

# India's Banking Market Structure: Impact Assessment of Bank Consolidation

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## Abstract

*The present study aims to extend the existing literature on measuring competition by including recent bank consolidation in India. Unlike existing literature, the study goes in-depth to account for the asymmetric behavior of bank competition owing to ownership, size, scale, efficiency, and pre/post-global financial crisis. The study takes the unbalanced panel data of Indian banks from 1995-2021 and utilizes the non-structural approaches- Lerner Index, PRH statistic, and Boone Indicators to measure the bank competition. The study finds the asymmetric level of competition across ownership, size, profitability, and inter-temporal- before and after the global financial crisis. It finds that the smallest banks experienced lower competition during 2006-2021, whereas the largest banks behaved competitively. Similarly, the low-profit banks have noted a higher level of competition than the high-profit-making banks, indicating the role of structure in bank performance. The less efficient banks have reported higher competition. Using PRH statistics, it was found that the Indian banking industry experiences monopolistic competition. The findings hail that the private sector banks and more extensive holdings are exhibiting a higher level of competition compared to the public sector banks. For the Boone indicator, the study finds a modest level of competition in line with the World Bank's estimation.*

**Keywords:** India, Lerner Index, PRH, Boone, panel data, asymmetric competition

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## 1. Introduction

In the economics literature, the promotion of market-driven economic forces has remained a major thrust among policymakers for its wider implications in terms of efficient allocation of resources. The implications of a competitive banking system are a multifold reduction in the risks of financial crises (Claessens & Klingebiel, 2001), more efficient credit allocation among firms (Glass et al., 2020), greater financial stability, product innovation, and more extensive access to financial resources to households and firms (Hauner & Peiris, 2005), among others. In due process, countries have initiated a number of pro-competitive measures to allow the market-based system for smooth functions of the banking system. However, the narrative of competition efficiency gained much prominence post-global financial crisis and invited the interest of policymakers worldwide to revisit the implications of competition in the banking industry. India has also invited renewed interests of policymakers towards the impact assessment of financial sector reforms on bank market structure, eventually affecting the real economy. The journey of banking sector reforms dates back to the 1960s with the nationalization of banks, followed by the deregulation of interest rates, private participation, reduction of the reserve requirement, and broadening of the horizon of credit allocation towards various sectors by the 1990s. All this resulted in a change in the composition with a decrease in the public sector banks' share in aggregate assets from 90 percent in 1991 to around 75 percent in 2004. In the recent past decade (post-2016) the associate banks of the State Bank of India have been merged into a large bank along with the setting up of four large banks through mergers to meet the industrial requirements. These findings motivate us to explore the ongoing market structure of the Indian banking industry.

Moreover, recent studies have considered the asymmetric effect of banks in the measurement of bank competition. Glass et al. (2020) measured the bank competition using the Boone indicator for large banks in the USA during the period 1994-2015. The study has captured the bank competition for pre-crisis, during-crisis, and post-crisis periods along with at the sub-sample level such as global and domestic systemically important (GDSI) and non-GDSI banks. The study finds that the USA banking industry has witnessed an upsurge in competition and experienced more intense competition in the post-crisis period than in the pre-crisis period. In India, prominent studies such as Rakshit and Bardhan (2019), Arrawatia et al. (2014), and Sinha and Sharma (2016) tried to measure the bank competition; however, the asymmetric effect across crisis period, size, ownership, and profitability remains overlooked in Indian banking literature. Even these studies could not account for the most recent developments, especially post-2016, a significant fiscal consolidation in Indian banking. The present study aims to bridge this gap and measures the competition during recent bank consolidations using non-structural approaches. The study puts forth special emphasis on bank competition amid asymmetric effects across size, profitability, scale of operations, ownerships, efficiency, and inter-

temporal, mainly pre- and post-crisis periods. Such analysis will help policymakers in addressing the changing landscape of market structure in the Indian banking industry. The paper is structured as follows: The next section brings a brief review of the literature related to bank competition. Section 3 mentions research methodology covering sample rationality, along with various methods of competition measurement. Section 4 presents empirical results and, finally, concludes the study.

## 2. Literature Review

Numerous studies have quantified the level of competition using the structural and non-structural approaches in the panel as well as the time series framework. Anzoategui et al. (2010) relied on H-statistics and the Lerner index to compute the bank competition across regions of the world economy and observed the lowest level of bank competition in the Middle East and North Africa (MENA) region. This differential level was attached to the weak flow of information in the credit market and less contestability in the region. Fungacova et al. (2010) examined market power in Russian banking during 2001-07 using the Lerner index and observed modest levels of competition in line with the bank structure of developed countries. Relying on the Boone (2008) measure of competition for 148 sample countries, Clerides et al. (2013) found a deterioration in competitive conditions during 1997-2006 and rising competition until the occurrence of the global financial crisis. In the country-specific study of Malaysian Islamic banking, Majid and Sufian (2007) observed the gradual decline in the concentration attributed to the pro-competitive measures in the economy. Stavarek and Repkova (2011) assessed the bank competition in the Czech banking industry for 2001-09 and observed the monopolistic competition during the sample period. Rahman et al. (2015) utilized the panel data of 30 Bangladesh banking industry from 2012 to 2015 and noted that large banks are more prone to risk-taking practices, and accordingly more concentrated banks may compromise the bank stability. Jiang and Wu (2023) considered the panel data for 101 developing countries during 2005-20 and observed the lower level of bank development in these countries, and the market concentration moves in the opposite direction to the industrial structure. Nielsen and Weinrich (2023) propose a theoretical model to measure the impact of regulatory provisions of the capital requirement on the bank market structure and report that higher regulatory provisions may lead to risk-taking by the banks.

