Library Progress International *Print version ISSN 0970 1052*
Vol.44 No.3, Jul-Dec 2024: P. 25247-25258 *Online version ISSN 2320 317X*

Original Article *Available online at www.bpasjournals.com*

BANK MERGERS AND COMPETITIVENESS OF MARKET IN INDIA : AN APPLICATION OF PANZAR ROSSE MODEL

[1] SUEEBA ARIZO, [2]NISAR AHMAD KHAN

How to cite this article: SUEEBA ARIZO, NISAR AHMAD KHAN (2024) BANK MERGERS AND COMPETITIVENESS OF MARKET IN INDIA : AN APPLICATION OF PANZAR ROSSE MODEL. *Library Progress International,* 44(3), 25247-25258

ABSTRACT

Market concentration across the banking business of India has expanded significantly since 1990s economic reforms as a result of M&As and bank consolidation. This method of bank consolidation has improved the banking industry's assets, capital reserves, and profitability. However, this process has sparked concerns pertaining to banks' monopoly and oligopolistic market power due to the rise in concentration of markets that has resulted from it. There is growing anxiety in the banking sector about market power.

The purpose of the current study is to examine how market consolidation has affected the competitiveness and market structure of the Indian financial system. In this study, the H- statistics are computed using the Panzar and Rosse's method to get the extent of competitiveness across the system of Indian banking. The proposed H-statistic is computed for the 2009–2017 (pre–merger) and 2018–2023 (post–merger) time periods. For both of the research periods, the Panzar-Rosse method produces positive H-statistics. The monopoly or perfect competition theory of market power appears to be disproved by the Wald test results. The empirical results unequivocally demonstrate that monopolistic competitive environment exists within the banking sector of India, and also that bank competitiveness has decreased as bank consolidation has increased. This discovery confirms earlier assumptions about increasing risk and lesser competitiveness resulting from a concentrated financial sector.

Keywords: Bank consolidation, competitiveness, concentration, market power, H-statistics.

JEL Classification Codes: L13, G34, L41

.INTRODUCTION

The financial services business, notably the banking industry, has seen tremendous development all over the world since the early 1980s. Consolidation has been an essential component of this process, as many banks have been merged, amalgamated, and reorganized. Efficiency along with scale economies has typically been used as justifications for consolidation; yet, the technique concerning consolidation and the financial conglomerates that resulted have raised concerns about stability. Furthermore, there are rising worries about how market concentrations might eventually lead to decreased competitiveness and strengthened monopoly or oligopolistic powers in the business.

Over the past 20 years, there has been a spike in mergers and acquisitions (M&As) of corporate organizations, particularly banks, globally. The global factors driving M&A activity in other nations have not spared the Indian banking sector. M&A activity in the Indian banking sector is not new, having occurred before independence.

Economic reforms implemented in the early 1990s, led in a significant shift in bank business strategy, with banks turning to mergers and amalgamations to increase size and efficiency in order to obtain a competitive edge. Despite the fact that acquisitions and mergers have been happening for a while now, India's banking industry has consolidated more quickly in recent decades. The merger of SBI and its associate banks in 2017 marked a new era for merger of public sector banks in India and the mega-merger of 2020 has been the most remarkable one. Ten public sector banks (PSBs) were combined into four on April 1, 2020, in one of the recent and largest consolidations in the sector. After these mergers, India would have a total of twelve Public Sector Banks (PSBs), which will include Bank Of Baroda (BOB) and State Bank of India (SBI). Fewer but more powerful global-sized banks are anticipated to emerge from the merger, spurring economic expansion. However, the wave of mergers currently taking place in the banking sector raises important public policy issues regarding whether or not mergers promote bank profits, efficiency strengthen the financial system, or reduce market competition. The relationship between banking system consolidation and growing concentration and competitiveness is one topic studied in the literature. Although the general relationship appears to be obvious, that is, a larger share of the market indicates greater power in the marketplace along with decreased degree of competition, several studies using empirical methods have revealed no conclusive link connecting the system's concentrations and the degree of its competition. Numerous studies have examined the performance of merged banks in an effort to solve this issue. However, the vast majority of the empirical research conducted emphasized on bank competition and mergers that took place either in US or in Europe. Few studies have been conducted on the competition consequences of bank consolidation for developing economies and even fewer in the Indian setting.

This research aims to explore the effects of bank mergers and acquisitions upon market competitiveness of the Indian banking sector. Against this backdrop, we attempt to objectively analyze the impact of mergers of public sector banks in India on market competitiveness covering a period from 2009 to 2023. Our research adds to and expands on past empirical investigations on this topic. While earlier empirical research looked at this relationship for a larger group of countries around the world, or for earlier mergers in India, we present novel evidence by focusing solely on India and on the recent mergers. A number of factors can be evaluated to determine how bank mergers specifically affect competitiveness of the banking system.However, Panzar and Rosse model is the most often used index of market competitiveness. Therefore, in the study, we shall be measuring market competition using the H-statistic.

The rest of the paper is organized into five sections where section 2 reviews the existent pool of research, both empirical and theoretical. Sections 3 and 4 go into detail about our methodology. Section 5 contains the statistical results and findings. Finally, the closure of the study will be provided in section 6 of the paper.

