specification in $\boldsymbol{Riskit} =$

$$f\left(Market\ Strucutre_{jt}, Market\ Strucutre_{jt}^{2}, Business\ cycle_{jt}, Bank\ Control\ Variables_{it}\right)$$

Equation 6.To this end, we test the relationship between stability and three market structure variables , between competition and stability .In the third and final step we also see the impact of concentration and degree of foreign penetration on degree of competition (as measured by non-linear estimation PRH statistic)

Table 5, Table 6, Table 7 presents 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.

In all the six different regressions lagged endogenous variable (both NPA ratios and Z-indexs) is significant at 1% level, which confirms the persistence in the riskiness values.

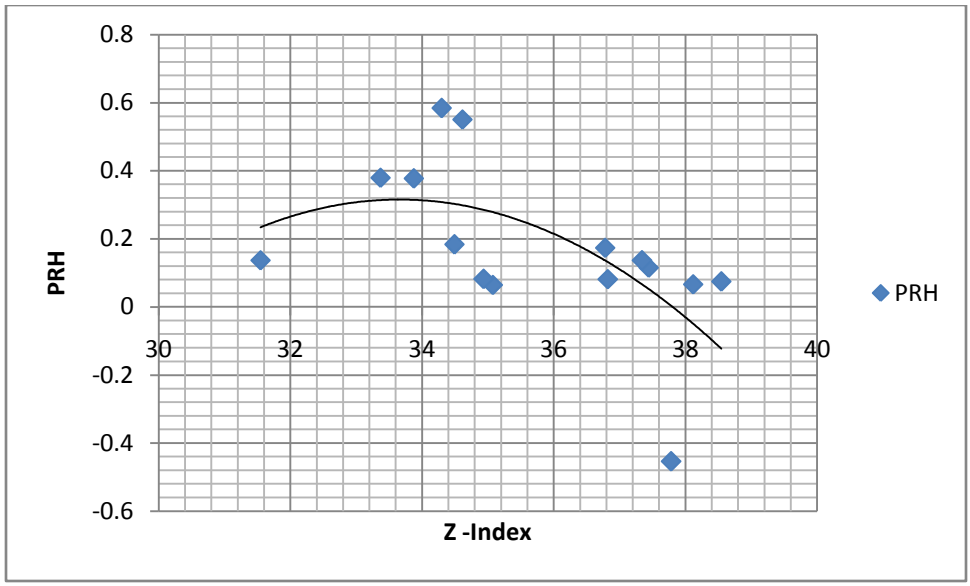

Figure 1 : showing the relationship between Z index and PRH statistic

The above figure shows a curvilinear relationship between Z index values and PRH statistic meausring competition.However, we need to document an empirical relationship by estimating GMM panel data model.

Table 5: Estimations showing relationship between Loan Portfolio riskiness and market structure variables (HHI,CR5,HHI(loans)

Dependent Variable: NPA	**GMM estimation results**					
Independent Variables	**HHI(Assets)**		**Cr5**		**HHI(Loans)**	
	Coefficient	**S.E**	**Coefficient**	**S.E**	**Coefficient**	**S.E**
NPA(-1)	0.4635***	0.0015	0.4716***	0.0028	0.4969***	0.00231
Capital to Asset	-3.7489	0.2118	-3.3409***	0.3006	-3.6812	0.1742
Size(lnTA)	0.3460***	0.0271	0.3842***	0.0725	0.3600***	0.05131
Loan To Asset	1.5428***	0.3196	2.0679**	0.5188	1.01429*	0.45015
Liquidity to Total Asset	-0.7951***	0.3340	-1.0436***	0.3033	-0.7909***	0.2546
RoA	-0.2571***	0.0088	-0.2621***	0.0144	-0.2895***	0.0121
Structure	0.0905***	0.0004	0.5015***	0.0674	0.0598***	7.47E-05
Structure^2	0.0021***	0.0098	0.4313*	0.0653	0.0564**	4.52E-02
GDP	-0.0394***	0.0049	-0.0355***	0.0114	-0.1393*	0.0155
Inflation	-0.0098	0.0065	0.1044***	0.0562	0.0150	0.02813
Constant	0.0520**	0.0167	0.1015*	0.1240	-0.2298*	0.04426
Prob(J-Stat)	0.486275		0.371447		0.3645	
AR(1)	0.1513		0.1451		0.1467	
AR(2)	0.1702		0.164		0.1479	
No. Of banks	67		67		67	

*, **,*** denote significance at 10%, 5%and 1% respectively.

