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An Empirical Analysis of Competition in the Indian Banking Sector in Dynamic Panel Framework

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Abstract

Competition has been regarded as a positive phenomenon for banks; it is perceived that competition makes banks more efficient, stimulates financial innovation and open up new markets. Given the dynamic changes within the Indian banking system in the last two decades, it might be of interest to see whether the developments in the market structure correspond with less competitive behaviour or more on the part of market participants. For empirical assessment of the nature of competitive conditions amongst scheduled Indian commercial banks over a period of 15 years, we use the 'Panzar-Rosser educed form revenue model' to compute the so-called H statistic by estimating the factor price elasticities. It has been argued that if adjustment towards equilibrium is partial and not instantaneous, then static estimates of H statistic will be biased towards zero. Thus in this study alternative estimation techniques have been used for comparing the dynamic H-statistic with static H-statistic. The static H-statistic was found to have a downward bias. However, dynamic as well as static H-statistic, both pointed to the presence of monopolistic competition. The hypotheses of perfect collusion as well as of perfect competition can be rejected using dynamic as well as fixed panel-econometric model estimations using micro data of banks' balance sheets and profit & loss accounts for the years 2000-2014. The division of the entire period into two sub-samples, i.e. before and after 2007 revealed a decrease in competition levels across the two periods. Although, empirical analysis supported the assertion that the nature of competition among the Indian Banks is monopolistic.But it showed a decrease in the level of competitionmay be due to consolidation exercises of top few large banks with smaller banks and also because of the shift from traditional financial business to off-balance sheet activities, which might have lead to the convergence of competitive levels in the second sub-sample period, i.e. after 2007.The second sub-period also corresponds to the global financial

crisis of 2008, a possible reason for the lower H-statistic values. The low persistence of profit values (in the sub-periods) should be associated with higher competition, but in the case of the Indian banking sector, it may not be implausible to think that a low persistence of profit may arise from other sources than the only competition. It is also found that the values of competitive conduct (H-statistic), does not coincide with the classical concentration approach (CR5, CR10), for the Indian Banking Industry. The unit cost of funds, capital, and labour were found to be positive and statistically significant. The unit cost of funds was the highest contributor to the overall H statistic. The control variables, such as size and risk were found to be positively affecting the revenue. The findings arrived in this study; highlight the possible links between Indian banking sector competitiveness, profitability, intermediation and regulatory scenario.

Keywords: *Competition, Competitive Structure, Dynamic Model, Indian Banking Sector, Monopolistic Competition, Panzar-Rosse H-statistic, Profitability.*
JEL classification: D4, D53, E44, E58, G21, G28.

1. Introduction

The Indian Banking sector reforms were introduced as a broad counterpart of the economic reforms of 1991, which was aimed primarily at globalisation and liberalisation of the Indian Economy. Functioning of banks prior to the reforms was hampered by a decline in productivity, asset quality, and profitability. The reforms revamped the system providing a base for operational flexibility and functional autonomy which in turn improved their efficiency and stability. In addition to recapitalisation and restructuring of the banking system, another major element of the reforms was an enhancement in the competition within the market due to the free and liberal entry of new banks which adapt to the minimum start-up capital requirements as well as other requirements. The reforms embarked upon an enhancement of competition leading to new and innovative products across various categories. A second Committee on Banking Sector Reforms (1998) under Shri M. Narasimham was appointed to track and monitor the reforms initiated under the policy suggestions made in 1991.The committee, apart from enhancing the limit of start-up capital from $10 million to $25 million, pointed out that subsidiaries and Joint Ventures (JVs) to be treated at the same level as private banks. It also signalled towards the enhancement of competition and highlighted about plausible benefits of liberal entry for foreign

banks, opening of new private sector branches, and ingress of newer technological practices with a low level of Manpower requirements.

In the past various, committees have been set up to examine the issue of structural changes in the banking system which had in generally favoured consolidation and the creation of well capitalised and more technology-oriented banks. Private Banks and foreign banks have been able to make their presence felt through active participation, which has fostered healthy competitive environment.

To conform to global standards, RBI adopted a two-track gradualist approach wherein on one side it focused on the consolidation process of domestic banks and on another side, it set the track for increased presence of foreign banks in a phased manner. To this end, in 2005 RBI unveiled a "Roadmap for the presence of Foreign Banks in India" under which foreign banks could set up foreign branches or set up wholly owned subsidiaries, and the limit on the number of branches was also proposed to be set higher than that stipulated by WTO.

In a report by OECD 2011, "Competition Issues in the Financial Sector," it has been stated equivocally that by nature, contestable markets are extremely competitive. However, entry barriers exist within financial markets in the form of minimum regulatory requirements, branch licensing and restrictions on the entry of foreign firms. As with context to the Indian Banking Sector, barriers exist mainly on the capital requirements for new banks, the information asymmetry and geographic restrictions.

Historically, competition has been considered to be a favorable phenomenon for most industries. With respect to banks, it is believed that competition makes banks more efficient and stimulates financial innovation and opening new markets (Bikker and Leuvenstein, 2014). In old view, competition is the main driver of economic growth and social welfare, as it also promotes efficiency and increases the risk-takingcapacity of banks. A certain level of competition is usually perceived to be desirable to increase the efficiency to provide financial services. A vigorous competition among banks can stimulate to improve the availability of products to consumers, their pricing and quality, and also promote financial innovation by using more modern updated techniques and skills.

Competition among banks is a topic of interest for academicians as well as supervisors. The importance of the competition lies in the fact that it affects the financing and the availability of services to the market, as well as households, which eventually will have an impact on the

product and service quality. An inefficient banking sector with less competition affects the deposit decisions and hinders the resource allocation, which disrupt the economic development and the investment activity (Giustiniani & Ross, 2008). The last fifteen years, from 2000 to 2014 may be called as the post-reform period (Narasimham Committee reforms-II, 1998), was embarked by various facets of change. Some of changes have been initiated by Reserve Bank of India itself, especially relating to branch licensing and foreign banks' entry. The last decade has also seen a decrease in the market share of the state-controlled banks, along with the entry of private and foreign banks in the industry. During our period of analysis, the global market was shuddered by one of the major shocks of the financial crisis 2008, out of which the Indian banks emerged relatively unscathed. It will be of interest to see the intensity as well as a change in the degree of competition during crisis and across sub-periods. Indian Banking Industry underwent structural and regulatory changes in the last two decades. Whether these developments in the market structure lead to a lesser competitive behaviour or more, on the part of market contestants needs to be analysed. Factor price elasticity can be estimated from the banks' reduced form revenue model. The sum of these estimated factor price elasticity, which constitutes the H statistic, provide information about banks' competitive behaviour.