1. 2.A REVIEW OF LITERATURE

A substantial amount of material on the competition impacts of bank consolidation has been written in two separate ways: structural (nonformal) studies and non-structural (formal) studies. The Structure-Conduct-Performance (SCP) and Efficient-Structure (ES) paradigms form the basis of nonformal or structural approach. The Structure-Conduct-Performance hypothesis implies that there is a causal relationship between market structure and pricing behavior of business. It includes two theories: the first one holds that action is influenced by structure, and the second one holds that action is influenced by performance. This indicates that bank intensity may lead to an increase in the power of banks, giving banks the ability to raise borrowing rates, lower deposit rates, and generate monopoly profits. The number of banks, Concentration ratios, and the Herfindahl index are some of the market structure measures employed in this strategy. The said measures don't allow for conclusions about banks' competitive strategies; they only assess actual market shares. They are rather basic measures that fail to take into consideration the possibility of banks behaving differently depending on who owns them under different ownerships or that they might not directly compete with one another in the same industry. Additionally, they do not assess how banks compete on the margin. According to Carbo,Valverde et al. (2009) , Schaeck et al. (2009) Casu and Girardone (2006), Bikker (2004), they might not, therefore, be the best indicators for measuring bank competition. As a result, Demsetz (1974) and Peltzman (1977) suggested the ES hypothesis. They argues that the finding that corporations with skillful administration, technologies for cutting costs and efficient production and operation may earn substantial profits, increase their share of the market, and foster market concentration can be used to explain the favorable link in between company profits and market concentration.

They attribute concentration to efficiency rather than market power. They contend that disparities regarding company-specific efficiency across marketplaces may lead to a high degree of concentration and uneven market shares. Superior management and production technologies may account for the efficiency gap (Neuberger, 1997). However, researchers reject this notion as well. Berger (1995) makes an effort to examine these two theories and finds that the traditional SCP theory cannot be proven. He argued that the impact of market control and efficiency factors on profitability cannot be explained by either the ES or the corresponding market power theory. As a result, he found it challenging to decide which theory better explains the concept of bank profitability.

The second stream focuses on non-structured strategies which were promoted in the literature related to the so-called NEIO or New Empirical Industrial Organization. Under the NEIO paradigm, there are two fundamental categories of econometric approaches. Shaffer (2004) contrasts and analyzes both of these approaches in-depth, outlining the advantages and drawbacks of each. Bresnahan and Lau (1982) provide the simultaneous equation technique as an example of one of them. This approach finds a parameter that captures bank behavior by concurrently assessing both demand as well as supply functions to estimate the amount of competition intensity. The most challenging part of this method is that it needs exact statistical data regarding banks financial matters, which is hard to get.

The second strategy consists of methods for estimating the characteristics that reflect the competitive intensity in specific marketplaces by employing bank-level data and prior assumptions about bank behavior. This section includes P-R H-statistics, Boone indicator and the Lerner index. Among the several non-structural techniques, the Panzar- Rosse (1987) approach is most commonly employed to analyze competitiveness in the banking sector. The H-statistic, which is defined as the value of the sum total of revenue elasticities in the literature, is used in this model to explain competitiveness. A higher H- statistic score indicates greater competitiveness. The first research to empirically use the P-R model was Shaffer (1982), who discovered monopolistic competitive behavior by analyzing a sample of banks in New York in 1979. Nathan and Neave (1989) disagree with the monopoly power hypothesis of Canadian banks. Examples of country-specific empirical studies related to market competition are Vesala (1995) related to Finland, Molyneux, Thornton and Lloyd-Williams (1996) for Japan, Coccorese (1998) related to Italy, Hondroyiannis, Lolos, and Papapetrou (1999) for Greece, and Hempell (2002) for German. Monopolistic competition is found in various European countries, according to Molyneux, Thornton, Lloyd Williams (1994), Biker and Groeneveld(2000). On the other hand, Bandt and Davis (2000) discover monopolistic competition for major banks with a monopoly in small ones in Germany and France. Bikker and Haaf (2002) demonstrate that monopolistic competition predominated in the banking sectors of 23 OECD countries from 1998 to 1999 except the countries of Greece and Australia. In their 2002 analysis of eight countries from Europe and Latin America, Gelos and Roldos concluded that the early phases of the banks consolidation process had not resulted in a reduction in competition. In the 1990s, Murjan and Ruza (2002) looked at the features of competition in the banking markets of the Arab Middle East (AME). The analysis shows that the region's financial markets witnessed monopolistic competition between the years 1993 and 1997 and that the banking industry in oil-producing nations (such as the Gulf States) seems to be somewhat less competitive than in non-oil countries. It does this through employing figures from nine AME nations and the Rosse-Panzar test. Hempell (2002) investigates competitive behavior in the German banking sector from 1993 to 1998 and rejects the assumptions of perfect collaboration and perfect competition. Claessens and Laeven (2004) conclude in their study of 50 developed and emerging nations that banking system concentration has no negative influence on competitiveness. In 2006 Perera et al. investigate market structure and competitiveness in South Asian banking markets and discover that bank earnings are produced through monopolistic competition. Yuan (2006) gives empirical analyses of the degree of competition prevalent in banking sector of China from the year 1996 to the year 2000, concluding that China's banking sector had near perfect competition. Prasad and Ghosh (2007) investigated market competition in the Indian setting, and their findings show that Indian banks make revenue as if they were subject to monopolistic competition.