For India, Bhattacharya and Das (2003) considered the post-economic reforms period and tried to measure the impact of bank mergers of the late 1990s. They noted a significant change in the levels of concentration in the early 1990s; however, the market structure remained intact despite bank mergers. Prasad and Ghosh (2007) utilized the annual data for 1996–2004 and found the monopolistic competition in the Indian banking industry. A similar finding was observed by Misra (2011) through the dynamic panel data approach of PRH statistics for a sample of 75

Indian banks. Murthy et al. (2016) utilized the fixed effects panel data from 1995 to 2010 to assess the market structure of Indian banking in light of the private banks' licensing policy of the early 1990s. The study observed the rising presence of private sector banks and confirmed the rising level of bank competition; however, the structural efficiency could not be ascertained. Numerous studies have measured the performance of Indian banks while utilizing the DEA approach and Shannon-DEA approach and observed the resiliency of Indian banks even during the global financial crisis period (Narwal & Pathneja 2015; Jayaraman & Srinivasan 2014). Rakshit and Bardhan (2019) measured the level of competition in Indian banking using the Lerner index and Boone indicator for the period 1996-2016. Overall, the banking sector reports a competitive environment and a higher degree of competition among public-sector banks. However, these studies fail to account for the recent developments of banking sector consolidation, mainly carried out after 2016, and also the asymmetric level of competition across size, scale, and ownership. The present study extends the existing literature by providing detailed insight into bank competition using all the prominent methods and the most recent period, including the major banking sector developments of the past decade.

### **3. Methodology**

#### **3.1. Sample Selection and Data Sources**

The study uses secondary data, and the sample period ranges from 1995 to 2021. This period includes the best and most challenging time for the Indian economy. Best can be used as an outcome of enhanced growth (2004-08), but challenging is classified for the occurrence of two economic shocks- GFC (2007-08) and sovereign debt crisis (2011-12). The sample period has the advantage of accounting for the roles of various reforms, including BASEL II, III, and the recent bank consolidation. We extract the accounting data from Statistical Tables Relating to the Bank in India, publication of the Reserve Bank of India. The study first takes the sample of 92 scheduled commercial banks and then, we trim the sample by removing those banks where the data availability gap is more than five years. In the case of a bank merger, the study considers the surviving entity and drops the merging bank into the primary entity. Accordingly, the sample bank numbers vary for different periods with the highest number of 75 in the year 2011 and the lowest of 58 in the year 2021. However, the sample banks have remained the representative of Indian banking industry throughout the sample period. Please see Table 1 for the inter-temporal number of banks and their asset shares.

#### **3.2. Method of Analysis**

Existing literature has considered the structural and non-structural approaches for competition measurement in the banking industry. The latter approach includes PRH statistics, the Lerner index, and the Boone indicator and offers an advantage over the structural approach in terms of capturing the threat of entry and existing

behavior and has been preferred in the recent past literature (Shijaku, 2017). Accordingly, the present study utilizes the latter approach for the measurement of bank competition in India.

**Table 1. Summary Statistic for Sample Banks**

Category	1995	2001	2011	2021
<b>Number of Banks</b>				
PSBs	26	26	26	13
Private	17	18	20	17
Foreign	24	24	28	28
Total	67	68	75	58
<b>Asset Share (%)</b>				
PSBs	83.51	78.71	73.43	62.06
Private	4.12	8.57	18.97	29.38
Foreign	4.99	5.64	6.47	6.11
Total	92.61	92.92	98.88	97.55

Source: Author's Computation

### 3.2.1. Lerner Index

The Lerner index measures the gap in output prices over the marginal cost to capture the market power of a firm (Lerner, 1934) and higher values suggest lower competition (Pruteanu-Podpiera et al. 2007). Prices are calculated as total bank revenue over assets, whereas marginal costs are obtained from an estimated translog cost function concerning output.

Following Fungáčová and Weill (2013) translog total cost function can be specified as follows:

$$\begin{aligned} \text{Log}(TC) = & \alpha_0 + \alpha_1 \log Q + \alpha_2 (\log Q)^2 + \sum_{j=1}^3 \beta_j \log(w_j) + \\ & \sum_{j,k=1}^3 \beta_{jk} \log(w_j) \log(w_k) + \sum_{j=1}^3 \gamma_j \log Q \log(w_j) + \epsilon \end{aligned} \quad (1)$$

The bank's marginal cost is computed as follows:

$$MC = \frac{TC}{Q} (\alpha_1 + 2\alpha_2 (\log Q) + \sum_{j=1}^3 \gamma_j \log(w_j)) \quad (2)$$

### 3.2.2. PRH

The PRH-Statistic captures the variation between input prices and revenue of the banks to draw an inference about market structure. There are static and dynamic models to measure the PRH statistic.

#### 3.2.2.1. Static Model

Following fixed effects (FE) regression is utilized for the static version:

$$\log(R_{it}) = \beta_0 + \beta_1 \log(W_{1it-1}) + \beta_2 \log(W_{2it-1}) + \beta_3 \log(W_{3it-1}) + X_{it} + e_{it} \quad (3)$$

Where X stands for the vector of control variables and studies have considered mainly the credit risk, leverage, and equity-to-total assets ratio (Rapapali & Simbanegavi, 2020; Sinha & Sharma, 2016). Most of the existing studies have used the revenue as a dependent variable; but some have treated the revenue to assets ratio for better comparative analysis across banks (Misra, 2011). Accordingly, we utilize the revenue to assets as a dependent variable and account for bank-specific control variables such as the leverage- the ratio of equity to total assets and credit risk- the provisions of NPA's to total advances.

