# Market Structure and Competition in the Banking Industry : A Review of Literature

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## Abstract

**The significance of the banking industry in the economy has generated a vast body of research on the study of competition within the industry. Especially with the deregulation and subsequent re-regulation of the banking sector in a large number of economies as well as the constant attempt towards consolidation via mergers and acquisitions, the changing structure of this crucial sector has become an area of interest for researchers. Traditional economic theory supports the view that efficient market structures facilitate competition in an industry. With this as base, the current paper discussed the theoretical foundations of measuring competition; it discussed the classical industrial organization theory on market structures in banking via the Structure-Conduct-Performance paradigm as well as the neo-industrial organization approach towards the structure in the banking industry. It reviewed the literature on previous studies that were conducted in this regard to measure competition and market structure in the banking industry with a view to identify the scope for further research on the changing market structure of the Indian banking sector.**

***Key words :*** **market structure, competition, banks, India, efficiency**

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The financial system in an economy facilitates the exchanges in the goods market, enables resource allocation, mobilizes savings, also creates a channel to access investment opportunities ; it simultaneously allows for risk management via hedging and pooling of risks (Levine,1997). Hence, the importance of this industry in any economy cannot be undermined. Research has shown that a competitive and efficient financial system is an essential pre-requisite for capital accumulation and economic growth (Claessens &Laeven, 2004).

The increased consciousness of the importance of the banking system has generated a vast literature on assessing competitiveness within this industry, with a view that efficient market structures move towards higher competition. While the classical industrial organization (IO) theory looks at the Structure-Conduct-Performance linkages, neo IO theories have given rise to direct measures of conduct. Some studies have focused on the optimization models which derive from concentration indices like the Lerner index, the Panzer-Rosse (PR) H-statistic, etc. The structure of the banking industry, therefore, has gained importance with numerous studies establishing the linkage of structure with efficiency and performance, some finding a significant bi-causal

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relation. With the financial crisis in 2007, the emphasis on the impact of the macro environment on industry structure gained further momentum, with researchers analyzing explanatory variables like GDP, inflation, business cycle, etc. to study their linkage with industry concentration and performance.

## Theoretical Foundations

The structure of an industry refers to the market structure, reflected by the variables affecting the behavior of buyers and sellers in a market. The elements impacting an industry's structure are the number of agents (buyers and sellers) in the market, the barriers to entry and exit, the nature of product (and technology) in the market, and market transparency. To define the market structure, a variety of measures are used, reflecting the degree of competitiveness in an industry.

Scitovsky (1955) distinguished between the measures of concentration and indices of monopoly (or oligopoly) power. According to them, while most concentration measures express the number of firms *(n)* and their distribution [often based on market shares ($\xi$)], indices reflect 'power relation among the sellers or the buyers'. The former can be used as a direct measure of the degree of market power, while the latter measure the same via the effects of the market power.

**(1) Measures of Concentration :** The most widely used methodology of investigating the competitiveness in a given market has been the market concentration ; fewer banks are associated with higher concentrations, as also the case of where the industry is composed of larger banks. Markets with high concentration need not essentially imply a lack of competitive behavior ; however, a large body of literature shows that market concentration is an important determinant of competitiveness, thereby shaping the industry structure (Nathan & Neave, 1989).

Hannah and Kay (1978), in their study of concentration indices, indicated four essential characteristics that concentration indices should satisfy: (a) the indices should be classified according to their concentration curve, with higher concavity associated with higher concentration ; (b) the transfer of sales from smaller to relatively large firms should increase the concentration index ; (c) entry of smaller firms should decrease the concentration index ; and (d) firm mergers should increase the concentration index.

According to Nickell (1996), bank entry has a negative impact on concentration, which in turn exerts a positive influence on monopoly power ; reduction in monopoly power is associated with a rise in competition. According to Rose (1999), "the degree of concentration in a market is measured by the proportion of assets or deposits controlled by the largest banks serving that market." A large body of literature, linked to the structural approach to assessing competition within the banking industry, uses concentration as a proxy to competition.

Two broad categories in which concentration measures can be bifurcated are 'absolute measures' which utilize both the number of firms *(n)* and relative variance in size of firms ($\sigma^2$) and 'relative measures' which only utilize the information contained in $\sigma^2$ (Curry & George, 1983).

Several studies on banking concentration embody the absolute measures. Marfels (1971) and Dickson (1981), infact discussed weighing schemes of several concentration ratios ; such a method of evaluating concentration ratios determines the index sensitivity at the tail-end of the bank-size distribution. While Marfels (1971) discussed four groups of weights that can be used for concentration measures (Appendix 1), Hause (1977) introduced two new Cournot measures of industrial concentration [1] and Dickson (1981) investigated 15 indices [2] and took up a more theoretical approach to assigning weights.

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[1] Hausse (1977) used the standard Herfindahl index to create a multiplicatively-modified Cournot measure of concentration and another additively-modified Cournot measure of concentration.