When different competition indicators are used, such as Lerner indices, H-statistic, and net interest margin, different conclusions about competitive behavior can be drawn because the competition indicators measure various things, according to Carbo, Humphrey, Maudos and Molyneux's (2009) research. Tabak et al. (2011) used the Boone index to study market rivalry in ten Latin American nations. The Boone indicator values are highly diverse, and so the degree of competition varies greatly among countries and across time. Beck et al. (2011) used

the Lerner index to study 79 nations from 1994 to 2009 and discovered that the index values were positive, indicating monopolistic competition. Furthermore, Researchers Bikker, Shaffer, and Spierdijk (2012) and Weill (2013) found that there is uncertainty in the data about the direction of changes in bank competition within the EU-15 countries. In their examination of Asia Pacific nations, Fu et al. (2014) found that both the Lerner index and efficiency adjusting Lerner index values fluctuate over time and between nations, suggesting monopolistic competition.

2. 3.METHODOLOGY

This study employs a well-established approach devised by Panzar and Rosse (1987) and utilized in prior research to assess competition in the Indian banking industry. The total of a bank's overall income elasticities with regard to the bank's input prices is known as the Panzar-Rosse H-statistics (Panzar and Rosse, 1987) (Turk Ariss, 2010). Based on the market system in which banks operate, the PR model postulates that banks react to fluctuations in the cost of inputs in various ways. This method benefits from the use of bank-specific data, that reflects the unique properties of a number of institutions. The test is developed from the typical banking market framework, which seeks to maximize profit both at the bank and company levels in order to determine the optimal balance of production and total number of banks. Two significant implications result from this equilibrium model. First, when marginal income and marginal expense are equal, bank profit is maximized:

$$MR_i\ (o_i\ , n, g_i) - MC_i\ (x_i, y_i, z_i) = 0 \quad (1)$$

Where marginal revenue function is represented by MR_i, marginal cost function is represented by MC_i, the O_i represents the bank's output, n represents the total number of banks, g_i and z_i are external factors that change the earning and expense functions of the bank, respectively, and y_i represents the scalar of the factor that affects input prices for the bank in question, x_i represents bank I's output.

The second condition for equilibrium is that the industry-level zero profit requirement is valid:

$$R_i\ (o, n, g) - C_i\ (x, y, z) = 0 \quad (2)$$

Based on these conditions, the H-statistic is defined as follows:

$$H = [(\partial R_i/\partial\ y_{ik})(y_{ik}/R_i)] \quad (3)$$

In this case, R_{it}/y_{it} acts as the differential of total revenues with regard to total expenses of the k^{th} input. The above equation demonstrates how the responsiveness of revenue (R_i) of a bank to the fluctuations in the price of its inputs (y_{ik}) define its market power. The extent of banking competition here is quantified using the summation of the input price elasticities. H is the total of the elasticities of revenue in the reduced form with regard to costs of all the factors. In other sense, the calculated H shows the percentage increase or decrease in banking institution's balanced revenue that occurs as a result of a one percentage point increase or decrease in all of its input prices.

The intensity of competition affects the magnitude of H regardless of whether there's perfect or monopolistic colluding or perfect or whether the competition is perfect or monopolistic. Under monopoly, the H-statistics must be smaller than or equivalent to zero. However, in models that are monopolistically competitive, the H-statistic should range between zero and one. Finally, in a perfect competitive environment, the H-statistics would be equivalent to 1. In general, a higher H-statistic denotes more competition. H-statistics are explained further in detail in Table 1 below.

Table 1: Explanations for the H-statistic of Panzar-Ross

Test Of Competitive Environment	
If $H \leq 0$	The short-run speculative oligopoly or monopoly variations
If $0 < H < 1$	Monopolistic Competitiveness In Market
If $H = 1$	Perfect competition, a natural monopoly in a completely difficult market, a corporation that optimizes sales despite being confined by the point at which it breaks-even.

Test of Equilibrium	
If H < 0	State Of Non equilibrium
If H= 0	State Of Equilibrium

Source: Molynuex et al.

While measuring the competitive behavior of banks, the H-statistic of Panzar and Rosse, that evaluates output's reaction to input prices, imposes some restrictive constraints on banks' cost functions. Increases in input costs explicitly cause the revenues and the marginal costs to shift jointly under perfect competition, whereas these joint shifts fail to occur under imperfect competition. Nevertheless, the speculations made with regard to the said metric and the profit maximizing premise is at best accurate only if the market under consideration is in balance or equilibrium. Nathan & Neave (1989) assert that this interpretation assumes that the study can be conducted only on those observations which are in a state of equilibrium over the long term. As a result, we will also be examining the long-run equilibrium of the observations that are utilized in our study.