Table 1 presents concentration ratios CR(5) and CR(10) and Herfindahl-Hirschman Index.

Year	HHI	CR(5)	CR(10)
2000	878.5	0.478	0.631
2001	900.7	0.476	0.620
2002	804.2	0.460	0.622
2003	750.9	0.445	0.604
2004	680.5	0.428	0.586
2005	631.5	0.415	0.576
2006	587.4	0.414	0.574
2007	554.1	0.404	0.560
2008	546.0	0.392	0.553
2009	579.1	0.391	0.561
2010	547.4	0.378	0.562
2011	541.9	0.381	0.569
2012	515.9	0.377	0.565
2013	522.3	0.377	0.565
2014	528.2	0.384	0.572

HHI = Herfindahl-Hirschman Indices

CR(5) = Concentration Ratio of top five banks

CR(10) = Concentration Ratio of top ten banks

The CR(5) values of the top five banks (based on the asset size) have been decreasing over the years. The concentration of Top 5 banks based on their asset values were almost half the total market share (47%) during the early period of the sample. However, it shows a decreasing trend over the years which may loosely indicate the increasing degree of competition. The results of CR (10) show a similar decreasing trend over the years with the values ranging from 63% to 57%. Similarly, the values of the HHI index show a decreasing trend over the years. All these statistics point out towards an increasing degree of competition over the sample period.

The contestability theory argues that in the presence of free market entry and exit, the threat of entry alone can make competitive conduct independent of the number of firms actually acting in

the market. As per the efficiency hypothesis, the market concentration may be a result of the strategic decision of the more efficient firms for increasing their market share rather than to exploit their efficiency advantages at the original market share and price level. Both the theories do not support a conclusion about competitive conduct in a market merely because of a higher degree of observed market concentration.

Background Analysis

The development in banking sector of India hasbeen broadly divided into three phases –

1. The pre-independence phase
2. The pre-liberalization& post-independence phase
3. The post-liberalization phase

The activities of borrowing and lending money in India have been there since the Vedic period, approximately four thousand years back, as per the Central Banking Enquiry Committee (1931). There isevidence of the presence of formal banking network and infrastructure in 500BC. It has been noted by the member of the Royal Commission on Indian Currency and Finance, that the thriving trade and commerce have necessitated the adoption and development of the banking sector in India across the ages. As per Kautiliya's famed book Arthashastra, during the 400BC, there were proper norms for the banking sector at that time. It also mentions about the practice of lending and borrowing, which makes the basic of the banking sector. Based on the evidence, until the point of time, India gained independence, there was a lack of a formal, organized and connected banking system. The lack of an organized banking sector also implied many players or many competitors, in the form of trade guilds or temples or the moneylenders, in the market. The mention of bank rates and norms implied some amount of regulation even during that point in time.

Table 2 shows the list of Mergers and Acquisitions in the Indian Banking Industry since Liberalization

Sr. No	Name of Transferor Bank / Institution	Name of Transferee Bank / Institution	Date of Amalgamation
1	Bank of Bihar Ltd	State Bank of India	November 8, 1969
2	National Bank of Lahore Ltd	State Bank of India	February 20, 1970
3	Miraj State Bank Ltd	Union Bank of India	July 29, 1985

4	Lakshmi Commercial Bank Ltd	Canara Bank	August 24, 1985
5	Bank of Cochin Ltd	State Bank of India	August 26, 1985
6	Hindustan Commercial Bank Ltd	Punjab National Bank	December 19,1986
7	Traders Bank Ltd	Bank of Baroda	May 13, 1988
8	United Industrial Bank Ltd	Allahabad Bank	October 31, 1989
9	Bank of Tamil Nadu Ltd	Indian Overseas Bank	February 20, 1990
10	Bank of Thanjavur Ltd	Indian Bank	February 20, 1990
11	Parur Central Bank Ltd	Bank of India	February 20, 1990
12	Purvanchal Bank Ltd	Central Bank of India	August 29, 1990
13	New Bank of India	Punjab National Bank	September 4, 1993
14	Kashinath Seth Bank Ltd	State Bank of India	January 1, 1996
15	Bari Doab Bank Ltd	Oriental Bank of Commerce	April 8, 1997
16	Punjab Co-operative Bank Ltd	Oriental Bank of Commerce	April 8, 1997
17	Bareilly Corporation Bank Ltd	Bank of Baroda	June 3, 1999
18	Sikkim Bank Ltd	Union Bank of India	December 22. 1999
19	Times Bank Ltd	HDFC Bank Ltd	February 26, 2000
20	Bank of Madura Ltd.	ICICI Bank Ltd	March 10, 2001
21	ICICI Ltd	ICIC I Bank Ltd	May 3, 2002
22	Benares State Bank Ltd	Bank of Baroda	June 20, 2002
23	Nedungadi Bank Ltd	Punjab National Bank	February 1, 2003
24	South Gujarat Local Area Bank	Bank of Baroda	June 25, 2004
25	Global Trust Bank Ltd	Oriental Bank of Commerce	August 14, 2004
26	IDBI Bank Ltd	IDBI Ltd	April 2, 2005
27	Bank of Punjab Ltd	Centurion Bank Ltd	October 1, 2005
28	Ganesh Bank of Kurundwad Ltd	Federal Bank Ltd	September 2, 2006
29	United Western Bank Ltd	IDBI Ltd	October 3, 2006
30	Bharat Overseas Bank Ltd	Indian Overseas Bank	March 31, 2007
31	Sangli Bank Ltd	ICICI Bank Ltd	April 19, 2007
32	Lord Krishna Bank Ltd	Centurion Bank of Punjab Ltd	August 29, 2007
33	Centurion Bank of Punjab Ltd	HDFC Bank Ltd	May 23, 2008
34	State Bank of Saurashtra	State Bank of India	August 13, 2008

35	State Bank of Indore	State Bank of India	June 19, 2009
36	The Bank of Rajasthan	ICICI Bank Ltd	August 13, 2010
37	ING Vysya Bank	Kotak Mahindra Bank	April 1, 2015

Source: *Author's report compiled from Trends and progress of progress of banking in India, RBI, CMIE Prowess database and Economic times*

More and relevant data is available for the eighteenth-century India, which shows the development of banks in different parts of the country. The Indian Banking sector formally started with the initiation of the Bank of Hindustan set up in 1770 and later the General Bank of India in 1786. This was followed by the establishment of more banks across the country in the early nineteenth century, like that of the Bank of Calcutta in 1806, Bank of Bombay in 1840 and the Bank of Madras in 1843. Several other banks came in between like that of the Union Bank in 1839, which failed to sustain itself and some like the Allahabad Bank in 1865, which is still continuing. The foreign banks started establishing in India as long back as the 1870s with the establishment of Comptoired'Escompte de Paris and HSBC, both in Bengal.