The results of NPA ratio as a measure of riskiness are shown in Table 5.The first column using HHI(assets) as a measure of competition shows that the coefficient of the linear term is significant and positive .It remains same when the alternative measures of market power are used be it , CR5 or HHI (loans).The coefficient of squared structure term is again positive and significant which indicates a significant positive relationship between NPA ratios and HHI or other concentration based competition measures. A comparable analysis using h HHI (loans) and CR5 also points out towards a positive relationship between market power and non performing loans ratio. Therefore in accordance with the "competition-fragility hypothesis" of Boyd and De Nicolo (2005) or the BDN hypothesis , we find sufficient evidence to conclude that market power is associated with riskier loan portfolios. The results are comparable and consistent among all the three concentration measures.

In another estimation, see Table 6 (column 2) we use the PRH statistics (as a measure of competition) to map the relationship between riskiness of loan portfolio and degree of competition. The results show a statistically significant positive relationship between linear competition term whereas a significant negative relationship between squared competition term and stability. The results are indicative of the MMR model, or a downward shaped parabola with a positive linear term. It may be noted that increasing competition increases riskiness of the bank portfolios .This is again in support of the previous finding that higher market power or higher concentration leads to riskier loan portfolios

In Table 7, GDP growth is positive and significant which indicates a positive effect of GDP on Z-index. Inflation measure is insignificant measure to influence Z indexs. All three structural variables were found to be strong and statistically significant .Bank Specific variables including size, liquidity loan ratios were found to be positively and significantly affecting stability. The concentration variables, HHI loans as well as assets and CR5 all are negatively affecting stability, however their squared structure term is significant and positive. This highlights a non-linear U shaped relationship between stability and concentration. The relationship between stability and concentration indices

Table 6: GMM estimations showing relationship between Z-index and PRH statistic and NPA and PRH statistic.

Dependent Variable : Z index			**Dependent variable: NPA**		
Independent variables	**Coefficient**	**S.E**	**Independent variables**		
Z_INDEX(-1)	0.299569***	0.00408	**NPA(-1)**	0.49393***	0.0031
Capital to Asset	3.005133***	0.53487	**Capital to Asset**	-3.9322***	0.21974
Size(lnTa)	2.043118***	0.06885	**Size(lnTa)**	0.39183***	0.05795
Loan to Asset ratio	-8.12973***	0.87307	**Loan to Asset ratio**	-0.5768	0.52658
NPA	0.164719	0.01263			
Liquidity to assets	2.543028**	0.31361	**Liquidity to assets**	-0.6627*	0.36698
ROA	0.366779***	0.04271	**ROA**	-0.2876***	0.01287
H-Stat	-3.367367**	0.63094	**H-Stat**	0.68974**	0.31622
H-Stat^2	-3.966274*	0.60134	**H-Stat^2**	-0.7854*	0.44263
GDP	-0.097831***	0.0196	**GDP**	-0.1567***	0.009
Inflation	-0.011128***	0.05177	**Inflation**	-0.0092	0.01967
Constant	-0.257984***	0.04409	**Constant**	-0.169***	0.02532
Hansen J-stat Test			***Hansen J-stat Test***		
Prob(J-statisitc)	0.413313		Prob(J-statisitc)	0.31606	
A-B Serial Correlation Test			***A-B Serial Correlation Test***		
AR(1)	0.0049		AR(1)	0.1436	
AR(2)	0.238		AR(2)	0.162	

*, **,*** denote significance at 10%, 5%and 1% respectively.