4.MODEL DESCRIPTION

The model's specification is analogous to that widely used in the empirical research (Delis et al. 2008; Goddard,Wilson 2009), even while the preference of experimental along with company specific regulated factors fluctuates with the description of banks' manufacturing process. As a result, log of total assets is frequently used in studies as a company-specific variable of control. Other studies utilize the logarithm of total of revenues upon the total of assets (TA) as an experimental variable within the Panzar-Rosse approach, in this case output price P (also known as TR/TA, a proxy for revenues), rather than revenues themselves, is explained by the prices of inputs and variables particular to firms firm-specific. Since banks' production operations are not exactly identical to those of other types of businesses, it is crucial to define them when using the P-R technique. To define a bank's production activities, two approaches can be used: (a) Production approach, (b) Intermediation approach. The total amount of securities and loans constitute outputs in accordance with the intermediation technique developed by Sealey and Lindley (1977), whilst deposits, together with capital and labor, constitute inputs in the production process of banks. The input variables in this research explicitly take into account average cost of labor, deposits, and capital. Shaffer (1982) and Nathan and Neaves (1989), on the other hand, used the variable total revenue (TR) as a dependent variable. This is due to a recent increase in the non-interest income's share of total revenue. We follow, among others, Shaffer & Di Salvo (1994), Molyneux et al. (1994), Bikker and Haaf (2002), Claessens & Laeven (2004) , Perera et al. (2006), Al-Muharrami et al. (2006), Schaeck et al. (2009) and Al-Muharrami (2009) to approach the H-statistic empirically. The first specification is consistent with the technique of the financial intermediation since it only considers the interest part of total income as the dependent variable. The input factors taken into account in present study include the mean price of labor, capital and deposits. In light of the intensifying competition in the financial markets, recent studies on banking operations demonstrate a notable rise in other revenue from chargeable services and from operations that are not recorded in balance sheets in near past. To account for the effect of incomes generated from other sources on the fundamental incremental revenue and incremental cost functions of the model, the proportion of additional incomes to total assets as an independent variable is added.

Therefore, we operationalize the following with a stochastic error factor (e) for the empirical analysis:

$$LNIRV_{it} = a_0 + a_1LNPE_{it} + a_2LNPC_{it} + a_3LNPTF_{it} + a_4LNTA_{it} + a_5LNRISK_{it} + a_6ORTR_{it} + a_7\,lnLTA_{it} + e_{it} \quad (4)$$

$$LNTRV_{it} = a_0 + a_1LNPE_{it} + a_2LNPC_{it} + a_3LNPTF_{it} + a_4LNTA_{it} + a_5LNRISK_{it} + a_6ORTR_{it} + a_7lnLTA_{it} + e_{it} \quad (5)$$

Here, each of the subfixes i and t, respectively, stand for i^{th} bank and the t^{th} time. Two measurements serve as the study's dependent variables. IRV explains the proportion of sum of interest revenues to the sum of assets, whereas TRV represents the proportion of total revenues to a total of assets. To account for size variations, the experimental variable has been divided by total assets. This work is built on prior research of Molyneux et al. 1994, Perera et al. 2006 and Al-Muharrami et al. 2006, which makes the assumptions that the approach of intermediation is used

and that all of the funding is input into the banks' production functions. Banks use three inputs in this intermediation approach: labour, deposits, and capital. We estimate the input cost of labour or workers (PE) by using a ratio of personnel costs to total of assets as an indirect measure because we lack accurate observations on this variable. The expense of capital (PC) is represented by the ratio of additional routine expenses to the total worth of durable assets, while total funding expenses (PTF) is represented by the ratio of interest costs to total deposits. The expression for each variable, whether dependent or independent, is expressed in a natural log form.

Several types of other factors that are specific to a bank were also introduced as parameters of control to compensate for changes in spheres of size, capacity, and risk. Total assets were utilized to calculate the size(lnTA), and the risk factor was represented by the proportion of cumulative provisions to total assets (lnRisk) and the amount of the loan to that of total assets ratio (lnLTA). The market-accommodating factor is given by the fraction of other revenues divided by total revenues (ORTR).

Accordingly here, $H = a_1 + a_2 + a_3$

Though the Panzar and Rosse test is intended to assess the magnitude of competitiveness within the banking industry, however its efficacy depends on the premise that markets are operating under stability in the long run. This test is intended to examine if rates of return, which are adjusted for risk, are comparable among banks and whether prices of inputs have an impact on the yields of bank assets. The stability test may be carried out through revising the H statistics and by changing the experimental variable, LnTRV to LnROA (Return on asset). The long run equilibrium test calculates a responsiveness of a sum of earnings on assets (ROA) to supply expenses. E-statistic is used to conduct this equilibrium test. According to the E-statistic, the banking industry is in long-term equilibrium if $b1 + b2 + b3 = 0$. If this premise $b1+b2+b3$ is not equal to zero, is not accepted then the banking sector is in disequilibrium in long run according to a 2004 study conducted by Claessens & Laeven.

The verification procedure that was discussed is crucial for both monopolistic and perfect competitive market models. H as already discussed equals 1 in a perfect competition. However, H is bigger than 0 in monopolistic competition. The existence of monopolistic competitive condition in the market is no longer caused by H being less than 0 if the data set under investigation isn't in equilibrium over the long term, or if it's unstable over time. However, it is true that monopoly or speculative variation short-term oligopolies are disproved if H is greater than 0 (Shaffer, 2005). However, there is an important noting that changes to an equilibrium banking system will take time to manifest. In accordance with the study of Claessens & Laeven, return on assets given in model (6) below is calculated as a natural logarithm of 1+ROA while trying to steer clear of computing the minus values' logarithm. The subsequent equation is what we forecast concerning the Indian banking industry to test this supposition

$$Ln(ROA)_{it} = a0 + a1LNPE_{it} + a2LNPC_{it} + a3LNPTF_{it} + a_4LNTA_{it} + a_5LNRISK_{it} + a_6ORTR_{it} + a_7 lnLTA + e_{it} \quad (6)$$