[2] Of the 15 indices that he investigated, Dikinson (1981) found *k*-Bank, HHI, CCI, Hause's Multiplicative Cournot Index, Hannah and Kay Index, and the U Index to be consistent with the theoretical foundations of market structures.

Bikker (2004) discussed the theoretical characteristics of concentration ratios and looked at 10 ratios [3]. This section does a brief sum-up of the concentration measures that can be used to empirically establish the competitiveness in a market.

**(i) *k* - Bank Concentration Ratio :** This is the most common concentration ratio which takes the form :

$$CR_K = \Sigma^{k}_{i=1} \xi_i \qquad (1)$$

$\xi_i$ is the market share of the *i*th bank. For the top *k* banks in the industry, in accordance with their market shares, we sum up the shares of each bank so as to arrive at the concentration in the industry. One could measure $CR_1$, $CR_3$, $CR_5$ and so on, representing the market shares of the topmost, top three, and top five banks in the industry. The simplicity of data required for calculating the *k*-bank ratio makes it one of the most frequently used measures of concentration. The larger the value of $CR_n$, the greater the monopoly power of firms in the industry. This is, however, a discrete measurement of concentration, ranging from 0 to 1 [4] .

One of the serious drawbacks of the *k* - bank ratio is its oversimplification ; it does not acknowledge the industry behavior of the remaining *n*- *k* firms in the market. Also, the size of firms is an ignored parameter - the top *k* firms may be large enterprises, medium, or small ; the inequality of firm sizes is unaccounted for. Hence, though the *k* - bank ratio is a simplistic indicator, it is seldom alone used as a judgmental measure of concentration.

**(ii) Herfindahl-Hirschman Index (HHI) :** The HHI index tides over the problems of oversimplification in the *k* - bank ratio by taking into account the total number of firms as well as their unequal sizes. In using the market share of all individual firms in the industry to measure concentration, the HHI index takes the form :

$$HHI = \Sigma^{n}_{i=1} \xi_i^2 \qquad (2)$$

where $\xi_i$ represents the percentage share of the $i^{th}$ firm in the industry. For *n* banks in the industry, we therefore, take the sum of squares of the individual share for each of the *n* banks to arrive at the HHI index. HHI is an appropriate concentration index to explain pricing behavior for firms behaving in accordance to typical Cournot models (Cowling & Waterson, 1976). It is known as the full-information index, since it captures bank shares as well as the bank size distribution, including every individual bank for the purpose of measurement of concentration. Davis (1979), in studying the choices between concentration indices, found that as *n* increases, the sensitivity of HHI to any changes in the number of banks in the industry goes down. Hence, $\frac{1}{n} \leq HHI \leq 1$ [5] .

Despite its popularity, one of the prime limitations of the HHI index is that it does highlight variance in market shares, but distributions with different tail properties may still end up with the same magnitude of HHI (Rhoades, 1995).

Different variations of the HHI index have been proposed in the empirical literature on concentration. Adelman (1969) and Kwoka (1985) incorporated the bank size distribution as part of their calculation of HHI and proposed

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[3] He looks at the *k*-Bank ratio, HHI index, the Hall-Tideman and Rosenbluth Index, the CCI Index, the Hannah and Kay Index, the Hause Index, the U Index, and the Entropy Index.

[4] $CR_K \rightarrow 0$ for $\xi_i = \xi_j, \ \forall i, j$ and $CR_K \rightarrow 1$ if $k = n$ where *n* is the total number of banks in the industry.

[5] $HHI \rightarrow \frac{1}{n} \ \forall \xi_i = \xi_j, \ \forall i, j$ and $HHI \rightarrow 1 \forall \ n = 1$

$$HHI = \frac{1}{n} + n\sigma^2 \quad (3)$$

However, different combinations of $n$ and $\sigma$ can give the same HHI, which lent an ambiguity to the use of this variation of HHI (Kwoka, 1985).

**(iii) Horvath Index (HI) :** Proposed by Horvath (1970), the Horvath Index (HI) is a combination of relative and absolute measure of concentration. It takes account of the proportion of banks' market share and the inequality of the size. With firms in descending order of market shares, HI would be given as :

$$HI = \xi_1 + \Sigma^n_{i=2} \xi_i^2 = [1 + (1 - \xi_i)] \quad (4)$$

Since the HI contrasts a proportion of one firm against the rest of the market, it acts as an indicator of potential rivalry in the market. High values of HI indicate concentration, while low values are in case of markets exhibiting early stages of competition. Shortcomings of HI are the same as of HHI, namely, higher weightage to firms with larger market shares. It is more popularly known as the comprehensive concentration index (CCI) and is a mix of the weight schemes, where $w_i = 1 \ \forall i = L$ , where $L$ is the firm with the largest market share in the industry, and $wi = \xi_i \ \forall i \neq L$ (Horvath, 1970). This gives the comprehensive concentration index as :

$$CCI = \xi_i + \Sigma^{n-1}_{j=1} \xi_j^2 (2 - \xi_j) \quad (5)$$

where $i$ denotes the largest firm and $j$ the remaining $n$ -1 firms in the industry.