Although, several banks came up during the pre-independence phase of India but mainly two factors affected the competition. Firstly, the banks were spread across the country, mostly in the eastern, western and the northern parts. Secondly, the unorganized sector was more thriving with a larger practice of unorganized lending and borrowing prevalent in those days. This created lesser competition in the banking sector during this phase. In the year 1881 one of the first ever documented acts, Negotiable Instrument Act (1881) which marks the commencement of regulation in the Indian Banking sector. The nation also experienced one of the earliest instances of the merger in 1921 when the Presidency Banks – Bank of Calcutta (then Bank of Bengal), Bank of Bombay and the Bank of Madras merged to form the Imperial Bank of India. From the very beginning of the nineteenth century, the country saw an exponential development of the banking sector. Many of the banks established during that period are still surviving, namely, the Bank of Baroda, Bank of India, Canara Bank, Central Bank of India, etc. The pre-independence period also saw the setting up of the Reserve Bank of India on the 1st of April, 1935 following the Reserve Bank of India Act, 1934. It was based on the recommendations of the Hilton-Young Commission or the Royal Commission of Indian Currency and Finance. Although, it was only after the independence of India, on the 1st of January, 1949, that RBI was nationalized. The time

of initiation was very crucial for India and rest of the world, as it was the recovery period from the Great Depression. The regulations at that point of time and the following decade was lenient, the lack of which lead a slow economy and low GDP growth during the aforementioned period.

After independence, a series of steps were taken to shape the financial backbone of the country. This included The Banking Regulation Act (1949), The State Financial Corporations Act (1951), The Reserve Bank of India (Amendment and Misc. Provisions) Act (1953), The Industrial Disputes (Banking Companies) Decision Act (1955) among others. In Imperial Bank of India was renamed as the State Bank of India under The State Bank of India Act, 1955, which was followed by The State Bank of India (Subsidiary Banks) Act (1959). All these above were steps towards the reinforcement of the trade, commerce and economics backed by agriculture while banking being the enabler at every step.

In the 1970s, soon after the attack, India went through a poor financial phase whichwas aggravated by poor utilization of resources, bad harvests, the capital crunch of the central government and lack of financing to the industries. This was further intensified by the burden of paying back the debt. In this gloomy scenario, the banking sector saw rapid changes from the very basic to the very depth of the industry. In the two decades leading to 1969, the number of banks came down by more than eighty percent, although there was a substantial increase in the overall banking facility. The overall increase was stimulated due to the growth of the banking in some parts of the country only. Major portions of the country remained unbanked and under-banked because of multiple reasons. The government looked for the establishment of the "social order" or "social control" in the banking sector and also to promote savings and credit behaviour in the rural parts of the country, which suffered due to the lack of information. As part of the steps to recover from the financial turmoil, the government took several steps in this sector, including tightening of regulations of the scheduled banks, modifying the credit policies. But the most important step in this direction in the post-independence and the pre-liberalization period was the nationalization of fourteen most important banks of the country, whose deposit exceeded rupees fifty crores. After the Emergency in the period of stabilization, the Government further took up the case of six more commercial Banks Under the Banking Companies (Acquisition and Transfer of Undertakings) Bill, these banks were nationalized in 1980, with the objective being – using large banks to achieve national objectives. This era saw a series of positives transformations and the expansion of banks with the Foreign Exchange Regulation Act (1973),

Reserve Bank of India (Amendment) Act, 1974 being passed and the Export-Import Bank being established. One of the major factors affecting the banking profitability and competition during this era was the high rates of inflation, which forced the RBI to implement high rates of SLR, CRR and Bank Rates. In fact, in 1985, the reserve cash in the form of SLR and CRR exceeded 45% of the total deposits. In spite of this, the sector saw a high growth, mainly led by several schemes that were implemented including the Export Credit (Interest Subsidy) Scheme (1968), Lead Bank Scheme (!969), New Bills Rediscounting Scheme (1970), Differential Interest Rate Scheme (1972), Foreign Currency (Non-Resident) Account Scheme (1975), Duty Drawback credit scheme (1976), Neighbourhood Travel Scheme (NTS) (1981). This period saw a series of mergers and amalgamations, which consolidated the stronger counterparts. All the major consolidations that happened during that happened during this era followed the same pattern. State Bank of India amalgamated with Bank of Bihar (1969), National Bank of Lahore in 1970, a bank of Cochin (1985), thus increasing market share. The set of mergers also reduced competition among the local and nationalized banks.

The crisis of bankruptcy and possible defaults on international payments in 1991 led to the Central Government devaluing the rupee in two stages and the introduction of the Liberalised Exchange Rate Management System or TERMS. The Government took steps to ensure that the high capital reserves as mandated by the RBI are decreased, and the strictness is regarding accounting standards, capital adequacy and income recognition norms. This also led to the licensing of private banks. The deregulations of lending rates for commercial banks were followed by the deregulation of interest rates on deposits. These were followed by high technological advancements and implementation of these technologies in the banking sector.

Based on the guidelines issued by RBI in 1993, on the deregulation of entry barriers and restrictions of branching, eight new private sector banks made way in the banking sector of India during 1994-2001. This period not only saw a series of new entries of new private sector banks but also saw entries of foreign banks. The period under consideration, i.e. 2000-2014 saw not only entries of new banks but also saw the major consolidation of the sector.