The H statistic is computed using the summation of coefficient values estimated from eq. 3. H-statistic =  $\beta_1 + \beta_2 + \beta_3$ . Goddard and Wilson (2009) observed that fixed effects may produce biased estimation and necessitate the utilization of dynamic models.

### 3.2.2.2. Dynamic Model

Following Sinha and Sharma (2016), the study considers the Generalized Method of moments (GMM) developed by Arellano and Bond (1991), where the lagged levels of endogenous variables are used as instruments in the differenced equation.

$$\log(ROA_{it}) = \alpha_0 + \delta \log(ROA_{it-1}) + \beta_1 \log(W_{1it}) + \beta_2 \log(W_{2it}) + \beta_3 \log(W_{3it}) + X_{it} + e_{it} \quad (4)$$

The acceptance of the null hypothesis for the sum of collective coefficients equal to zero suggests for condition of equilibrium and rejection for disequilibrium. Having confirmed the equilibrium, we use the following model to measure the PRH statistic under the dynamic framework.

$$\log(R_{it}) = \beta_0 + \delta \log(R_{it-1}) + \beta_1 \log(W_{1it}) + \beta_2 \log(W_{2it}) + \beta_3 \log(W_{3it}) + X_{it} + e_{it} \quad (5)$$

Here the PRH statistic is given by  $H = \frac{\sum \beta_i}{1 - \beta_0}$

The value of the H-statistic can determine whether there exists perfect competition (H=1), monopoly (H=0), and monopolistic competition (H in between 0 & 1).

### 3.2.3. Boone Indicator

This indicator measures the competition based on profit-efficiency in the banking market. The more negative the Boone indicator is, the higher the level of competition in the market. Following Van Leuvensteijn et al. (2013), the Boone indicator is estimated as follows:

$$\log(ROA_{it}) = \beta_0 + \beta_1 \log(MC_{it}) + \beta_2 \log(Equity_{it}) + \beta_3 \log(NPA_{it}) + \beta_4 \log(NIM_{it}) + \varepsilon_{it} \quad (6)$$

## 3.3. Variables Selection

The present study follows the intermediation approach and accordingly uses three variables for input prices- a) price of labor (W1), measured by the ratio between personnel expenses and total assets; b) price of physical capital (W2), measured by

the operating expenses (net of employees expenses) to assets ratio; c) price of funds (W3) quantified by the interest expenses to total assets ratio; For the output (Q) indicator, we take the total assets of the banks, and total cost (TC) through the cost of operating and interest expenses (Mustafa & Toci, 2017). The study follows the standard variables for competition measurement as mentioned in Table 2.

**Table 2. List of Variables of the Study**

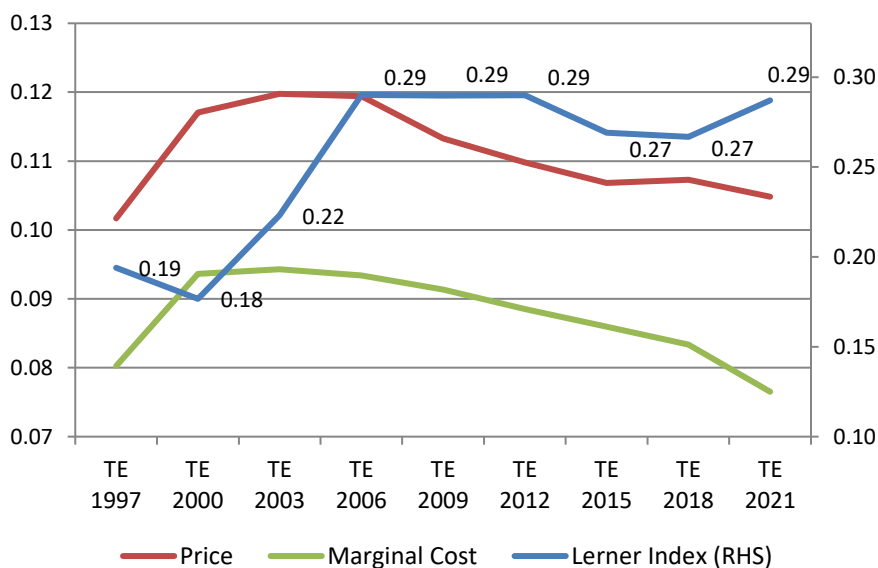
Variable	Dimension	Measurement
W1	Labor cost	Payment to employees to assets ratio
W2	Operating cost	Operating expenses net of employee expenses to assets
W3	Cost of funds	Interest expenses to assets ratio
Q	Output	Log of total assets
ROA	Profitability	Net earnings to total assets ratio
TC	Total Cost	Operating cost-plus interest expended
MC	Marginal cost	The partial derivative of a translog cost function
Prices	Prices	Total bank revenue over assets
R	Revenue	Log values of income
Equity	Equity Capital	Equity to Assets ratio
NPA	Credit risk	NPA provisions for Gross Advances
NIM	Bank efficiency	Net interest margin to total assets
Scale	TR	Total revenue
Efficiency	TR/TC	Total revenue to total cost ratio