**(iv) Rosenbluth Index (RI) :** Unlike the HHI, indices like the Rosenbluth Index (RI) attach higher weights to smaller banks. When ranked in descending order of market shares :

$$RI = [2 \Sigma^n_{i=1} i \xi_i - 1]^{-1} \quad (6)$$

The RI is, however, strongly influenced by the small banks in the distribution, giving dubious results.

**(v) Entropy Concentration Index (ECI) :** The realization that the measurement of concentration was not a one-dimensional issue led to the generation of new indices that took account of the multidimensionality of indicators of competition [6] (Maasoumi & Slottje, 2002). Maasoumi and Theil (1979) studied Thiel's measures of concentration and found that positive skewness and leptokurtosis increases concentration. This popularized Entropy as a measure of concentration. The Entropy Concentration Index (ECI), which is based on information theory, looks at measuring competition as :

$$ECI = {}_e\Sigma^n_{i=1} \xi_i \log \xi_j \quad (7)$$

The ECI was proposed by Jacquemin (1975) and later by Jacquemin and Berry (1979), and is an ex-ante measure of the expected information content in a distribution.

**(vi) Hall-Tideman Index (HTI) :** A similar measure of concentration using the weightage system was proposed by

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[6] Maasoumi, Prowse, and Slottje (2002) identified seven indicators of competition, namely relative price performance, pricing behavior, productivity, demand elasticity, contestability, supply elasticity, and financial performance.

Hall and Tideman (1967), who assigned a weightage of 1 to the largest bank. Known as the Hall-Tideman Index, (HTI) :

$$HTI = [2(\Sigma^{n}_{i=1} i\xi_i - 1)]^{-1} \quad (8)$$

such that $0 \leq HTI \leq 1$, where $HTI \rightarrow 0 \; \forall \; \xi_i = \xi_j$ where $i \neq j \wedge n \rightarrow \infty$
and $HTI \rightarrow 1 \; \forall \; \xi_i = 1$

The former would be the case of near perfectly competitive markets, while the latter would be in case of a monopoly.

**(vii) Hause's Measures of Bank Concentration :** Hause introduced two new measures of bank concentration, using additive and multiplicative modifications to the Cournot measurement of concentration. Both indices are based on the HHI measure of concentration. The multiplicatively modified Cournot measurement of concentration ($H_m$) as proposed by Hause is :

$$H_m(\alpha, \{\xi_i\}) = \Sigma^{n}_{i=1} \xi_i^{2-(\xi i (HHI - \xi_i^2))^{\alpha}} \quad (9)$$

where, α is the elasticity parameter capturing the degree of collusion within the industry.

The additively modified Cournot measurement of concentration, $H_a$ is such that :

$$H_a(\beta, \{\xi_i\}) = \Sigma^{n}_{i=1} [\xi_i^2 + (\xi_i (HHI - \xi_i^2))^{\beta}] \quad (10)$$

where, the elasticity parameter, β captures the degree of collusion, and $\beta > 1$.

**(viii) Hannah and Kay Index (HKI) :** The Hannah and Kay Index *(HKI)* is based on the market shares of banks and an elasticity parameter (α), with the freedom to choose α and , therefore, the option to lay emphasis on the upper or lower end of the distribution on bank sizes.

$$HKI = [\Sigma^{n}_{i=1} \xi_i^{\alpha}]^{\frac{1}{(1-\alpha)}} \quad (11)$$

where $\alpha > 0$ and $\alpha \neq 1$.
As $\alpha \rightarrow 0, HKI \rightarrow n$
And, as $\alpha \rightarrow \infty, HKI \rightarrow \frac{1}{\xi_k}$, where $k$ is the largest bank in the industry.

**(ix) Lorenz Ratio (Gini Coefficient) :** The Lorenz Ratio (Gini Coefficient) is a relative measure of concentration and makes use of the Lorenz curve, focusing on the inequality of bank size in the industry rather than the number of banks. It is considered as a valid technique in case of oligopolistic markets, but not so in others, since it gives the same Lorenz curve in case of an industry with $n$ equally sized firms, irrespective of the value of $n$.

However, the scope of these concentration ratios, which are infact popularly used by official agencies to measure industry competitiveness, are somewhat restricted. The variance of market shares forms the basis for some of these indices like the HHI and Gini Coefficient ; but when addressing issues related to industry competitiveness, policy makers are interested in not just variance, but also the tails of the market share distribution (Bhattacharya & Das, 2003).

Measure of concentration is a frequently used means of assessing market structure, given the economic argument of higher concentration accompanied with higher market power. According to Stigler (1947), price

flexibility is also correlated with the number of firms that are larger than a certain percentage of the largest firm in the industry. However, empirical banking literature shows concentration to be a poor measure of competition and therefore, a weak reflector of market structure (Claessens & Laeven, 2004 ; Shaffer, 1982b,1983a, 1993,). Increases in market concentration can, however, occur due to (a) a substantial increase in size of the dominant firm in the industry, (b) a substantial decrease in the size of the non-dominant firms. Conversely, decreases in market concentration may occur due to (a) a substantial decrease in size of the dominant firm, (b) a substantial increase in the size of the non- dominant firms (Athanasoglou, Brissimis, & Delis, 2008). Nathan and Neave (1989), infact, suggested, via their contestability theory, that a highly concentrated banking industry could behave competitively in the presence of low entry and exit barriers.