Table 7 : GMM estimations showing relationship between Z –index and market concentration variables (HHI, Cr5)

Dependent variable	Arellano-Bond GMM estimation Results					
Z-Index	**HHI (Loans)**		**CR5**		**HHI (Assets)**	
Independent Variables	**Coefficient**	**SE**	**Coefficient**	**SE**	**Coefficient**	**SE**
Z_INDEX(-1)	0.285851***	0.0053	0.2859***	0.0037	0.28197***	0.00508
Capital to asset	0.6885	0.6180	1.2755	0.8106	1.14292***	0.51202
Size	2.022012***	0.1787	1.8408***	0.1411	2.06878***	0.19780
Loan to asset	-9.4451***	0.6617	-10.8561***	0.9234	-9.20725***	0.71997
NPA	-0.1040***	0.0060	-0.0454***	0.0056	-0.09877***	0.00802
Liquidity to assets	1.8984***	0.2554	2.2764***	0.3039	2.09476***	0.44774
ROA	0.2851***	0.0273	0.3609***	0.0216	0.25602***	0.03042
Structure	-0.0621***	0.0131	-1.7090***	0.2235	-0.05680***	0.00431
Structure^2	0.0013***	0.0022	0.1620***	0.0029	0.01721***	0.00151
GDP	0.0712***	0.0094	0.1900***	0.0174	0.04086***	0.01991
INFL	0.0855***	0.0179	0.1765**	0.0919	0.11454***	0.04866
Constant	0.2838***	0.0769	-0.0913	0.1841	0.21403	0.13965
Hansen J-statistic						
Prob	0.203965		0.319282		0.575999	
AR(1)	0.0063		0.0066		0.0062	
AR(2)	0.1273		0.1897		0.1113	
No. of banks	67		67		67	

*, **,*** denote significance at 10%, 5%and 1% respectively.

However as argued by Berger (2010), even if market power 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. The Table 6 and Table 7

address this issue by examining the impact of these structure variables as well as degree of competition on Z-index, which is as an inverse proxy of overall bank risk. A higher Z-index might be a result of higher returns or higher capital ratios, which is a measure of stability. The result in Table 7 shows that the linear terms of the structure measure are negatively related to Z index , however, their squared market power terms is positive. This result is consistent with the inverse U shaped function under the MMR model under the concentration fragility view. The stability of the banking sector decreases with increasing degree of concentration, however, after a certain point this relationship becomes positively related thereby indicating that higher market power would increase stability. Boyd and De Nicolo (2005;2006) predict that if interest rates are high, it is more likely that the loans will become bad assets. Consequently 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 empirical results of Z index with PRH statistics point towards a decreasing linear relationship between competition and stability. The findings provide evidence to the "competition fragility" view. This may be due to the fact that when monopoly power is exercised, bank will try to limit their risk taking in order to maintain their quasi monopoly rents given to them by government charters. When banks compete in the same market place, in the presence of higher competition they lose their market shares. Therefore more competition will erode away their franchise value and lend them to become less stable (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 instability. Another issue which affects fragility in a highly competitive set up is the inter-banking 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 and ultimately affect the stability.

Finally, we briefly discuss the results pertaining to our control variables. Firstly, as we would expect banks with greater loan to asset ratios have greater riskiness and lower stability. This is indeed understood from the relationship of 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 becomes significantly positive. Larger size in terms of assets contributes to greater stability as well as increased riskiness. As expected, greater profitability margin is significantly related to higher stability and lower riskiness of loan portfolio

In the next sections of the study (see Table 8)we would like to derive a relationship between competition, concentration and the effect of entry of foreign banks entry into the banking system. Specifically , we would want to know whether the increasing participation of foreign banks , decreasing concentration is hindering or fostering the formation of a competitive set up for Indian banks or not. We estimate this relationship by following a simple linear regression analysis using annual data on PRH statistics, HHI concentration index, foreign ownership and profitability.

Table 8: Estimation showing relationship between foreign penetration , competition and concentration

Dependent variable : *PRH statistic*				
Independent	***Coefficient***	***S.E***	***Coefficient***	***S.E***
Concentration((HHI(assets))	-1.547865	1.171912	-	-
Concentration(CR5)	-	-	-0.701641	0.577168
Foreign bank share	5.16661	1.57893	5.80814	11.223
GDP	0.010276	0.003822	0.010352	0.003895
Inflation	-0.023981	0.003828	-0.025237	0.004197
LnTA(Size)	-0.003183	0.020201	-0.002836	0.020248
RoA	0.005619	0.008456	0.005705	0.008461
Constant	3.893446	0.604924	4.194493	0.812253
R-squared	0.337255		0.337048	

*, **,*** denote significance at 10%, 5% and 1% respectively.