## 4. Bank Competition in India: Empirical Results

### 4.1. Lerner index

Figure 1 shows the evolution of the output price, the marginal cost, and the Lerner index of the Indian banking sector during 1995-2021. Marginal costs initially increased till 2003 but decreased consistently after that till 2021. The prices increased during 1995-2006 but declined gradually after that. The Lerner index fell in the late 1990s but increased significantly during the first decade of the 21st century, reaching its highest level of 0.29 in TE 2006, jointly pushed by a rise in prices and marginal cost till 2006. After that, the Lerner index stagnated till TE 2012, suggesting that lower competition means higher concentration. The stable Lerner index during 2006-12 can be attributed to the more regulatory provisions initiated in the backdrop of the global financial crisis of 2007-08. The magnitude of our compiled Lerner index matches with the Lerner index reported by World Development Indicators for the period 2001-15. The trend pattern of the Lerner index of the study is in line with Arrawatia et al. (2014) in the Indian banking industry, albeit marginal change in the magnitude may be due to the sample size of the banks. The Lerner index value fell marginally during 2013-18 (to 0.27 from the previous level of 0.29), but again surged in TE 2021 same as to the level of 2005-12. The continuous high level of the Lerner index is attributed to stagnancy in the price level (during 2010-21) despite falling marginal cost in the same period. Interestingly, the monetary policy

has been in an accommodative stance post the global financial crisis, and as a result, the prices have eased during TE 2012 compared to the previous level, but the continuous decline in marginal cost has not been passed on to the price level, thereby suggesting for overall a degree of market power in the banking industry. One inference can be drawn that the banking industry has been cautious about the tight monetary stance, continuously exploring alternative means for sources of funds. As an outcome, the industry could reduce the marginal cost. Of course, the initiative of MCLR and the capital accord of Basel III promoting equity capital would have helped the banking industry to explore the other competing alternatives of supply of funds for the banks. The recent surge seems a reflection of policy initiatives strengthening the ideas of big banks through mergers of various public sector banks into four banks, namely SBI, Canara Bank, Bank of Baroda, and PNB. Thus, it can be concluded that the average Lerner index value of 0.20 during 1997-2021) is a little higher than the lowest value (zero); hence, the Indian banking industry is marginally away from the perfect competition market. There had been a tendency to move towards perfect competition; however, the recent mergers of banks might have again led to increased concentration in the market.



**Figure 1: Price, Marginal Cost, and Lerner Index in Indian Banking**

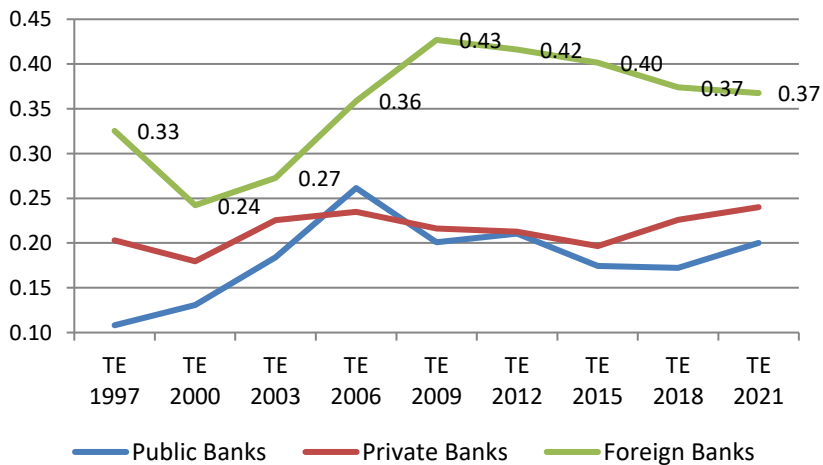
*Source: Author's Computation.*

Figure 2 presents the distribution of the Lerner index across bank ownership groups- public, private, and foreign banks. The Lerner index in value terms is much higher for foreign banks compared to public and private banks, suggesting a high level of concentration in the foreign banks' segment, whereas the public sector banks appear



to be relatively competitive. This finding indicates that the overall Lerner index of India (as reported in the above discussion) was mainly pulled by foreign banks. An inter-temporal analysis reveals that the Lerner index values have been stagnant for the entire sample period for the private sector banks; however, there have been many fluctuations in the index value for public sector banks. In the latter case, the index values increased in the early years of the 21st century and reached the highest (0.26) in TE 2006 from the previous level of 0.11 during TE 1997; then subsequently declined and came to the lowest level of 0.17 during TE 2018, before rising in TE 2021. This finding confirms the low level of competition in public sector banks during 2004-12 but higher competition thereafter. Before 2006, the public sector banks experienced lower competition (with the rising Lerner index). However, after that, the stemming competition from private sector banks (as the Lerner index tended to fall gradually, encouraged the public sector banks to go ahead competitively. Over the years, private banks have had a moderate level of competition. These findings are consistent with the outcome of Rakshit and Bardhan (2019), confirming the competitiveness of public banks over private banks.

Interestingly, the gap between the Lerner index value for private and public sector banks, which was much higher during the late 1990s, mainly on the higher side value for the early group, hinted at the low competition in private banks by the end of the 20th century. However, this gap narrowed down during 2004-12, with a faster rise in index values for public sector banks, resulting in low competition thereon for the public banks. However, after 2012, the gap widened with a rising Lerner index of Private sector banks amid their cautious move in the wake of the consolidation of public sector banks post-2016 mergers.



**Figure 2: Lerner Index in Indian Banking across Ownership**

Source: Author's Computation based on data from Statistical Tables Relating to Banks in India of RBI.

Table 3 presents the evolution of the Lerner index along with its components- prices and marginal costs during 1995-2021 across bank ownerships. A disaggregate level analysis of MC indicates that the public sector banks had met with higher MC during TE 1997 compared to the other two counterparts, but post-2003, these banks could reduce the marginal cost and even reported a lower level than those of the MC in private sector banks. This behavior might have led the public sector banks for relatively more competitive than the private sector banks. Over the entire sample period, the MC for foreign banks has been consistently lower than the public sector banks.