Classic industrial organization theory, via the structure-conduct-performance (SCP) paradigm, assumes a causal relationship of market structure to conduct of banks, as depicted by their pricing behaviour, and to performance, that is, profits and market power. According to the SCP hypothesis, a higher number of banks (with lower market concentration) lead to price competitiveness and hence, minimize the market power of an individual bank. According to the efficient structure hypothesis (ESH), a corollary of SCP, higher productive efficiency translates into higher profits, which in turn lead to a higher concentration for banks in an industry. Hence, higher concentration may not be associated with an increase in market power, but a consequence of greater efficiency (Berger, 1995).

Also, to link concentration to competitiveness empirically, majority of the studies regress performance of banks on its market share, market concentration (as measured by the concentration indices), and pre-defined control factors. The performance measure used is either profits, or prices; the latter, however, is relatively ambiguous in banking, with interest rates used commonly to reflect prices.

**(2) H-Statistic :** A non-structural approach towards empirical evaluation of market structures was taken by Panzar and Rosse (1987) wherein they developed the H-statistic as a means of testing and distinguishing oligopolistic, competitive, and monopolistic markets. They developed a test to discriminate between competitive, oligopolistic, and monopolistic markets. Based on a reduced-form revenue equation, the test is built to determine the equilibrium output and number of banks by profit maximization at the bank specific level as well as the industry level.

At the bank level, for bank $i$ , the profit maximization condition is given by :

$$R_i'(x_i, n, z_i) = C_i'(x_i, w_i, t_i)$$

where, $R$ denotes revenue and $C$ denotes cost ; $x_i$ denotes the output for bank $i$, $n$ the number of banks in the industry, $z_i$ denotes the vector of exogenous variables that impact the revenue function of bank $i$, $w_i$ represents the vector of $m$ factor input prices and $t_i$ is the vector of exogenous variables that impact the cost function of bank $i$.

At the market level, in equilibrium, the zero profit constraint means that :

$$R_i^*(x^*, n^*, z) = C_i^*(x^*, w, t)$$

Assuming that a bank needs $m$-inputs and a single output, empirically, the reduced-form PR Model can be written as :

$$log\, TR = \alpha + \Sigma^n_{i=1} \beta_i \, log w_i + \Sigma_j \gamma_j \, log CF_j + \mu \qquad (12)$$

where, $TR$ is the total revenue, $wi$ is the $i$th input, $CF$ is the firm specific control factor, and $\mu$ is the error term. According to Panzar and Rosse (1987), the sum of input elasticities with respect to $TR$ is the H-statistic reflecting the competitive structure of the market, that is :

$$H = \Sigma^{n}_{i=1} \beta_i \quad (13)$$

The H-statistic is calculated as the sum of elasticities of gross revenue with respect to the prices of inputs. According to Panzar and Rosse (1977),

$H < 0 \Rightarrow$ collusive oligopoly or neoclassical monopoly
$0 < H < 1 \Rightarrow$ monopolistic competition
$H = 1 \Rightarrow$ perfect competition, where the individual banks are price takers.

Shaffer (1982a) also showed that $H < 0$ could also imply a conjectural variations oligopolist and $H = 1$ in case of a natural monopoly in a contestable market. Rosse and Panzar (1977) contested that the magnitude of $H$ was as important as the Lerner Index since it could yield an estimate of the Lerner Index, measuring the monopoly power of banks.

**(3) Measures of Market Structure :** The Lerner Index allows for direct measurements of the degree of monopoly power of a bank. Lerner (1934) suggested that the degree of competition in the banking industry can be inferred by using the mark-up of price over marginal cost.

$$L = (1 - e^{-1}) = H(H - 1)^{-1} \quad (14)$$

Bresnahan (1982, 1989) and Lau (1982) too estimated the mark-up of price over marginal cost to measure market power. The Bresnahan-Lau (BL) model can be applied for an empirical analysis of markets. The conduct parameter derived can give an estimate of market structure : a conduct parameter of zero implies absence of market power, and near perfect competition, while a variable of one implies a monopoly.

One of the major handicaps in the measurement of the Lerner index is that absence of marginal cost as an operational concept within firms. Corbae and D'Erasmo (2013), however, suggested variations to the Lerner index, wherein market imperfections can be captured using average variable cost as well; they developed a quantitative model to capture the dynamics in the banking industry. Using a Stackelberg environment, they developed a structural model of the banking industry using data from U.S. banks over 1976-2008. The Stackelberg game they developed provided a framework wherein the actions of the larger banks impact the profitability of smaller banks.