Table 2: Descriptive statistics of log values of variables

Variable	Mean	Std. Dev.	Min	Max
lnIRTA	-1.133675	0.0554065	-1.28541	-1.021458
lnTRTA	-1.080654	0.0518812	-1.203731	-0.6586748
ln1ROA	0.0007598	0.0044264	-0.025995	0.011921
lnPC	-0.1820901	0.2199777	-0.6574776	0.3803578
lnPE	-2.022378	0.1575723	-2.489332	-0.0667084
lnPTF	-1.223191	0.0847823	-1.462451	-1.037692
lnLTA	-0.2179309	0.1198065	-0.4132898	1.786762
lnRISK	-1.90212	0.2239701	-2.998553	-1.222487
ORTR	0.1119945	0.0333656	0.0475475	0.2467983

lnTA	5.361555	0.4169427	3.162564	6.741701
lnEQ				

Source: Author's calculation

Notes: In the table above lnIRTA is defined as the log of ratio of interest revenue to total assets. lnTRTA is calculated by taking the natural log of ratio of total revenue to total assets. Similarly, lnROA is the log of net profits divided by total asset, lnPC is calculated by taking log of operating expenses divided by fixed assets, lnPE is the log of ratio of employee expenses to total assets, lnPTF is natural log of interest expenses upon total deposits, lnTA is the log of total assets of a bank, ORTR is the ratio of other revenue to total revenue, lnLTA is measured by dividing total loans by total assets and then taking log and finally lnRisk is the log of ratio of loan provisions to total loans of bank.

4.1 Data

Despite the fact that India has several different kinds of commercial banks, mergers in recent years have primarily occurred in public sector banks. As a result, they are chosen as the sample for this study. The study examines annual bank-level data for all Indian public sector banks from 2009 through 2023. This entire time period is divided into two sub periods. The first phase spans from 2009 to 2017, immediately following the global financial crisis, when banks struggled with rising loans that were non-performing and earnings losses that ultimately resulted in bank failure. The second phase lasts from 2018 to 2023 and is marked by waves of merger activity and better execution in the banking sector, notably among public sector banks, mainly because of the federation's various financial changes meant to encourage competitiveness. This study selects 2017 as a year of structural change, since mergers were a key aspect of the Modi government's banking sector reforms, which began in 2017 with the merger of India's largest public sector bank, SBI, and its associate banks.

The variables related to the study are gathered from the annual reports of each individual bank's public balance sheets and revenue statements. The information on bank-specific variables was taken from yearly reports of the central bank(RBI) called "Statistical Tables Relating to Banks in India", which provides bank-specific data related to indicators of statement of financial position and income statement of banks. The overall count of government-owned banking institutions that operate within the Indian banking sector declined to 12 in 2023 from 27 in 2009 as a result of bank mergers throughout this time period. For analysis, unbalanced panel data are employed since, throughout the sample period, certain banks joined while others withdrew from the banking system. In the study, we had 329 bank year observations.

5. Empirical Findings

Ensuring that the banks are functioning in their long-term equilibrium phase is the starting point for the analysis. It requires that they should not have a statistically significant correlation between their returns and their input costs. We do a regression analysis on the variables stated in equation (6) to get ROA which is stated as a fraction of after expense income(net income) to aggregate assets to confirm existence of long-run equilibrium in order to test the H=0 hypothesis. This is done in accordance with the usual literature. According to the estimation in Table 3 a joint coefficient of a_1, a_2, and a_3 is not equal to zero. According to the table's findings, the statistical hypothesis, E is equal to zero, is disproved, and the market is said to be out of equilibrium. The constraint of market equilibrium, E=0, is required to be true in case of a perfectly competitive market scenario, but not necessary when there is competition that is monopolistic, which happens to be a feature of the Indian banking system, according to Matthews et al. (2007). Further, the empirical results showing $a_1+a_2+a_3$ not exactly equals zero also suggest that reorganization of the Indian banking industry is still going on, therefore it is probable that the market will not always be in equilibrium.

Ordinary least squares has often been used by prior studies for predicting this P-R model. This method of assessing the model could, however, lead to unreliable outcomes. The present study used the fixed-effect model to solve this issue by accounting for the potential impacts of bank-specific and time-varying variables (such as M&A) on the estimation findings. Since the OLS approach does not account for bank heterogeneity or other characteristics specific to each bank, the method allows us to adjust for these factors. However, random-effect model and OLS has been used to provide robustness to the findings obtained using fixed-effect model.

Table 3: The Test of long-run equilibrium with return on asset (ROA) as dependent

lnPC	0.002 (1.79)*
lnPE	-0.010 (-6.56)***
lnPTF	-0.007 (-2.96)**
lnLTA	0.010 (4.70)***
lnRISK.	-0.014 (-18.64)***
lnORTR	0.004 (0.67)
lnTA	-0.001 (-1.15)
No Of Observations	329
R^2	0.70
st for H=0 (p)	94.27 (0.000)

H = 0 is rejected (market not in equilibrium)

The value written within the bracket is the t-statistic

In order to assess if the obtained H-statistics were distinguishable from zero and one in statistical terms, a Wald test, that follows an F-distribution, has also been conducted. The calculated outcomes of models (4) and (5), which used interest and aggregate revenues as experimental variables, are shown in Table 4 for public sector banking institutions in India. In general, empirical outcomes show that the calculated models have a fine goodness of fit.

When interest revenue was taken as an experimental variable, value of H statistic declined from 0.656 during the pre-merger phase to 0.618 during the post-merger period. It decreased marginally from 0.621 to 0.617 when total revenue was utilized as an experimental variable. It also has a positive sign in all the models as can be seen below in Table 4. The findings are similar with previous research by Claessens & Laeven (2004), Al-Muharrami et al. (2006), Perera et al. (2006), Aktan and Masood (2010), and Mensi (2010), all of which have found that H- Statistic lies between 0 and 1, indicating monopolistic competition.