The results of the above Table 8 indicate that there exists a significant negative relationship between market concentration and competition, which means that higher concentration, leads to lower competition. The result is consistent with the empirical literature on the same. Furthermore,

increasing share of foreign banks in the total assets of the banks, lead to an increase in the competition level within the country. This highlights the importance of foreign banks penetration in the country. The results are consistent with Classens and Laeven (2004), who showed that higher foreign bank participation was associated with higher competition. We also find that higher competition is related to reduced bank profitability, although insignificantly, and competition is also negatively related to bank asset size. Larger bank asset may amount to reduced market powers implying lesser competition.

6 Conclusion

Under the traditional view of competition-fragility, greater bank competition will erode away market power and will decrease profit margin resulting in reduced franchise value. This would motivate banks to take more risk to increase their profitability. Alternatively, under the competition-stability view, greater market power in the market may also lead to higher risk taking. Both these views are also documented as risk shift and franchise value models. However, under the MMR model banking competition and stability have found to be linked in a non-linear manner. Berger et.al (2009) argues that competition and concentration may coexist in a market and can induce fragility or stability at the same time. Against this backdrop, it is of interest to assess the relationship between bank competition, concentration and bank fragility in case of Indian banks. The paper investigates the impact of bank competition and impact of bank concentration on stability, as well as on the riskiness of their loan portfolios. We also investigate whether this impact is linear or non-linear, in line with risk shift and franchise value models, in line with MMR model. In addition we also investigate the effect of foreign bank penetration on bank competition as measured by PRH statistic, and the relationship between bank concentration and competition. We use data for 68 Indian banks from 2000 to 2014 .The main results highlight, that higher concentration may lead to higher riskiness of loan portfolio; however this is offset by increasing competition which will decrease the riskiness. Evidently, it may be noted that increasing concentration or decreasing competition leads to greater riskiness of the loans portfolios. We find presence of a non-linear relationship or a U shaped pattern between competition and loan portfolio riskiness, in support of the MMR model. With respect to stability as measured by Z-Index, we find a significant negative relationship between stability and concentration, while this relationship is negative for competition as well. While higher

concentration and lower competition may increase riskiness with respect to loan market, it may also decrease overall riskiness of banks (measured by Z index).

Finally, it may be pointed out that in case of Indian banks, both concentration and competition work simultaneously to lend support to the competition-fragility view. Increased concentration and decreased competition may lead to greater riskiness and greater instability. The understanding of this tradeoff between completion and concentration, and its impact on riskiness of loan portfolios and stability of banks is important to formulate, and devise steps to foster competition within the industry.

References

Allen, F., & Gale, D. (2000). *Comparing Financial Systems.* Cammridge,MA: MIT Press.

Arellano, M., & Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *58* (2), 277-297.

Beck, T., Demirguc-Kunt, A., & Levine, R. (2006). Bank Concentration, competition and crisis:First results. *Journal of Banking and Finance , 30* (5), 1581-1603.

Berger, A. N., Klapper, L. F., & Turk-Ariss, R. (2009). Bank Competition and Financial Stability. *Journal of Financial Services Research , 35* (2), 99-118.

Bikker, J. A., & Haaf, K. (2002). Competition, concentration and their relationship: An empirical analysis of the banking industry. *Journal of Banking and Finance , 26* (1), 2191-2214.

Bofondi, M., & Gobbi, G. (2006). Informational Barriers to Entry into Credit Markets. *Review of Finance , 10* (1), 39-67.

Boot, A. W., & Greenbaum, S. I. (1993). Bank Regulation, Reputationand rents: theory and implications. In C. Mayer, & X. Vives, *Capital Markets and Financial Intermediation.* Cambridge: Cambridge University Press.

Boyd, J. H., & De Nicolo, G. (2005). The theory of bank risk taking and competition revisited. *The Journal of Banking and Finance , 60* (3), 1329-1343.