According to the new empirical industrial organization (NEIO) theory, costs are a potential driver of market structure, and hence, a detailed representation of costs becomes essential to evaluate market structures (Paul, 1999). Bodenhorn (1990) also proposed a measure of mobility using the changes in the ranking of banks overtime.

$$\text{Bodenhorn's Measure of Mobility} = \Sigma^{n}_{i=1} |Ri(t) - Ri(t-1)| \quad (15)$$

where $Ri(t)$ is the rank of the $i^{th}$ firm in the $t^{th}$ year. A higher value signifies high competition, and a lower value reflects greater collusion.

## Studies on Market Structure in the Banking Industry

**(1) International Level Studies :** Rose and Fraser (1976) proposed the use of the Herfindahl-Hirshmann index (HHI), or the Gini coefficient for the measurement of market concentration to take account of the size distribution of all firms in the market. They studied 704 banks across 90 metropolitan statistical areas (MSAs) in Texas and

established the supremacy of the HHI index over traditional measures of structure - concentration ratios.

A large number of studies assessed the degree of concentration, as measured by the Herfindahl - Herschman index (HHI), K - firm concentration ratio (K- ratio) and other parameters, and concluded that the market - concentration levels are inversely linked to competitiveness (Bain, 1951; Domowitz, Hubbard,& Petersen, 1986; Martin, 1988 ; Weiss, 1971). These findings, infact, form the basis of antitrust policies to prevent mergers that may lead to significantly concentrated industries.

In their study of the Canadian banking industry, Nathan and Neave (1989) made use of the Panzar – Rosse (PR) model to test for industry competitiveness over the period from 1982 - 1984. For each of these years, they concluded by rejecting the hypothesis of pure collusion. Data on bank revenues suggested monopolistic competition for 1983-84 and perfect competition for 1982. Shaffer (1982a) ; Nathan and Neave (1989) ; and Altunbas, Gardener, Molyneux, and Moore (2001) used the PR Model, each of them using total assets (TA) as the control variable.

Gelos and Roldos (2002), in their examination of the evolution of market structures in emerging economies, found significant consolidation in the 1990s; this consolidation, however, is not associated with an increase in concentration as measured by standard indices using market share in deposits and the HHI index. They used the PR model to conclude that the East European and Latin American markets have not become less competitive, and the changes in a regulatory framework, easing entry of foreign banks has been a major factor preventing the decline in competition. Molyneux and Forbes (1995), Bikker and Groeneveld (2000), Bikker and Haaf (2002), Claessens and Laeven (2004), and Yildirim and Philippatos (2007) used a scaled version of the PR model, controlling for firm size. They did so by regressing the log of (Total Revenue/Total Assets) on the log of inputs and the log of control factors (including total assets). Claessens and Laeven (2004) studied 50 countries over 1994-2001, running two regressions with log(Interest Income/Total Assets) and log (Total Income/Total Assets) as the dependent variable, scaling each using log(Total Assets). Bikker and Haaf (2002) studied 23 OECD countries over 1988-1998 and used log (Interest Income/Total Assets) as the dependent variable.

In his study of the banking market in Canada, Shaffer (1993) found high competition in the conduct of banks, despite high concentration in the market. Shaffer and DiSalvo (1994) found similar results in their study of the local banking industry in U.S. Opposed to this were the results of Calem and Mester (1995) and Shaffer (1999), both studies finding high levels of monopoly power in the U.S. credit card industry where banking concentration was found to be very low.

Demirgüç - Kunt and Levine (2001) used the fraction of bank loans controlled by the three largest banks in a banking system as a measure of industry concentration within the banking sector. Demirgüç-Kunt, Laeven, and Levine (2004) assessed the impact of regulatory policies on bank competition. These regulatory policies included restrictions on activities undertaken by banks, restrictions on bank opening as well as entry restrictions. In their study of the Italian banking industry, Angelini and Cetorelli (2000) provided evidence that the banking industry became more competitive post the 1993 regulatory reforms.

In examining the competitive conditions across 23 countries using the PR Model, Bikker and Haaf (2002) found that for almost all countries, the results were consistent with monopolistic competition, with competition being stronger in countries of Europe as compared to the U.S., Canada, and Japan. They measured concentration using the k-bank ratio and the HHI index. They measured competitiveness using the H-statistic, and attempted to relate it with market structure, that is, the degree of concentration. Though they found competitiveness to be negatively related to concentration, the results were statistically weak. They concluded that across all countries, competition in 1997 was higher than in 1991, marring a few exceptions.

Claessens and Laeven (2004) took forward the work of Bikker and Haaf (2002) and used panel data over 1994-2001 for 50 countries. They constructed the H-statistic for these countries and consistent with the earlier studies, the results found that each of these countries exhibited imperfect competition to varying countries, especially in light of the regulatory changes implemented in these markets. They concluded that being open to new entry was

one of the most important competitive pressures in the banking system. This result was reinforced by the study of Besanko and Thakor (1992) ; they found the threat of new entrants as an important determinant of behavior of existing players in a market. Using the P-R Model, Molyneux, Lloyd-Williams, and Thornton (1994) used the 'ratio of total interest revenue to the total balance sheet' as the dependent variable. Shaffer (1982a and 1982b) and Nathan and Neave (1989) too used the Panzar - Rosse Model, using total revenue as their dependent variable.