A major consolidation of the sector took place during this period. All major banks including State Bank of India, Bank of Baroda, and HDFC acquired other banks to increase the market share and obtain economies of scale. In the same period, the foreign banks also wanted to take advantage of the high-growth forecasts, which led to ANZ Grindlays Bank getting acquired by

Standard Chartered. The Narasimham Committee set up in 1998 stated in the report that mergers of banks with stronger banks are required and not with the weaker banks. Apart from the State Bank of India, ICICI Bank and HDFC Bank have been acquiring multiple banks in the past two decades. ICICI Bank acquired Bank of Madura Ltd (March 2001), ICICI Ltd (May 2002), Sangli Bank Ltd (April 2007), the Bank of Rajasthan in (August 2010). HDFC Bank acquired the Times Bank Ltd (February 2000) and the Centurion Bank of Punjab Ltd (May 2008). Most of the merger and acquisitions before the Narasimham Committee II report were driven by the weak financials of the acquired banks, whereas the quality of the banks regarding their financial health improved drastically post the report. Unlike the governments of the East Asian countries, where the regulators and the central government played an active role in the consolidation process. In India, the role was in the form of laying down the regulations and ensuring compliance with those regulations, which were formulated in the same lines as that of the international BASEL norms. Based on the suggestions of the Narasimham Committee II, the government rationalized the public sector banks before endorsing the privatization of the banks and passing the Financial Institutions Laws (Amendment) Bill in 2000. In 2002, the Securitisation and Reconstruction of Financial Assets and Enforcement of Security Ordinance were passed. This initiative was the way forward for the quicker recovery of the amounts provided in credits by the concerned bank.

One of the reasons for the decrease in competition can be the higher requirements or norms for the BASEL II standardized norms. The other can be a consolidation of the sector, with the major banks acquiring smaller banks to gain economies of scale, market share and transaction volume.

3. Previous Studies

Various ideologies exist in the literature that contributes to the early empirical work on competition studies. The theory of competition is based on the assumption that markets are contestable, which implies that the firms can easily enter or leave the market without any barriers and that the potential firms operate at the same cost functions as the existing firms.

The non-structural models Bresnahan (1982), Lau (1982) and Panzar & Rosse (1987) are all resultants of the basic assumptions of profit-maximizing equilibrium established in the aforementioned models. This means that a market, which is contestable, will inherently be competitive (Baumal et al.1982).

Concentration ratios were initially used as a measure of competitive performance in the banking market. One of the early approaches was the Structure Conduct Hypothesis(SCP), based on the work by Bain, (1951) which indicates towards an inverse relationship between concentration and competition wherein banks often collude and indulge in price setting thereby reducing competition.SCP paradigm has been applied and tested in the banking industry to analyse market structure competition in banking. Market structure based on the traditional model is measured using the concentration ratio of top k banks. However,the contestability theory suggests that a concentrated banking industry can behave competitively if the hurdles for entry and exit are low. This theory asserts that the threat of potential entry forces banks with large market shares to price their products competitively under conditions like contestable markets. The other ideology was Efficient Structure Hypothesis(ESH) which also describes a positive relationship between concentration and competition. They differ in terms of reasons they provide for the positive relationship between the two (Demsetz, 1973).Many researchers have used concentration measure for the level of competition (Lloyd-Williams, et al .1994). Although there is evidence in support of these theories (Bikker & Haaf, 2002), nevertheless, it has been shown in the literature that concentration is an unreliable measure of competition (Shaffer, 1993,2002).

It has been argued that there is no direct measure to assess the level of competition due to the absence of cost and prices of individual banking products. However, there are various indirect measures, which are both structural as well as non-structural in nature (Bikker, 2004).

The New empirical industrial organisation (NEIO) framework estimates the various parameters of competition among firms, and these parameters are largely based on the microeconomic as well as price cost theories. It emerged as one of the major methods as it assumes that market structure is an endogenous factor and depends upon market characteristics as well as the premeditated and strategic behaviour of banks themselves. Under this framework, two models emerge – the Bresnahan (1982)& Lau (1982) approach and Panzar and Rosse model (1987).

The Bresnahan (1982)& Lau(1982) model is based on simultaneous equation modelling which estimates demand and supply functions. Shaffer (1989, 1993), Coccorese (2004) and Bikker & Haaf (2002) particularly, have applied this test to banking markets. However, it requires extensive data which may not be available quite easily especially in the case of banks. The other method is the Panzar and Rosse (1987) model, which require bank-specific data or firm level data and is popularly used in banking studies. It measures the competition by the level to which

any change in the input prices affects the revenues of a bank. The H-statistic is obtained, which can be interpreted for the presence of Monopoly, oligopoly or monopolistic competition.

Shaffer (1989) uses this methodology to study the competitiveness among U.S. Banking Industry. He argues that banks behave neither as monopolists' firms nor as perfectly competitive firms in long-run equilibrium. Nathan & Neave (1989) estimate the H-statistic from 1982-1984 and indicate the presence of perfect competition for 1982 and monopolistic competition for 1983 and 1984. Various other studies which have indicated the presence of monopolistic competition are Hondroyiannis et al.(1999) for Greece, Belaisch (2003) for Brazil, Coccorese, (2004) for Italy, andRozas (2007) for Spain. Bikker & Haaf(2002) conclude that monopolistic competition is predominant for most of the countries out of the 120 countries which he has studied.Park, (2009) pointed out that in Korea, there was perfect competition during the crisis. Among the cross-countrystudies, Bikker & Spierdijk (2008) studied that there is declining competition among the developed economies whereas competition is increasing for emerging-market economies. Yildirim & Philippatos (2007)conclude for the presence of Monopolistic competition among 11 Latin American countries. Mensi (2010) also observed monopolistic competition for Tunisia. In a recent study, Sufian & Habibullah (2013) test for the effect of mergers on the change in the degree of competition in Malaysian Banking Industry using the Panzar-Rosse model and indicate towards a monopolistic competition. Generally, the results are consistent with the presence of monopolistic competition. However, monopoly has been rarely observed in some studies for Germany in 1986 as well as Italy for 1986-1987 by Molyneux et al.(1994). To assess the intensity and the nature of change in the competitive structure of the banking sector from 2000 to 2014, we apply the Panzar-Rosse Model on reduced form revenue equations. We estimate both the static as well as the dynamic versions of the model with the variations as proposed by Goddard & Wilson, (2009), and deal with misspecification of PRH (Panzar-Rosse H-statistic) as pointed out by Bikker (2004) by estimating the static as well as dynamic models alternatively.