**Table 3. Lerner Index, Price, and Marginal Cost in Indian Banking Across Ownership**

Ownership	TE 1997	TE 2000	TE 2003	TE 2006	TE 2009	TE 2012	TE 2015	TE 2018	TE 2021
<b>Lerner index</b>									
Public Banks	0.1081	0.1309	0.1842	0.2614	0.2007	0.2107	0.1745	0.1724	0.2001
Private Banks	0.2031	0.1796	0.2257	0.2347	0.2164	0.2125	0.1965	0.2260	0.2401
Foreign Banks	0.3252	0.2423	0.2726	0.3586	0.4269	0.4160	0.4014	0.3738	0.3676
All Sample Banks	0.1940	0.1767	0.2231	0.2901	0.2898	0.2899	0.2691	0.2668	0.2871
<b>Price</b>									
Public Banks	0.1034	0.1040	0.1032	0.0850	0.0819	0.0832	0.0901	0.0840	0.0769
Private Banks	0.1119	0.1131	0.1075	0.0853	0.0907	0.0902	0.1010	0.0935	0.0883
Foreign Banks	0.1292	0.1302	0.1094	0.0914	0.0974	0.0888	0.0923	0.0846	0.0750
All Sample Banks	0.1128	0.1142	0.1063	0.0876	0.0900	0.0872	0.0937	0.0867	0.0793
<b>Marginal Cost</b>									
Public Banks	0.0916	0.0901	0.0842	0.0624	0.0654	0.0657	0.0744	0.0696	0.0616
Private Banks	0.0894	0.0931	0.0833	0.0648	0.0711	0.0710	0.0811	0.0723	0.0693
Foreign Banks	0.0858	0.0908	0.0779	0.0589	0.0569	0.0544	0.0568	0.0534	0.0494
All Sample Banks	0.0894	0.0911	0.0819	0.0619	0.0638	0.0627	0.0692	0.0638	0.0583

Source: Author's Computation based on data from Statistical Tables Relating to Banks in India of RBI.

Table 4 presents the behavior of the Lerner index across sub-groups of the sample banks based on size, profitability, scale of operation, and efficiency. These dimensions are measured with the log of assets, level of return on assets, total income, and total revenue to total cost ratio, respectively. Across the size of banks, it is noted that the Lerner index has been much higher (more than 0.40) for the smallest size of banks during 2006-2021, resulting in lower competition in this segment. The larger banks have reported a relatively lower Lerner index (around 0.20), meaning these banks have behaved competitively. These results align with earlier studies in the Indian context, highlighting that the large banks had lower price mark-ups, signifying those efficient banks captured markets through their efficient conduct (Varma & Saini, 2011).

The Lerner index concerning the profitability or financial performance of banks reveals that the lowest values of the index are reported by the banks falling into the second quarter of the return on assets (Table 4). High-profit banks have noted a higher Lerner index, thereby indicating the low level of competition in this segment.

This highlights that the bank's performance is attributed to the low level of competition or the high market concentration, supplementing the hypothesis of structure-conduct performance. Concerning the scale of operation measured through the total income across banks, we find that the banks reporting higher income (lying into the Q4) had the highest level of competition, with the average Lerner index hovering around 0.20 as compared to 0.40 of the lower scale of operation banks (Table 4).

**Table 4. Lerner Index across Bank Sizes, Profitability, Income and Efficiency**

Quarters	TE 1997	TE 2000	TE 2003	TE 2006	TE 2009	TE 2012	TE 2015	TE 2018	TE 2021
<b>Size</b>									
Q1	0.2590	0.1993	0.2565	0.3636	0.4260	0.4229	0.4451	0.4358	0.4419
Q2	0.1671	0.1947	0.2282	0.2420	0.3167	0.3046	0.2858	0.2692	0.2181
Q3	0.1064	0.1051	0.2001	0.2862	0.2259	0.2419	0.2561	0.2720	0.3098
Q4	0.1775	0.1650	0.1822	0.2394	0.2290	0.2509	0.2113	0.2192	0.2558
Total	0.1940	0.1767	0.2231	0.2901	0.2898	0.2899	0.2691	0.2668	0.2871
<b>Profitability</b>									
Q1	0.1940	0.0222	0.0448	0.2704	0.2717	0.3668	0.3014	0.2386	0.3612
Q2		0.1197	0.1817	0.2412	0.2572	0.2613	0.1927	0.2342	0.2725
Q3		0.1812	0.2155	0.3025	0.2392	0.2648	0.2649	0.2610	0.2379
Q4		0.3398	0.3378	0.2913	0.3481	0.2990	0.3322	0.3641	0.3275
<b>Income</b>									
Q1	0.2619	0.1971	0.2679	0.3448	0.4356	0.4270	0.4392	0.4259	0.4082
Q2	0.1703	0.1933	0.2238	0.2578	0.3006	0.3038	0.2950	0.2665	0.2533
Q3	0.1081	0.1275	0.2040	0.2818	0.2184	0.2345	0.2517	0.2724	0.3076
Q4	0.1775	0.1650	0.1888	0.2550	0.2375	0.2520	0.2116	0.2180	0.2506
<b>Efficiency</b>									
Q1	0.0803	0.0892	0.0936	0.1119	0.1192	0.0989	0.1131	0.1124	0.1400
Q2	0.2091	0.1891	0.1973	0.2036	0.1978	0.1997	0.1902	0.1940	0.1881
Q3	0.2733	0.2649	0.2715	0.2724	0.2524	0.2586	0.2578	0.2623	0.2565
Q4	0.4235	0.4265	0.4051	0.4032	0.4748	0.4804	0.4706	0.4526	0.4531
Total	0.1940	0.1767	0.2231	0.2901	0.2898	0.2899	0.2691	0.2668	0.2871

Note: Q1-Q4 is the first to the fourth quarter in respective variables.