Mamatzakis, Staikouras, and Koutsomanoli- Fillipaki (2005), while studying the Southeast Europe banking markets over 1998-2002, used a similar dependent variable as Claessens and Laeven (2004); they, however, used an unscaled PR Model for this purpose. Matthews, Murinde, and Zhao (2007) too studied the conduct of 12 UK banks over 1980-2004, using the same dependent variable, scaling the PR equation using log*(TA)*. Carbo, Humphrey, Maudos, and Molyneux (2009) studied banks across 14 EU countries over 1995-2001. Using log *(TA)* for scaling, they regressed log*(TI)* on a set of independent variables to derive similar results.

In his study of the changes in market structure of the U.S. banking industry over 1993- 1999, Dick (2006) used Lorenz's curves to assess the changes in concentration levels, comparing these for dominant and fringe firms within the banking sector. He used the deposits of banks to calculate market shares, and found that over the sample period of the study, the basic market structure was more or less similar, represented by Lorenz's curves that were superimposed over one another.

Boyd, De Nicolò, and Al Jalal (2006) found a significant positive relationship between bank concentration and the risk of bank failure. De Nicoló and Loukoianova (2007), in another study, found that this relationship is stronger when bank-ownership is accounted for, especially when state banks have a large market share. They studied data across 133 industrialized countries over 1993-2004 and found the risk profiles of foreign banks to be much stronger than those of private domestic banks.

Casu and Girardone (2006) assessed the H-statistic for banking markets in 15 European countries and found no evidence of their linkage with concentration measures. Yildirim and Philippatos (2007), in their study of 11 Latin American countries over the period from 1993- 2000, concluded that allowing for foreign entry increased competitiveness, though they were unable to link it to any significant change in concentration.

Bikker, Shaffer, and Spierdijk (2009) used the PR model in its unscaled form as well as scaled form to test the competitive conduct of banks across 67 countries over 1986-2004. They calculated *H, Hr*, and *Hp* for each of the 67 countries under study, where *H* is the unscaled value of the *H*-statistic, *Hr* and *Hp* are the scaled versions of the model, using log *(TR/TA)* as the regressor [7], and the last one adding an additional log *TA* into the P-R price equation [8]. Their study concluded that a reduced form price equation cannot be used to infer the degree of competition in an industry, and hence, only an unscaled revenue equation can be used to interpret the competition amongst banks in an industry. They concluded that the H-statistic serves as a one-tail test of the competitive conduct in the industry.

Tushaj (2010), in his empirical study of the Albanian banking sector, assessed the impact of deregulation, penetration by foreign banks, and rapid consolidation on the industry structure. He concluded that based on banking assets, the HHI index showed stability with the Albanian banking sector continuing to show high concentration, despite deregulation. A significant negative relation existed between the HHI for deposits and the number of banks. Using the data on banking credits, the study concluded a strong negative correlation between HHI for credit and the number of banks.

Bikker, Shaffer, and Spierdijk (2012) used banking data across 63 countries over 1994-2004, applying on this the price equation of the PR model, as well as the scaled revenue function to show that neither of these is a valid

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[7] $log\ \left(\frac{TR}{TA}\right) = \alpha + \Sigma^{n}_{i=1}\beta_i\, logw_i + \Sigma_j \gamma_j\, logCF_j + \mu$ such that $H^r = \Sigma^{n}_{i=1}\beta_i$

[8] $log\ \left(\frac{TR}{TA}\right) = \alpha + \Sigma^{n}_{i=1}\beta_i\, logw_i + \Sigma_j \gamma_j\, logCF_j + \delta \log TA + \mu$ such that $H^r = \Sigma^{n}_{i=1}\beta_i$

measure of the degree of competition, as reflected in a large body of empirical literature on banking. According to their study, a meaningful interpretation of the H-statistic can only be made in light of additional information relating to demand elasticity, market equilibrium, and cost data.

Ijaz (2012) used profit after tax as the relevant variable to measure the market concentration in the banking industry in Pakistan over 2001-2009. She made use of the HHI index, CR ratio, and the Lorenz curve using profit after tax to measure the market concentration. She proposed a model to thereafter assess the linkage between concentration of Pakistani banks and their market power in the loans' market. Using average loan rate charged as the dependent variable, she took market concentration (CR ratio), growth in bank's profits, and total volume of advances of a bank as the independent variables, and the results showed an increase in market concentration and market power of banks over the sample period of the study.

Cifter (2015) studied the bank competition and concentration in the Turkish banking industry. Kick and Prieto (2015) too analyzed the bank risk and competition across regional banking markets. They used bank characteristics to study the competition-stability nexus in the banking industry. Their research focused upon the monetary policy changes that impact competition, and studied its effect on bank risk, and therefore, stability.