Going forward, this section gives the background of the methodology that has been used. Section 4 gives the analysis of the data that have been used. Section 5 gives the empirical evidence based on the data. Section 6 gives the analysis and interpretation of the empirical findings and finally relates to the current policy decisions. Section 7 concludes the research with the policy implications.

3.1 Theoretical Framework: Panzar-Rosse Model (PRH)

John C. Panzar and James N. Rosse developed a statistic to test for the competitive conditions in a contestable market using reduced form revenue equations. This statistic could be precisely discriminate between oligopolistic, monopolistically competitive and perfectly competitive banking markets, and may be considered as an overall assessment of the competitive conditions The foremost advantages of the Panzar-Rosse methodology over the other models are its efficiency with bank-specific or company-specific data, i.e., the input costs and the output revenues. It does not have any specific requirement for the equilibrium information – either company specific or industry specific. While the other models tend to provide a bias towards monopolistic competition, the Panzar-Rosse methodology works quite well with small samples. The assumptions in this method include that the firms can enter and exit the market freely without making substantial losses in the procedure, i.e., the absence of entry or exit barriers. It also assumes that the new entrants or the expected entrants operate at the same cost function as the traditional and well-established firms. In case the market is contestable, and if there is the threat of new entry with price cutting as the only differentiation, the established firms are forced to sell their products at the rate of marginal cost. So in the condition of market equilibrium, the established firms do not realize a super normal profit, and the new entrants do not enter due to the lack of profit making opportunity in the near term.

The empirical test is based on the equilibrium model which determines the equilibrium output E by maximization of revenue or profits. Underlying this bank i maximizes profits where marginal cost equals marginal revenue. For a single bank i Total profit maximization equation will take the following form:

$$R_i'(y_{i,}, k, v_i) - C_i'(y_i, f_i, q_i) = 0 \qquad \text{Equation (1)}$$

Where R_i' is the marginal revenue function,

$C_i'$is the marginal cost function,

$y_i$is the output of the bank,

k is the number of banks,

v_i and q_i are the exogenous variables that shift the bank's revenue and cost functions, respectively

f_i is a vector of ith bank's m factor input prices.

The second rule implying this would be that there would be a zero profit level constraint at the industry level, in that case, the profit equation takes the following functional form

$R_i^*(y^*, k^*, v_i) - C_i^*(y^*, f_i, q_i) = 0$ Equation (2)

Where R_i^*, C_i^*, y^*, k^* represent equilibrium values of R_i, C_i, y, k respectively.

Market power will be measured by the extent to which a change in the factor input prices ∂f_{i_x} is reflected in the equilibrium revenues ∂R_i^* earned by the bank i. Panzar-Rosse describe H statistic as a sum of elasticities of the revenue function as below:

$$H = \sum_{x=1}^{m} \frac{\partial R_i^*}{\partial f_{i_x}} \cdot \frac{R_i^*}{f_{i_x}}$$ Equation (3)

The value of H will range between $-\infty < H < 1$

Therefore, H is the sum of factor price elasticity and it measures how the revenue of a bank changes with response to the percentage change in factor input prices. The main argument behind the model is that if a market is freely contestable then the potential entrants have the same cost effectiveness as the other incumbents already in the market. We implement the Panzar-Rosse revenue test (1987) using bank-level panel data in the present study.

Table 3 shows the interpretation of the Equilibrium and Competition Analysis

Equilibrium Analysis	
E = 0	Equilibrium
E < 0	Disequilibrium
Competitive Conditions	
H <= 0	Monopoly or conjectural variations short-run oligopoly
0 < H < 1	Monopolistic Competition i
H=1	Perfect competition or natural monopoly in a perfectly contestable market or sales maximizing firm subject to a break-even constraint

The interpretation of H-statistic is clear and precise. The value of the estimated H-statistic ranges between negative infinity to one. Panzar and Rosse (1987) suggested that the value of H is equal to one for the market in perfect competition. This would imply that an increase in the factor of

input price will increase the revenues proportionally. The H-statistic interpretation primarily lies in the fact that we measure variations in revenues with respect to input costs at the firm level.

In the case of the monopolistic competition, the proportional increase in revenue is less as compared to the proportional increase in input prices, which may be due to the inelasticity of the demand function. Panzar and Rosse also show that if the long-run equilibrium assumption is valid, then the value of H may be equal to one in the case of perfect competition. This is accounted for due to the interaction of input prices and the reaction effect of the costs. An increase in the input prices of a bank may further result in an increase in marginal and average costs of a bank, and under the equilibrium assumption, it would not affect the maximum output of a bank. Consequently, this may result in walking out by many banks, which eventually led to an increase in the demand of the remaining banks in the market. This causes an overall increase in the revenues of the banking market indicating the presence of a perfect competition. Bikker & Haaf (2002) interpret the estimated value of the PRH statistic as a continuous measure of competition and suggest that larger values of H indicate an increasing degree of competition. The basic assumption underlying the model is the presence of long-run equilibrium.

The application of this methodology on the banking sector also requires an additional assumption that the banks may be treated as single product firms providing intermediary services (Bandt &Davis, 2000).The estimation of H statistic can be obtained by transforming the Panzar-Rosse Model into the following econometric specification:

$$\ln P_{it} = \mu_0 + \sum_{a=1}^{a'} \mu_a \ln X_{ait} + \sum_{b=1}^{b'} \rho_b \ln Y_{bit} + \sum_{c=1}^{c'} \sigma_c \ln Z_{ct} + \varepsilon_{it} \qquad \text{Equation (4)}$$

where ,

P_{it} *represents revenue of the i th bank at time t*

X_{ait} *vector of represents the input prices of the i th bank at time t*

Y_{bit} *vector represents bank specific variables that impacts the ith bank's cost and revenue functions*

Z_{ct} *vector represents the vector of macroeconomic factors*

ε_{it} *represents the stochastic disturbance term,*

also,

$$\varepsilon_{it} = u_{it} + v_i \qquad \text{Equation (4.1)}$$

u_{it} *represents the unobservable ith bank-specific effect*

v_i *represents the independently and identically distributed random error term*

$E = \sum_{a=1}^{a'} \mu_a = 0$ *represents long-run equilibirum* Equation (4.2)

$H = \sum_{b=1}^{b'} \rho_b$ *represents the competition condition* Equation (4.3)