Source: Author's Computation.

We also present the level of competition across bank efficiency measured through the general criteria of total revenue to total cost ratio. The less efficient banks have reported a deficient level of Lerner index, meaning by exhibiting high competition, and the highly efficient banks (ratio of TR to TC banks falling into the fourth quarter) have recorded the highest Lerner index of more than 0.45, suggesting a low level of competition. It is evident that the competition structure has bearings on the bank's performance. At the prima facie, it reveals that market power seems to be the governing factor for the performance of banks in India.

#### 4.2. PRH-Statistic across Bank Ownerships

Table 5 provides the empirical estimation of PRH-statistic for the Indian banking industry at an aggregate level, and also for dis-aggregate levels across bank

ownership as well as before and after global financial crisis periods. Model 1 presents the PRH estimation using the complete sample data, and it is found that the H-statistic is significant with a positive sign, but the magnitude is less than one (0.64), indicating thereby the existence of monopolistic competition. The result rejects the monopoly and perfect competition as PRH is neither zero nor one. Models 2-4 capture the level of competition across bank ownerships- public, private, and foreign banks. Among the public sector banks, the H-statistic value is 0.69 (Model 2) as compared to the private sector banks 0.85 (Model 3) and 0.59 for foreign banks (Model 4). The findings show that the private sector banks are exhibiting a higher level of competition compared to the public sector banks, and the foreign banks have a lower level of competition and suggest more concentration. These empirical results are consistent with the findings of Misra (2011) carried out for the Indian banking sector. Models 5 and 6 compute the level of competition for sub-periods- before the crisis (1995-2007) and after the crisis (2008-2021). The level of competition has come down after the crisis period compared to the pre-crisis level as the PRH statistic is recorded as 0.56 in the post-crisis period compared to 0.69 in the earlier phase of the pre-crisis, owing to the tight regulation aftermath of the crisis.

**Table 5. PRH Estimation with Static Model, Fixed Effect Panel Estimation**  
**Dependent Variable Log of (Revenue to Assets ratio)**

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Variable	All SCBs	Public Banks	Private Banks	Foreign Banks	Before Crisis	After Crisis
Log_w1	0.119***	0.127***	0.085***	0.056**	0.096***	0.107***
Log_w2	0.249***	0.152***	0.156***	0.329***	0.176***	0.229***
Log_w3	0.275***	0.413***	0.604***	0.214***	0.413***	0.226***
NPA	0.000	-0.004***	0.004***	0.000	-0.001	-0.003*
Equity	0.351***	0.698***	0.100	0.219**	0.683***	0.318***
Constant	0.168***	0.140	0.529***	0.024	0.139	-0.143
Observations	1,784	671	474	639	812	972
Number of codes	75	26	20	29	72	75
PRH Statistic	0.642	0.692	0.845	0.598	0.685	0.562
R Square	0.538	0.705	0.859	0.549	0.578	0.469

Note: \*, \*\*, and \*\*\* significance at 1%, 5%, and 10% level, respectively.

Source: Author's Computation.

It is worth noting that the above analysis of PRH is carried out under a static approach. However, this estimation can render an underestimation of the degree of competition once the assumption of partial equilibrium or adjustment is taken into consideration (Goddard & Wilson, 2009). Various studies have computed the PRH statistic with the dynamic panel data approach. In this regard, the necessary condition for dynamic estimation requires checking the key assumption of long-run equilibrium among the variables of interest. For this purpose, we utilize model P1 in Table 6 to assess the existence of long-run equilibrium. In fact, we are estimating the dynamic panel model using the GMM methods. This method captures the endogeneity issues by considering the lagged values of a dependent variable and the

level variables as instruments in the GMM framework. The coefficient value for lagged ROA is 0.43 and significant also, thereby suggesting partial equilibrium and there is no instantaneous adjustment. The test statistic of the combined summation of regression coefficients for the factor price inputs is 0.004, and the same is statistically insignificant, indicating the summation of these values is not significantly different from zero; hence, there is equilibrium in the long run among selected variables.

Model P2 captures the modified PRH statistic with consideration of the dynamic model, as suggested by Goddard and Wilson (2009). The lagged coefficient value of the log of revenue (to assets ratio) is positively significant (0.17), confirming the partial adjustments. The H-statistic for the dynamic model is 0.73, higher than 0.64, as computed in the case of the fixed effect model (Model 1, Table 5). These results align with Goddard and Wilson (2009) indicating the downside estimation for H-statistics through fixed effects in the case of partial equilibrium. The finding of the present study aligns with prior research in the Indian context (Arrawati & Misra, 2014), indicating the existence of monopolistic competition.