The Wald test rejects both the perfectly competitive market model (H=1) and the monopolistic market model (H=0) hypotheses at the 1% level for both periods.

In terms of the market framework for the Indian banking industry, the Wald tests arrive at an identical result which is monopolistic competition. The findings of the H-statistic estimate for the two independent variables, namely total revenue and interest revenue were reliable.

Table.3: Calculated findings for experimental variables log IRTA which is defined as a division of interest revenue by total asset and log TRTA which is equal to aggregate revenue upon aggregate asset (fixed effects model)

	2009-2017		2018-2023	
variables	Interest Revenue	Total Revenue	Interest Revenue	Total Revenue
lnPC	0.028	0.013	0.072	0.071
	(4.07)***	(0.77)	(2.29)**	(2.24)**
lnPE	0.093	0.099	0.067	0.067
	(7.69)***	(3.33)**	(4.02)***	(4.01)***
lnPTF	0.535	0.509	0.479	0.479
	(25.99)***	(9.56)***	(13.96)***	(13.94)***
ORTR	-0.386	0.321	-0.149	0.357
	(-8.54)***	(2.79)**	(-2.57)**	(6.11)***
lnTA	-0.043	-0.006	0.027	0.027
	(-4.82)***	(-0.26)**	(1.41)	(1.42)
lnLTA	0.146	0.201	0.193	0.192
	(4.82)***	(2.61)**	(3.77)***	(3.75)***
lnRISK	0.057	0.046	0.024	0.024
	(8.14)***	(2.57)**	(3.58)**	(3.57)**
No of observations	234	234	95	95
R square	0.89	0.64	0.91	0.88
H	0.656	0.621	0.618	0.617
Wald Test, H=0	(0.000)	(0.000)	(0.000)	(0.000)
Wald Test, H=1	(0.000)	(0.000)	(0.000)	(0.000)

(1) The t statistics appear within the brackets. (2) The hypothesis that H = 0 along with H = 1 are tested using the Wald test. To test the possibility that H = 0 for the 1% significance level , the F statistic is (H = 0), and to test the premise that H = 1 at the 1% significance level , the F statistic is (H = 1). (3) This article does not include the constant coefficients in the fixed effect model. (4) The total of lnPC, lnPE, and lnPTF is the H statistic.

In both eras, each of the three interest variables are positive, demonstrating that rising factor costs are accompanied with rising total revenue. Further all three variables are significant at different levels except price of capital which is insignificant in total revenue model in pre- merger period. In terms of the size of the coefficient, the unit cost of funding (lnPTF) is the variable that has the most influence on how much revenue changes. It is also the one of the three factor input prices that has the greatest statistical significance. For public sector banks, the per unit cost of labor is large and strongly correlated with interest rates and overall income in both instances. But it decreased in post-merger period which may be because of increasing technology, voluntary retirement scheme or loss of employment after mergers. In the pre-merger period the per-unit cost of capital was positive but exhibits a significant relation only with interest revenue. For total revenue though the coefficient is positive but it is not significant. The per-unit cost of capital turned significant during the second sub period in both models highlighting the increasing importance of capital.

The sign and significance of the majority of control variables remain unchanged between the two periods. The first control variable (ORTR) demonstrated the same relation which was anticipated that is, to be inversely correlated with interest revenue and positively correlated with total revenue. Such a link suggests a quick increase in total

revenue instead of a loan-deposit margin, as suggested by Bikker & Haaf (2002). A similar positive correlation between the bank's overall income and its liquid assets is demonstrated by our control variable lnLTA. This means that banks with fewer loans and higher proportion of liquid assets produced more total revenue. This could be due to banks with a higher proportion of liquid assets being able to invest in more profitable projects or capitalize on other revenue-generating opportunities. The expected positive association exists between the control variable lnRisk and total revenue and interest revenue. A higher accumulated provision shows that the bank has taken proactive steps to limit future losses and maintain financial stability. This cautious risk management technique improves the bank's overall financial health and contributes to increased revenue.

For banks in the pre-merger period, the last control variable, lnTA, shows a negative and significant coefficient, implying that the benefits of their size, such as economies of scale, may not fully translate into cost efficiency and performance. Though the variable asset is positive after the merger, it is not statistically significant at any conventional level. As a result, the empirical findings of this study strongly corroborate Eichengreen and Gibson's (2001) claim that the effect on performance of a bank of continuously expanding size may be advantageous up to a point only. After this particular stage, bureaucracy and other obstacles may result in no impact of the size on the performance of bank.

As a result, the H-statistic results imply that after mergers the competition has decreasing in a setting that is monopolistically competitive after mergers. This decreased competition was brought on by the banking sector's reorganization and consolidation that led to a smaller number and therefore, more concentrated banks, which in turn produced monopolistic competitive conditions in the market. Despite growing revenue from intermediary activity, banks are also battling more fiercely for deposits and lending margins.

6. Robustness Of Results

The robustness and reliability of the results is assessed by including Random effect model and pooled OLS model as alternative model specification. It is beneficial in understanding whether the outcomes are independent of various modelling hypothesis or not. The objective is to offer a comprehensive study of robustness of findings and enhance the general reliability of the findings by using alternative models. The results of random effect model and pooled OLS are given in tables 4 and 5 respectively. The results are consistent with the results obtained earlier in our primary model.