Specifically, the estimation of the equilibrium condition is done by estimating the following equation:

$$\ln ROA_{it} = \alpha_0 + \alpha_1 \ln EE_{it} + \alpha_2 \ln CF_{it} + \alpha_3 \ln IL_{it} + \beta_1 \ln Risk_{it} + \beta_2 \ln TA_{it} + \beta_3 \ln CA_{it} + \gamma GDP_t + \varepsilon_{it} \quad \text{Equation (5)}$$

Where,

$ROA = Return\ on\ Assets$

$EE = Ratio\ of\ Employee\ Expenses\ to\ number\ of\ Employees$

$CF = Ratio\ of\ Capital\ Expenses\ to\ Fixed\ Assets$

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

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

$TA = Total\ Assets$

$Risk = Loan\ loss\ provisions\ to\ total\ assets$

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

$GDP = GDP\ Growth\ Rate$

In a dynamic framework, the equation (5) will include a lagged dependent variable as an independent variable as given below:

$$\ln ROA_{it} = \alpha_0 + \delta \ln ROA_{i(t-1)} + \alpha_1 \ln EE_{it} + \alpha_2 \ln CF_{it} + \alpha_3 \ln IL_{it} + \beta_1 \ln Risk_{it} + \beta_2 \ln TA_{it} + \beta_3 \ln CA_{it} + \gamma GDP_t + \varepsilon_{it} \quad \text{Equation (6)}$$

The equilibrium condition can be tested by taking the sum of the coefficients, α_1 ,α_2, α_3 of Equation (6),

$E = \alpha_1 + \alpha_2 + \alpha_3$ and using the following hypothesis: Equation (7)

$H_0 : E = 0 \Rightarrow$ *There is equilibrium*

$H_1 : E \neq 0 \Rightarrow$ *There is no equilibrium*

If the above condition of equilibrium is satisfied, the estimation of H statistic can be done by the following equation taking revenue as a dependent variable:

$$\ln TR_{it} = \alpha'_0 + \alpha'_1 \ln EE_{it} + \alpha'_2 \ln CF_{it} + \alpha'_3 \ln IL_{it} + \beta'_1 \ln Risk_{it} + \beta'_2 \ln TA_{it} + \beta'_3 \ln CA_{it} + \gamma' GDP_t + \varepsilon'_{it}$$

Equation (8)

where $TR = Total\ Revenue.$

In a dynamic framework, the above equation (8) will include a lagged dependent variable as an independent variable given below:

$$\ln TR_{it} = \alpha'_0 + \delta' \ln TR_{i(t-1)} + \alpha'_1 \ln EE_{it} + \alpha'_2 \ln CF_{it} + \alpha'_3 \ln IL_{it} + \beta'_1 \ln Risk_{it} + \beta'_2 \ln TA_{it} + \beta'_3 \ln CA_{it} + \gamma' GDP_t + \varepsilon'_{it}$$ Equation (9)

The H-statistic, a measure of degree of competition, is the sum of the coefficients, $\alpha'_1, \alpha'_2, \alpha'_3$ of Equation (8), $H = \alpha'_1 + \alpha'_2 + \alpha'_3$

To measure the level of competition bank's core business activity, we take interest revenue as a dependent variable in the following equation:

$$\ln IR_{it} = \alpha''_0 + \alpha''_1 \ln EE_{it} + \alpha''_2 \ln CF_{it} + \alpha''_3 \ln IL_{it} + \beta''_1 \ln Risk_{it} + \beta''_2 \ln TA_{it} + \beta''_3 \ln CA_{it} + \gamma'' GDP_{it} + \varepsilon''_{it},$$ Equation (10)

$where\ IR = Interest\ Revenue.$

In a dynamic framework, the above equation(10) will include a lagged dependent variable as an independent variable given below:

$$\ln IR_{it} = \alpha''_0 + \delta'' \ln IR_{i(t-1)} + \alpha''_1 \ln EE_{it} + \alpha''_2 \ln CF_{it} + \alpha''_3 \ln IL_{it} + \beta''_1 \ln Risk_{it} + \beta''_2 \ln TA_{it} + \beta''_3 \ln CA_{it} + \gamma'' GDP_{it} + \varepsilon''_{it}$$ Equation (11)

We estimate the above the equations ((5) to (11)) using fixed effect as well as dynamic panel estimations in the present study.

3.2 Misspecification of Panzar-Rosse H-Statistic (PRH)

We deal with two misspecifications of the PRH statistic. It was pointed out by Goddard (2009) that when the adjustment towards equilibrium is partial and not instantaneous, the estimation of H statistic with fixed effects produces results which are biased towards zero. Consequently, the bias implies an incorrect identification of the competition structure of the market. The partial adjustment requires the inclusion of lagged dependent variable among the independent factors of the revenue equation. The dynamic estimation of the revenue equation will help in the assessment of the speed of adjustment towards equilibrium through estimated value of the coefficient of lagged dependent variable. It is formulated that in case we do not consider the dynamics of the PRH equations and if Total Revenue is actually dependent upon its past or lagged values, then it would create a pattern of autocorrelation in the disturbance terms. ε_{it} andu_i This will render Fixed effect or Random effects estimations biased and the inferences drawn about the degree of competition will be incorrect, especially when time period under consideration is small. Then there also exists a need for the estimation of dynamic models to observe the persistence of profit. Goddard et al, (2004) conclude that the convergence towards equilibrium in the long run is partial and not instantaneous. This evidence is documented by Goddard et al.(2004) and Berger et al.(2000) using non parametric techniques. We therefore have enough evidence to use the dynamic model for the estimation of the H-statistic. In view of the above criticism of the static model, we estimate a dynamic model by specifically including a lagged dependent variable among the independent factors. We remove the bank specific effects by differencing the Equation no 4.The suggested dynamics will lead the equation (4) to take the following form after first differencing it:

$$\ln \Delta P_{it} = \lambda \ln \Delta P_{t-1} + \sum_{a=1}^{a'} \mu_a \ln \Delta X_{ait} + \sum_{b=1}^{b'} \rho_b \ln \Delta Y_{bit} + \sum_{c=1}^{c'} \sigma_c Z_{ct} + \varepsilon_{it} \quad \text{Equation (12)}$$

And the corresponding H statistic for the dynamic model will be obtained by:

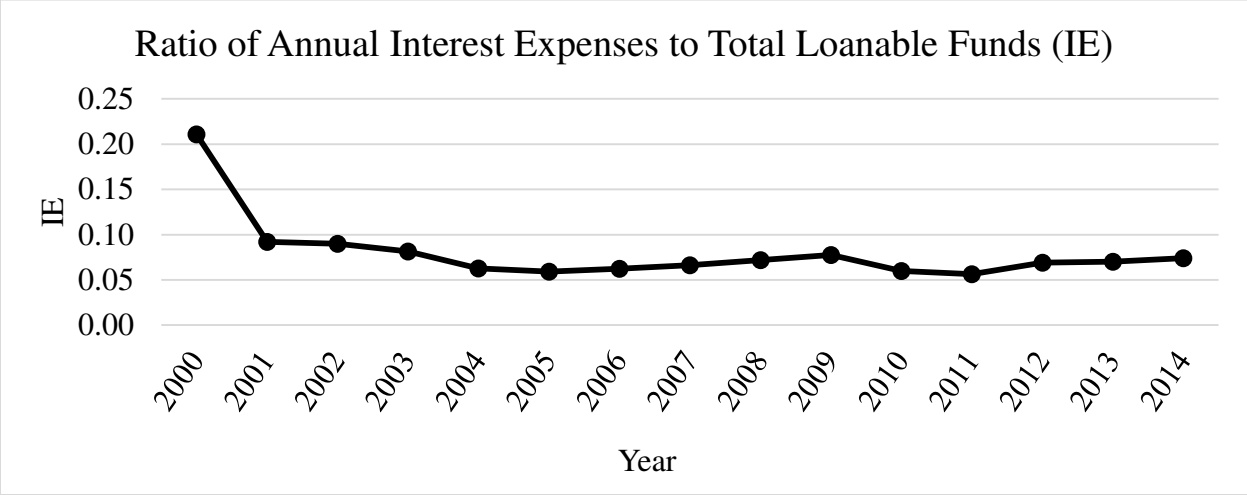
$$H = \frac{\sum_{a=1}^{a'} \mu_a}{1-\lambda} \quad \text{Equation (13)}$$

To control for the endogeneity bias, we use lagged variables as instruments in the differenced equation, as by construction they are correlated with the differenced error terms. To account for such endogeneity bias, Goddard & Wilson, (2009) and Olivero et al. (2011) use the difference

GMM estimator proposed by Arellano and Bond (1991), where lagged level of endogenous variables are used as instruments in the differenced equation.

The second misspecification was pointed out by Bikker et al.(2006) for the use of scaled value of revenue or the dependent variable in the revenue equation which results in a systematic overestimation of the PRH statistic. According to the author, the use of scaled dependent variable changes the form of a revenue equation to a profit equation resulting in estimates of H-statistic biased towards one. Bikker & Spierdijk (2008) were the first to calculate the correctly specified H-statistic for a Panel of 101 countries for 15 years.

Figure 1 Time Series showing Ratio of Annual Interest Expenses to Total Loanable Funds (IE)



We, therefore, account for the misspecification in the PRH statistic developed by Panzar and Rosse (1987) and compare the static Fixed effect estimation with the dynamic panel data model given by Arellano and Bond(1991), as specified by Goddard(2009). We also use unscaled values of the dependent variable in the revenue equations as indicated by (Bikker et al. 2006).

Data

We use bank-level data for 68 Public,Private as well as foreign banks over a period of fifteen years from 2000 to 2014 resulting in an unbalanced panel with 933 bank-year observations. Data has been extracted from Ace Equity, CMIE Prowess and RBI reports (A Profile of Banks).

Figure 2 Time Series showing Ratio of Employee Expenses to number of Employees (EE)

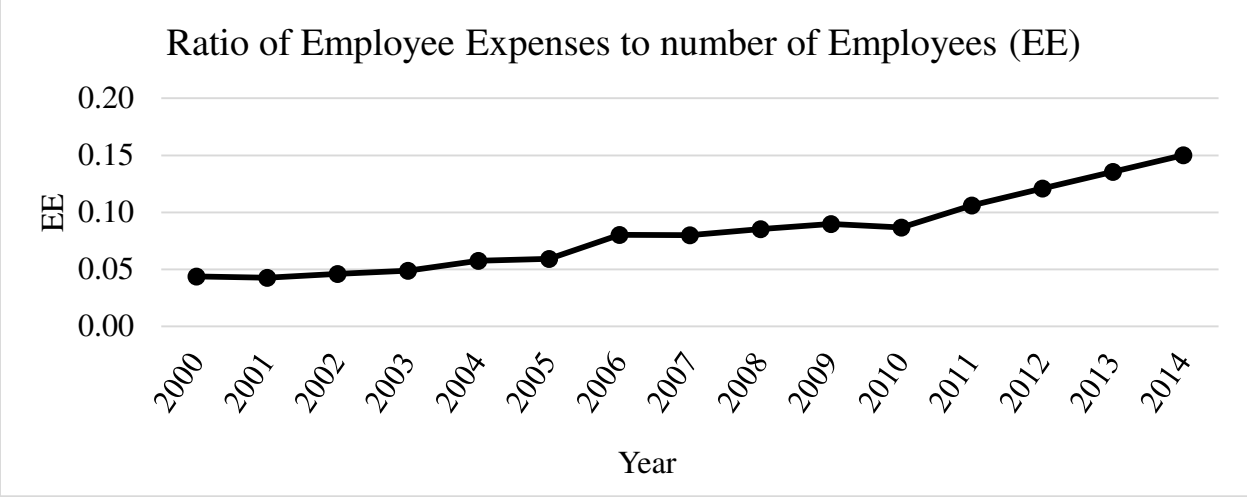
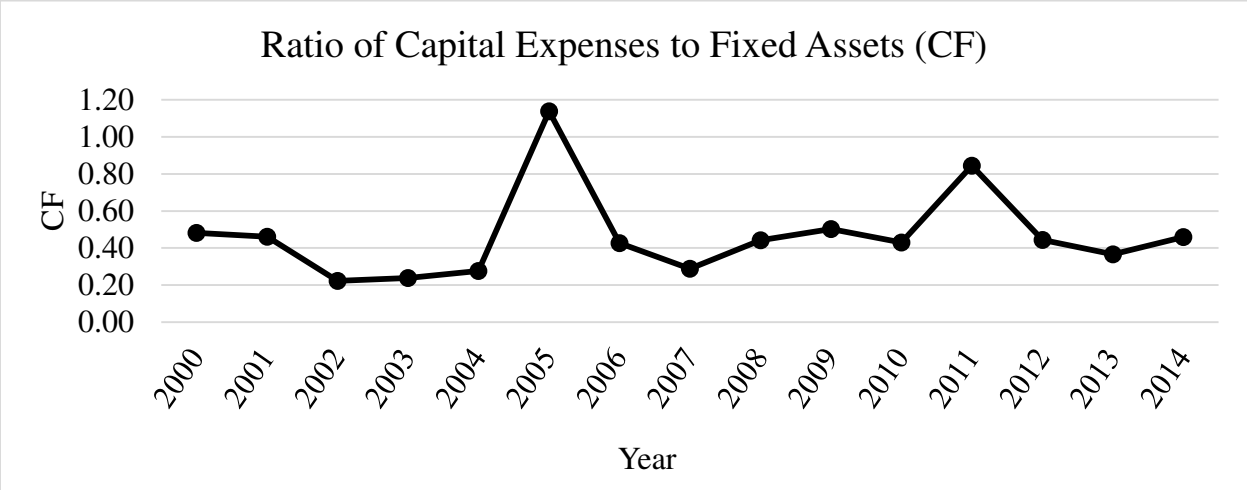