**(2) Studies on the Structure of the Indian Banking Industry :** Bhattacharya, Lovell, and Sahay (1997) used the data envelopment analysis to measure and explain the variation in the performance of Indian commercial banks during the early period of liberalization for 70 commercial banks over 1986 - 1991. They used the data envelopment analysis (Charnes, Cooper, & Rhodes, 1978) to measure technical efficiency and to explain the variation in the efficiency using stochastic frontier analysis (Aigner, Lovell, & Schmidt, 1977).

A study of the impact of foreign banks on the market concentration in the Indian banking industry (Sathye, 2005) used HHI as a measure of concentration, and regressing it on a set of explanatory variables concluded that the entry of foreign banks did not significantly reduce the level of concentration in the Indian banking industry.

Bhattacharya and Das (2003) studied the market structure and competitiveness of the Indian banking industry over 1989-2001 to test if there was a change in market structure post the financial deregulation. They used static and dynamic measures of concentration, using the spread between lending and deposit rates as a proxy to 'price'. A measure of the static concentration measures showed a high *k*-bank ratio, low HHI, and low RI over the post reform period. The *K*-bank ratio over the period under study is consistently found to be higher than HHI values owing to the fact that the latter assigns a higher weightage to market shares. They found that the concentration ratios have decreased over the post-reform period, the results supporting the success of the liberation process. However, the decrease in concentration due to the process of financial deregulation is albeit slow. For a dynamic measurement of market structure of the Indian banking industry, they used Theil's first and second inequality measures, along with the linear and Cobb-Douglas forms of the aggregator function, respectively. They worked out the inequalities in the short-run and the long-run, that is, in the aggregated assets, and found the asset stability measure, RM. They found that while there has been equalization within each group of banks, the inequality between groups is noticeably high. The impact of concentration on competitiveness are suggestive of monopolistic competition.

Ansari (2012) studied the Indian banking industry over 1996-2011. He developed a new index- the Augmented Relative Profit Difference (ARPD) - quantifying the impact of marginal cost on bank performance. He argued that conventional indices like the Lerner Index and PR H-statistic are poor reflectors of the competition in the Indian banking sector when compared with the ARPD approach. He found the market structure as monopolistically competitive when assessing the loans market, similar to the results yielded by other studies on the industry during the same period.

Prasad and Ghosh (2005), in their study of Indian banks over 1996-2004, used the PR H-statistic to conclude the monopolistically competitive nature of Indian banking. Using the Panzar and Rosse model, Prasad and Ghosh

(2005) concluded that with the implementation of financial reforms in India, the industry has increasingly moved towards monopolistic competition. Bhanu Murthy and Deb (2008) studied the private sector banks in India over 1992-2002 and concluded that it is monopolistic in nature. They made use of the Bodenhorn's Measure of Mobility (1990) to assess competition. In assessing the structure of the private banks in India, they made use of the Bodenhorn Measure of Mobility and the HHI index. They used a Tobit model to explain competition using the SCP paradigm. They concluded that competition transcends beyond conduct, encompassing all four components of the SCP framework, which they analyzed using the Tobit technique on three simultaneous equations. Their results suggested that with the entry of foreign banks, the Indian private banking has moved towards monopolistic completion.

Doshit, Dhokai, and Lodhia (2005) used the Panzar - Rosse statistic and concluded that the Indian banking industry is increasingly moving towards monopolistic competition, more so after the financial reforms. And over 2001-2004, the industry has moved to become increasingly monopolistic.

Sharma and Bal (2010) studied the Indian banking industry over 1998-2008, using both relative and absolute concentration measures as a reflection of competitiveness in the industry. They found a decline in the concentration, reflecting increased competitiveness; the decrease in Gini's coefficient over the study period suggested a decline in inequality among the commercial banks.

Zhao, Casu, and Ferrari (2010) employed a stochastic frontier approach to examine the impact of the financial reforms on the competition in the Indian banking industry over 1992-2004. They used a partial adjustment model to estimate the price - MC ratio, finding an increase in competition in the lending market in the latter part of the reform period. Both the CR5 and the HHI index showed a decreasing trend over the period under study, showing a consistent decrease in concentration. However, a high CR5 and relatively low HHI indicated lowering of inequality of market shares overtime. To study the competition intensity, they used the 'persistence of profitability' approach, the premise being that POP will become less likely with higher competition, which shall erode any abnormal profits of the banks in the industry. They used a 2-input, 3-output specification. To control for loan quality, they measured the difference between total loans and NPLs (total performing loans); the ratio of interest received on loans and total performing loans is the imputed price of loans. The 'other earning assets' and 'fee-based income' are the other two outputs used. 'Total loanable funds' and 'non-interest operating costs' are the two inputs for the model. A translog function was used to estimate the stochastic cost frontier, with a time trend variable and a dummy variable for the policy shift. They found an increased convergence of price to MC, contributing to the increased competition in the latter part of the sample period, than in the earlier part.