Table 4: Results for lnIRTA and lnTRTA using Random Effect Model

	2009-2017		2018-2023	
Variables	Interest Revenue	Total Revenue	Interest Revenue	Total Revenue
lnPC	0.020	0.014	0.066	0.064
	(3.60)***	(1.35)	(3.25)**	(3.22)**
lnPE	0.103	0.110	0.074	0.073
	(9.50)***	(4.80)***	(4.98)***	(4.95)***
lnPTF	0.509	0.488	0.430	0.430
	(26.52)***	(11.52)***	(14.97)***	(14.98)***
ORTR	-0.354	0.28	-0.204	0.305
	(-8.54)***	(2.98)**	(-4.01)***	(6.01)***
lnTA	-0.025	-0.022	-0.004	-0.005
	(-4.79)***	(-2.42)**	(-0.57)	(-0.60)
lnLTA	0.176	0.236	0.190	0.188
	(5.99)***	(3.45)**	(4.28)***	(4.24)***

lnRISK	0.050	0.059	0.024	0.024
	(8.10)***	(4.27)***	(3.67)***	(3.66)***
No of observations	234	234	95	95
R square	0.89	0.68	0.91	0.88
H	0.632	0.612	0.570	0.567
Wald Test, H=0	(0.000)	(0.000)	(0.000)	(0.000)
Wald Test, H=1	(0.000)	(0.000)	(0.000)	(0.000)

(1) The t statistics appear within the brackets. (2) The hypothesis that H = 0 along with H = 1 are tested using the Wald test. To test the possibility that H = 0 for the 1% significance level , the F statistic is (H = 0), and to test the premise that H = 1 at the 1% significance level , the F statistic is (H = 1). (3) This article does not include the constant coefficients in the fixed effect model. (4) The total of lnPC, lnPE, and lnPTF is the H statistic. A significance level of 10%, 5%, or 1% is indicated by the symbols *, **, and ***, respectively.

As can be seen from table 4, H statistics has decreased from 0.63 and 0.612 for lnIRTA and lnTRTA respectively in pre merger period to 0.570 and 0.567 in post merger periods. The main variables have same sign and significance as the variables in the main model providing robustness to our results. Almost all the control variables also exhibit the same signs and significance confirming our earlier results. Though the variable lnTA has remained negative post consolidation also but is still insignificant like earlier model. Similarly, Wald test rejects both H=0 and H=1 hypothesis at 1% level of significance confirming the existence of monopolistic competition in the market.

Table 5: Results for lnIRTA and lnTRTA using Pooled OLS model

	2009-2017		2018-2023	
Variables	Interest Revenue	Total Revenue	Interest Revenue	Total Revenue
lnPC	0.013	0.014	0.045	0.045
	(3.28)**	(1.68)	(3.36)**	(3.35)**
lnPE	0.115	0.113	0.061	0.061
	(12.30)***	(6.12)***	(3.72)***	(3.75)***
lnPTF	0.461	0.468	0.376	0.378
	(24.68)***	(12.67)***	(11.80)***	(11.98)***
ORTR	-0.340	0.243	-0.266	0.247
	(-7.47)***	(2.70)**	(-5.08)***	(4.72)***
lnTA	-0.022	-0.024	-0.014	-0.015
	(-7.09)***	(-3.93)***	(-3.07)**	(-3.14)**
lnLTA	0.225	0.266	0.174	0.172
	(6.72)***	(4.02)***	(4.36)***	(4.33)***
lnRISK	0.053	0.067	0.028	0.028
	(7.98)***	(5.06)***	(3.48)**	(3.46)**
No of observations	234	234	95	95
R square	0.88	0.60	0.86	0.83

H	0.589	0.595	0.485	0.484
Wald Test, H=0	(0.000)	(0.000)	(0.000)	(0.000)
Wald Test, H=1	(0.000)	(0.000)	(0.000)	(0.000)

(1) The t statistics appear within the brackets. (2) The hypothesis that H = 0 along with H = 1 are tested using the Wald test. To test the possibility that H = 0 for the 1% significance level , the F statistic is (H = 0), and to test the premise that H = 1 at the 1% significance level , the F statistic is (H = 1). (3) This article does not include the constant coefficients in the fixed effect model. (4) The total of lnPC, lnPE, and lnPTF is the H statistic. A significance level of 10%, 5%, or 1% is indicated by the symbols *, **, and ***, respectively.

Further, it can be seen from table 5 above that the primary variables maintain the sign and significance when pooled OLS model is employed. All the control variables have maintained their sign and significance except lnTA which has become significant in all the models pre and post merger . Wald test has rejected both H=0 and H=1 hypothesis at 1% level of significance for all models confirming existence of monopolistic competition in Indian banking industry.