Boyd, J. H., De Nicolo, G., & Jalal, A. M. (2006, December). Bank-Risk Taking and Competition revisited:New Thoery and Evidence. *IMF Working Paper* , p. 47.

Carletti, E. (2008). Competition and regulation in banking. In *Handbook of Financial Intermediation* (pp. 449-482). North Holland: Elsevier.

Carletti, E., & Hartmann, P. (2002). Competition and Stability: What's Special About Banking? *ECB Working Paper No. 146* .

Casu, B., & Girardone, C. (2009). Testing the relationship between competition and efficiency in banking: A panel data analysis. *Economics Letters , 105* (1), 134-137.

Cerasi, V., & Daltung, S. (2000). The optimal size of a bank: Costs and benefits of diversification. *European Economic Review , 44* (9), 1701-1726.

Claessens, S., & Laeven, L. (2004). What Drives Bank Competition? Some International Evidence. *Journal of Money, Credit and Banking , 36* (3), 563-583.

De Nicolo, G., & Loukoainova, E. (2007). Bank Ownership,MArket Strcuture and Risk. *IMF Working Paper no 07/215* .

Demsetz, R. S., Saidenberg, M. C., & Strahan, P. E. (1996). Banks with Something to Lose: The Disciplinary Role of Franchise Value. *Economic Policy Review , 2* (2).

Goldstein, I., & Pauzner, A. (2005). Demand-Deposits Contracts and Probability of Bank Runs. *The Journal of Finance , 60* (3), 1293-1327.

Hannan, T. H., & Prager, R. A. (1998). The Relaxation of Entry Barriers in the Banking Industry: An Empirical Investigation. *Journal of Finacial Services Research , 14* (3), 171-188.

Jayaratne, J., & Strahan, P. E. (1998). Entry Restrictions, Industry Evolution, and Dynamic Efficiency: Evidence from Commercial Banking . *J.L.& Econ , 239*.

Jimenez, G., Lopez, J. A., & Saurina, J. (2013). How does competition affect bank risk-taking? *Journal of Financial Stability , 9* (2), 185-195.

Keeley, M. C. (1990). Deposit Insurance, Risk, and Market Power in Banking. *The American Economic Review , 80* (5), 1183-1200.

Martinez-Miera, D., & Repullo, R. (2010). Does Competition Reduce the Risk of Bank Failure? *Review of Financial Studies , 23* (10), 3638-3664.

Molyneux, P., LLoyd-Williams, D., & Thorton, J. (1994). Competitive Conditions in European Banking. *Journal of Banking and Finance , 18* (3), 445-459.

Rochet, J.-C., & Vives, X. (2004). Coordination Failures and the lender of last resort : Was Bagehot right afterall? *Journal of the European Economic Association , 2* (6), 1116-1147.

Schaeck, K., Cihak, M., & Wolfe, S. (2009). Are Competitive Banking Systems More Stable? *Journal of Money, Credit and Banking , 41* (4), 711-734.

Shaffer, S. (1998). The Winner's Curse in Banking. *Journal of Financial Intermediation , 7* (4), 359-392.

Sinha, P., Taneja, V. S., & Gothi, V. (2009). Evaluation of riskiness of Indian Banks and probability of book value insolvency. *International Research Journal of Finance and Economics , 38*, 7-12.

Sinha, Pankaj and Sharma, Sakshi and Ghosh, Sayan (2015): *An empirical analysis of competition in the Indian Banking Sector in dynamic panel framework. MPRA paper number 68556.*

Stiglitz, J. E., & Weiss, A. (1981). Credit Rationing in Markets with Imperfect Information. *The American Economic Review , 71* (3), 393-410.

Yeyati, E. L., & Micco, A. (2007). Concentration and foreign penetration in Latin American banking sectors: Impact on competition and risk. *Journal of Banking and Finance , 31* (6), 1633-1647.

Zhao, T., Casu, B., & Ferrari, A. (2010). The impact of regulatory reforms on cost structure, ownership and competition in Indian banking. *Journal of Banking and Finance , 34* (1), 246-254.