**Table 6. PRH Estimation in Indian Banking with Dynamic Panel Models: GMM**

	Model P1 <sup>§</sup>	Model P2	Model P3	Model P4	Model P5	Model P6	Model P7	Model P8
Variable	All SCBs	All SCBs	Small Size	Large Size	Low Profit	High Profit	Before Crisis	After Crisis
L. (LogR/A)	0.433*	0.170*	0.201*	0.150**	0.103	0.322*	0.246*	0.229**
Log_w1	-0.048	0.096*	0.086**	0.093*	0.029	0.151*	0.082*	0.075
Log_w2	-0.069	0.150*	0.175*	0.178*	0.176*	0.145*	0.107**	0.179*
Log_w3	0.122	0.354*	0.281*	0.404*	0.378*	0.222**	0.362*	0.249*
NPA	-0.051*	-0.003**	0.000	-0.004**	-0.002	-0.001	-0.002	-0.005***
Equity	2.282	1.643*	1.223*	1.436**	1.236*	0.755	1.443*	1.033*
Constant	-0.187	0.181	0.095	0.244***	-0.069	0.401***	0.139	0.060
PRH-Statistic	-	0.731*	0.599*	0.894*	0.546*	0.864*	0.639*	0.535*
Observations	1158	1,709	775	934	799	910	742	967
Groups	75	75	65	57	73	74	72	75
Instruments	52	56	56	56	56	56	30	56
AR1	0.000	0.003	0.004	0.034	0.015	0.008	0.006	0.008
AR2	0.691	0.413	0.296	0.840	0.653	0.394	0.386	0.337
Hansen test <sup>#</sup>	0.205	0.121	0.410	0.349	0.255	0.068	0.100	0.038
Combination	0.004	0.599*	0.542*	0.675*	0.583*	0.517*	0.550*	0.503*

Notes: \*, \*\*, and \*\*\* significance at 1%, 5%, and 10% level, respectively. L (LogR/A) indicates the first lag of the log of revenue to assets ratio. <sup>§</sup> indicates the dependent variable as return on assets (ROA), <sup>#</sup>: P-value for test of over-identification restrictions.

Source: Author's Computation

Table 6 also presents the level of competition cross-bank asymmetric behavior in terms of their size, profitability, and sub-periods (Models P3-P8). In models P3/P4, we report the PRH statistic for banks belonging to smaller/larger sizes. Large size is defined as the banks falling into the third and fourth quarter of the log value of total

assets across banks during 1995-2021. Smaller-size banks are those which are falling in the first two-quarters of the log of assets. The PRH statistic is much higher for larger-size banks (0.89) compared to 0.60 for smaller-size banks. This finding indicates that larger-size banks are more competitive than smaller-size banks. Across the profitability of banks (models P5 & P6), the higher profit banks have behaved more competitively than the low profit banks as the PRH statistics for the first and later group of banks are 0.86 and 0.55, respectively. In the same fashion, the PRH statistic for sub-periods (models P7 & P8) is higher for the before-crisis period (1995-2007) with a value of 0.64 as compared to 0.54 for the post-crisis period (2008-21). This suggests a lower level of competition in the post-crisis period amid more emphasis on regulatory norms and the mergers of key public sector banks in 2016 and 2018. We skip the PRH estimation across bank ownership owing to the problem of instrument proliferation of dynamic GMM estimation in the presence of a lower number of cross-section units.

### **4.3. Boone Indicator (BI)**

BI measures the responsiveness in banks' profitability concerning the fluctuations in marginal cost while controlling for the bank-specific control variables. Following Rapapali and Simbanegavi (2020), we take the controlling variables such as leverage, defined as equity to assets ratio, and credit risk, measured with NPA provisions to gross advances ratio. Das (2013) claims that the net interest margin to total assets reflects the bank-specific efficiency, and we also account for this variable as a controlling factor for the profit elasticity function. The more negative elasticity indicates a higher competition level and positive elasticity suggests the presence of an extreme level of collusion.

Table 7 presents the empirical results for the Boone indicator using Equation 6. In model B1, we present the estimation using the fixed effects panel model. The coefficient value of the marginal cost variable is negatively significant with a magnitude of 0.16, implying that a one percent increase in marginal cost leads to a decline in profitability by 0.16 percent only, indicating a modest level of competition. Model B2 provides the empirical estimation for the GLS approach without controlling the panels' hetero behavior and finds the coefficient value (of our interest) concerning marginal cost as -0.22, a bit higher than the fixed effects estimation. However, model 3 accounts for the panels' hetero aspect, wherein the coefficient value of our interest turns up to -0.14, marginally higher than the reported value by Global Financial Development (GFD). The smaller negative coefficient value indicates the modest level of monopolist competition.

The level of competition through the Boone indicator is measured at disaggregate levels, such as before and after the global financial crisis (Models B4 & B5), across low and high-profitable banks (Models B6 & B7), and the small and large sizes of banks (Models B8 & B9). In the case of inter-temporal difference, it is found that the coefficient value for the profit elasticity with the marginal cost is more negative in

the pre-crisis period (-0.22) as compared to the post-crisis period (-0.10), implying that the level of competition has reduced and come to the half of the level of the pre-crisis period. This finding indicates that after the crisis, banks have turned cautious and moved ahead with more regulatory compliances and even allocated the funds with a more rational approach rather than just indulging in competitive practices.

Across the asymmetric effect concerning high and low-profitable banks (Models B6 & B7), the Boone indicator is negatively significant in the case of the first group of banks, whereas it is not significant in the case of the latter group of banks. This suggests that the banks with lower profits are tuned to the more competitive level, whereas high-profit banks operate less competitively. This finding goes in line with the Efficient-Structure (ES) hypothesis. Concerning the size asymmetry of banks (Models B8 & B9), we find that the smaller size banks have a more competitive nature of operations than the larger size banks. The coefficient value of the Boone indicator is more negative (-0.25) and significant in the first group as compared to insignificant (-0.003) in the latter group of banks. This finding indicates that the smaller banks remain more competitive, and the larger banks believe in operating in a less competitive environment while taking an incentive to be big in the market.