7.Conclusion

The study looked at the intensity of competitiveness in the banking system of India from 2009 to 2023, divided into two sub-periods: 2009-2017 and 2018-2023. For both the periods under study the calculated values of H-statistic comes out to be positive and it declines from a value of 0.656 to a value of 0.618 for the IRTA equation and from 0.621 to 0.617 for the TRTA equation. The study concluded that competition has decreased because of consolidation process within public sector banks in India. However, the results are in line with other studies conducted in 2006 by Al-Muharrami and Perera et al., for underdeveloped nations which have found H- statistics ranging from zero to one. In this study the Wald test disproves the theory of perfect competition or monopoly within the market for both research periods. Additionally, the research shows that both the conventional markets based on interest rate as well as the entire marketplace, which also includes operational revenues from fees and commission based goods market segments, are subject to close to equal competition. However, given that financial system consolidation is still in its early stages and is a continuing process, the conclusions of the present article should be viewed with care. In recent years, however, studies have shown that there are more nuanced relationships between competitiveness and performance of banking system (Vives 2001). Considering banks compete with other institutions and financial markets, it does seem that a healthy financial system is also crucial, even though allowing new competitors into the market may encourage banks to perform effectively when there are relatively few banks in the market (Boot and Thakor 2000). In addition, for contestability—which may be related to increasing rivalry over the financial system—fewer restrictions upon the operations that banks can participate in are essential.

References

Al-Muharrami, S.(2009): "The competition and market structure in the Saudi Arabia banking,"Journal of Economic Studies 36, 446-460.

Bikker, J. A./ *Groeneveld*, J. M. (2000): "Competition and concentration in the EU banking industry,"Kredit und Kapital 33(1), 62-98.

Bikker, J. A./ *Haaf*, K. (2002): "Competition, concentration and their relationships: an empirical analysis of the banking industry," Journal of Banking and Finance 26, 2191-2214.

Luc./Can./Ariff, M.(2008): "Cost and Profit Efficiency of banks: A Non-parametric Analysis,"China Economic Review 19, 260-278.

Casu, B./*Girardone*, C./*Molyneux*, P. (2006): "Introduction to Banking,*"*Harlow: FT Prentice Hall.

Claessens, S./*Laeven*, L.(2004): "What drives bank competition? Some international evidence,"Journal of Money, Credit, and Banking 36, 563-584.

Coccorese, P. (2004): "Banking competition and macroeconomic conditions: a disaggregated analysis,"International Financial Markets, Institutions and Money 14, 203-219.

De Bandt, O./ *Davis*, E. P. (2000): "Competition, contestability and market structure in European banking sectors on the eve of EMU,"Journal of Banking and Finance 24, 1045-1066.

Demsetz, H. (1973): "Industry structure, market rivalry and public policy," Journal of Law and Economics16, 1-19.

Gelos, R. G. / *Roldos*, J. (2002): "Consolidation and Market Structure in Emerging Market Banking Systems,"IMF Working Paper, 02/186.

Gilbert, R. A. (1984): "Bank market structure and competition: a survey," Journal of Money, Credit, and Banking 16 (4 Part 2),617-644.

Gunalp, B./ *Celik*, T. (2006): "Competition in the Turkish banking industry,"Applied Economics 38,1335-1342.

Hempell, H. S. (2002): "Testing for Competition among German Banks,"Discussion Paper, Economic Research Center for the Deutsche Bundesbank.

Hondroyiannis, G./*Lolos,* S./ *Papapetrou*, E. (1999): "Assessing competitive conditions in the Greek banking system," Journal of International Financial Markets, Institutions and Money 9, 377-391.

Lau, L. (1982): "On identifying the degree of competitiveness from industry price and output data,"Economics Letters 10, 93-99.

Lloyd-Williams, D. M./ *Molyneux*, P./ *Thornton*, J. (1991): "Competition and contestability in the Japanese commercial banking market," Research Papers in Banking and Finance,16. Institute of European Finance.

Majid, A.M.Z. / *Sufian*, F. (2006): "Consolidation and competition in emerging market: an empirical test for Malaysian banking industry," Economic Change and Restructuring 39, 105-124.

Molyneux, P./ *Lloyd-Williams*, D.M. / *Thornton*, J. (1994): "Competitive conditions in European banking," Journal of Banking & Finance 18, 445-459.

Molyneux, P. / *Thornton,* J. / *Lloyd-Williams*, P.D. (1996): "Competition and market contestability in Japanese commercial banking,"Journal of Economics and Business 48, 33-45.

Murjan, W. / *Ruza*, C. (2002): "The competitive nature of the Arab middle eastern"

Nathan, A. / *Neave*, E.H. (1989): "Competition and contestability in Canada's financial system: empirical results," Canadian Journal of Economics 22, 576-594.

Panzar, J. C./ *Rosse*, J. N. (1987): "Testing for 'monopoly' equilibrium.,"Journal of Industrial Economics 35, 443-456.

Perera, S./ *Skully*, M. / *Wickramanayake*, J. (2006): "Competition and structure of South Asian banking: a revenue behaviour approach," Applied Financial Economics 16, 789-801.

Prasad, A. / *Ghosh*, S. (2007: "Competition in Indian banking: an empirical evaluation," South Asia Economic Journal 8, 265-284.

Shaffer, S. (1993): "A test of competition in Canadian banking," Journal of Money, Credit and Banking 25, 49-61.

Shaffer, S. (2002): "Conduct in bank monopoly," Review of Economic Organizations 20,221-238.

Turk-Ariss, R.(2009): "Competitive behavior in Middle East and North Africa banking systems," The Quarterly Review of Economics and Finance 49, 693-710.

Yuan, Y. (2006): "The state of competition of the Chinese banking industry,"Journal of Asian Economics 17, 519-534.

*#Additional Information: * The author is a research scholar at Aligarh

Muslim University and can be contacted through E-mail, mirsueeba14@gmail.com

#The author is a Professor at Aligarh Muslim University and can be reached out through nisarahmadkhanecon@gmail.com