Misra (2011) reconfirmed the structure of Indian banking as monopolistically competitive, using a panel data of 75 private and foreign banks in India over 1991-2008. He too used the PR H-statistic to estimate the degree of competition in the Indian banking industry post the entry of foreign banks in the country. He considered revenue as a percentage of total assets as the dependent variable, with employee expenses, administrative expenses, and fund expenses as the independent variables. To capture market equilibrium, one-period lagged dependent variables are also used in the regression. The ratio of equity to total capital is used as the control variable.

Sahoo and Mishra (2012) used the panel data of 59 banks over 2000-2009 and applied two stage least squares (2SLS) to study the link between structure-conduct and performance in case of Indian banks. They used market concentration as a reflector of market structure. The four indices used in their study are market shares of banks, *n* - bank concentration ratio, HHI, and entropy index. In the SCP framework, they used market share as a proxy of market structure, and assumed it to be a function of the bank size (as measured in terms of current assets), the lagged market size, lagged selling intensity of the bank, lagged ROA, and the nature of ownership. The endogenous variables included current market share, current returns on assets, current bank size, current selling intensity, current market size, and current costs intensity. On the other hand, the lagged market share, lagged bank size, lagged selling intensity, lagged market size, lagged profitability, and nature of ownership are treated as the exogenous variables. Along with the market share, both lagged market size as well as bank size proxy for the

structural aspect of the market. Using the SCP approach, they showed a bidirectional relationship between market structure and financial performance of Indian banks. The study of conduct via selling intensities showed that Indian banks have failed to create an 'image advantage' as an entry deterrent as is common in monopolistically competitive markets.

Sharma and Kumar (2013), in their study of the impact of the financial reforms on the profitability of Indian commercial banks, found a significant impact of the reforms on the total income of public, private, and foreign banks in the post reform period.

## Conclusion

The banking industry in economies worldwide has witnessed considerable changes in structure and competition, more so with the changing regulatory frameworks, and increase in mergers, failures owing to global industry dynamics, and entry of foreign banks. Given the dynamics within the industry, and its importance for an economy, the banking industry continues to be an interesting area of research. A substantial part of banking research, in fact, focuses upon the SCP relationship, with studies also assessing the ES hypothesis. Most of these studies seem to focus on bank deposits and measure concentration using the K-bank ratio or the HHI, or both. This is primarily due to ease of data availability. However, the quantification of the market structure within the banking industry continues to be a difficult task – the use of several indices requires a clear outline of inputs and outputs as well as a measurement of prices. Literature suggests a decrease in banking concentration in India over the decade of the 1990s, with the market being monopolistically competitive, and a lowering of concentration ratios upto 2009. Some studies seem to comment on the slow rate at which the bank concentration has decreased between 2001-2009. With the dynamic changes in the global economy reflecting on the policy framework of the banking sector, it becomes a lucrative area for research, more so in light of the importance of decreasing the NPAs in the industry.

## Research Implications, Limitations of the Study, and Scope for Future Research

The current study is a literature review and examines work done on the international and Indian banking industry. The study focused on the theoretical and empirical literature on the measurement of concentration and market structure, assessing evidence of the relationship of market structure to performance in the banking industry. The dynamic changes, both regulatory and environmental, seem to have an impact on the concentration, structure, and performance of the Indian banking industry. While most studies assess the competitive changes over the 1990 reform period, there is a paucity of literature on the temporal changes in structure and competition of the industry post the reform period, contrasting it to the more recent developments in the industry; more so in light of the Basel framework.

The research on the banking industry has varied in its approach to defining the industry -from assessing the loans market in certain cases to deposit market in others, some studies also define banking to include regional rural banking. A limitation of the current literature is that it generalizes this to the result for the 'banking industry' as a whole. Also, while theoretically, it can be argued that bank stability changes with the changes in competition (Boyd & Nicolo, 2005), these considerations don't seem to feature prominently in the study of competition in the Indian banking industry.

There seems to be lacunae in the studies done on the Indian banking industry with respect to the inter-temporal assessment of the variation in competition over the decade of the 1990s and how it compares to the 21st century where industry experts, especially post the global financial crises, have felt the constant need for re-regulating the industry. While a vast body of research addresses the SCP linkages, there exists scope to consider additional

variables like 'risk appetite' and stability variables, as also policy tools that have led to changes in concentration in the banking sector of India. With the implementation of Basel changing the risk-based capital framework in the banking industry, the impact of these on the structure and performance of the banking industry is an unexplored territory, especially with regard to the Indian banking industry.

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## Appendix 1

### Marfels' Weightage Scheme & Associated Indices

| | Weights | Example of Index |
|---|---|---|
| Weight Scheme 1 | $w_i = 1 \forall i \leq k$ and $w_i = 0 \ \forall \ i > k$ | *k*-Bank Ratio |
| Weight Scheme 2 | $w_i = \xi_i \ \forall i$ | HHI |
| Weight Scheme 3 | $w_i = i \ \forall i$* | RI and HTI |
| Weight Scheme 4 | $w_i = -log\xi_i \ \forall i$ | Entropy Concentration Index |

*where the banks are arranged in ascending or descending order of their market shares.

$\xi_i$ is the market share of the *i*th bank in the industry.