**Table 7. Bank Competition in India: Boone Estimation**

	Model B1	Model B2	Model B3	Model B4	Model B5	Model B6	Model B7	Model B8	Model B9
Variable	Fixed Effects	GLS	All SCBs	Before Crisis	After Crisis	Low Profit	High Profit	Small Size	Large Size
Log_MC	-0.164**	-0.215*	-0.137**	-0.223**	-0.102**	-0.016	-0.086**	-0.249*	-0.003
Equity	-0.592**	-0.293	0.231	-0.356	0.102	-1.844*	0.449*	-0.412**	0.613
NPA	-0.082*	-0.082*	-0.081*	-0.072*	-0.235*	-0.035*	-0.015*	-0.069*	-0.158*
NIM	0.185*	0.244*	0.290*	0.210*	0.274*	-0.005	0.177*	0.242*	0.304*
Constant	-0.890*	-1.210*	-1.146*	-1.029*	-0.853*	-0.870*	-0.504*	-1.098*	-0.758*
Observations	1,320	1,320	1,320	519	801	401	919	557	763
Wald Test	323.74*	414.71*	412.08*	412.08*	1341.3*	115.85*	489.90*	522.14*	994.83*

Note: \*, \*\*, and \*\*\* significance at 1%, 5%, and 10% level, respectively.

Source: Author's Computation.

About the controlling variables, we find that the leverage quantified through the bank equity as a percentage of assets could not establish a significant relationship with bank profitability in the case of estimation for all the sample banks (Model B3). However, its impact becomes significant once we account for the asymmetric behavior of banks across profitability- high and low return on assets (ROA) and sizes- smaller and larger. The impact of equity is negative on profitability for the banks operating with low ROA and positive for the high ROA banks. This finding indicates that investors gain more confidence in high-ROA banks. Accordingly, the equity impact is positive, whereas the low ROA banks have yet to gain confidence among investors to have a visible positive impact of equity on banks' performances. The impact of leverage is negative in the case of smaller size banks (Model B8) as these

banks have little opportunities to access the capital market, whereas the positive coefficient value of equity (Model B9) suggests greater access to capital markets; however, this access is below potential to have a significant impact on the push for bank profitability.

The credit risk variable measured with NPA provision out of total advances has a negative significant impact on the bank's profitability. This result is intuitive that rising NPAs have turned the banks with poor balance sheets and consequently affected the lending capacities of banks for profitable investment projects. The negative impact of NPAs on bank profitability has deepened in the post-crisis period (Model B5), linked to the ongoing slowdown in credit of the banks amid more cautious lending during the growth slowdown period, and also to the compliance of banks with capital requirements norms set forth under Basel III.

The bank-specific efficiency indicator, proxied through the net interest margin to total assets, (NIM) has a positive impact on bank profitability across all the estimated models except model B6. In the later model, we capture the behavior of banks with lower profitability, and these banks have lacked efficiency and accordingly could not establish a significant positive impact. The magnitude of the positive impact of NIM is higher for large banks (Model B9) compared to small-size banks (Model 8), suggesting that the operational economies of scale lie with the earlier group of banks. The Wald statistic in all the models is significant, indicating the overall significance of models utilized for Boone indicator measurement.

## 6. Conclusion

The study measures bank competition in India using a non-structural approach on panel data spanning from 1995-2021. Unlike existing literature, the study goes in-depth to account for the asymmetric behavior of banks owing to ownership, size, and inter-temporal. The Lerner index fell in the late 1990s, reflecting higher competition, but increased significantly during the first decade of the 21st century. The index stagnated till 2012 with more regulatory provisions in the backdrop of the global financial crisis of 2007-08 but increased post-banking consolidation. Across ownership, the Lerner index suggests the high level of concentration in the foreign banks' segment, and the overall Lerner index of India was mainly pulled by the foreign banks. Before 2006, the public sector banks experienced lower competition (with a rising Lerner index), but thereafter the stemming competition from private sector banks encouraged the public sector banks to go ahead competitively. Over the period, private sector banks have a moderate level of competition. Interestingly, the gap between the Lerner index values for private and public sector banks was much higher during the late 1990s, mainly on the higher side value for the early group, but the same has narrowed down during 2004-12 with the faster rise in index values for public sector banks suggesting the lower competition thereon for the public banks. However, after 2012, the gap widened with a rising Lerner index of Private sector



banks amid their cautious move in the wake of the consolidation of public sector banks post-2016 mergers.

Across the size of banks, it is noted that the smallest size of banks experienced lower competition during 2006-2021, whereas the largest size banks behaved competitively. The Lerner index concerning profitability reveals that the low-profit banks have noted a higher level of competition than the high-profit-making banks, indicating the role of structure in bank performances. The less efficient banks have reported a shallow level of Lerner index, meaning they exhibit high competition, and the highly efficient banks have recorded the highest Lerner index of more than 0.45, suggesting a low level of competition. It gives an early indication that banks with falling profitability coupled with higher competition do not indulge in risk-taking practices.

Using PRH statistics, it was found that the Indian banking industry experiences monopolistic competition. The findings hail that the private sector banks and more extensive holdings are exhibiting a higher level of competition compared to the public sector banks, and the foreign banks have a lower level of competition and suggest more concentration. For the Boone indicator, the study finds a modest level of competition in line with the World Bank's estimation. Across the asymmetric effect for high and low-profitable banks, it is found that the banks with lower profits are tuned to the more competitive level, whereas high-profit banks operate less competitively. This finding indicates that the higher-profit banks remain more concentrated and behave in a relatively less monopolistic environment. Concerning the size asymmetry of banks, the smaller size banks have a more competitive nature of operations than the larger size banks. The study highlights the possible link between the fall in the sector's competitiveness and the introduction of new regulations in light of the sectoral crisis, requiring a cautious watch of bank consolidation for financial stability. The present study lacks in considering the direct impact of macroeconomic environment during empirical estimation, however the same offers scope for future research in the bank market structure of India.

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