Figure 3 Time Series showing Ratio of Capital Expenses to Fixed Assets(CF)



The graphs in figure 1, 2 and 3 show the gradual change of the three input price variables across the time- period from 2000-2014.

Table 4 shows the Description of Dependent and Independent Factors used in the study

Dependent Variables	
Return-on-Assets (ROA)	The ratio of after-tax Profits to Total Assets.
Total-Revenue(TR)	Total Income, i.e., the sum of Interest Income and Non-Interest Income.
Interest-Income(IR)	Total Income from Interest Earning activities.
Input Prices -Independent Variables	
Capital expenditure- to-	The ratio of Capital Expenses to Fixed Assets. It represents theunit cost

Fixed Asset (CF)	of capital.
Interest Expenses-to-Loans (IL)	The ratio of Annual Interest Expenses to Total Loanable Funds which is Deposits plus borrowings. It represents the unit cost of funds.
Employee-Expenses (EE)	The ratio of Employee Expenses to the number of Employees. It represents the unit cost of labour.
Control Variables	
Total Assets (TA)	It is taken as a proxy for size.
Capital-to-Asset (CA)	The ratio of Sum of Shareholder's Capital and Reserves to Total Assets.
NPA-to-Asset (PA)	The ratio of Net Provisions for Non-Performing Assets to Total Asset. This is used as a proxy for credit risk.
Macro-Economic Variable	
GDP	Gross Domestic Production Growth Rate

The table (correlations) demonstrates the cross correlations among all the independent variables. We observe that none of the independent factors show a correlation greater than 0.80 or 80% and VIF of independent variables less than 5,which implies that the problem of multicollinearity does not exist for our chosen independent factors.

Table 5 shows the Cross Correlation Matrix of Independent Factors

	EE	**CF**	**IL**	**RISK**	**TA**	**CA**	**GDP**
EE	1	–	–	–	–	–	–
CF	-0.093	1	–	–	–	–	–
IL	0.066	-0.001	1	–	–	–	–
RISK	-0.238	0.040	0.098	1	–	–	–
TA	0.210	-0.111	0.083	-0.076	1	–	–
CA	0.251	0.066	-0.247	-0.114	-0.398	1	–
GDP	0.099	-0.125	-0.178	-0.013	0.092	0.070	1

EE= Ratio of Employee Expenses to number of Employees, CF=Ratio of Capital Expenses to Fixed Assets, IL= Ratio of Annual Interest Expenses to Total Loanable Funds, PA=Ratio of Net Provisions for Non-Performing Assets to Total Asset, TA=Total Assets, Risk = Loan loss provisions to total assets, CA=Ratio of Sum of Shareholder's Capital and Reserves to Total Assets, GDP=GDP Growth Rate

Table 6 shows the Descriptive statistics of Independent Factors

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
EE	0.18	0.04	91.36	0.01	2.99	926
CF	0.43	0.18	55.13	0.03	2.31	859
IL	0.08	0.06	6.95	0.03	0.25	925
RISK	0.01	0.00	0.06	-0.05	0.01	886
TA	71755.72	24923.18	1792748.29	2312.00	143610.45	930
CA	0.09	0.06	0.98	0.00	0.09	930
GDP	7.04	7.42	10.26	3.80	2.18	933

EE= Ratio of Employee Expenses to number of Employees, CF=Ratio of Capital Expenses to Fixed Assets, IL= Ratio of Annual Interest Expenses to Total Loanable Funds, PA=Ratio of Net Provisions for Non-Performing Assets to Total Asset, TA=Total Assets, Risk = Loan loss provisions to total assets, CA=Ratio of Sum of Shareholder's Capital and Reserves to Total Assets, GDP=GDP Growth Rate

The descriptive statistics of the independent factors show that there are major differences among banks specifically with respect to employee wages, salary and the cost of deposits. This highlights the heterogeneity among banks with respect to the bank-specific factors.

5. Empirical Findings and Analysis

Since the Panzar-Rosse model is applicable under the equilibrium conditions only, we first test for the existence of Equilibrium Conditions over the full period as well as for rolling sample of sub-periods extending for five years each. It also helps in identifying the phases or stretches of disequilibrium in the sub-periods of analysis. The table (ROA Rolling) analyses the complete period as well as all the five-year long sub-periods in the given time period. Analysis for the equilibrium test is done based on the rolling data sample with the dependent variable being Return on Assets, to comprehend the shift or transition of the equilibrium conditions along the years. We calculate the value of E or the equilibrium test. It can be mathematically determined by the following formula:

$$E = \mu_1 + \mu_2 + \mu_3$$

$where,$

$\mu_1 = Coefficient\ of\ Ratio\ of\ Employee\ Expenses\ to\ number\ of\ Employees(EE)$
$\mu_2 = Coefficient\ \ of\ Ratio\ of\ Capital\ Expenses\ to\ Fixed\ Assets\ (CF)$
$\mu_3 =\ Cofficient\ of\ Ratio\ of\ Annual\ Interest\ Expenses\ to\ Total\ Loanable\ Funds\ (IL)$

The validity of PRH statistic depends upon the assumption of long-run market equilibrium which we have tested in the table (table 5). We check whether the value of E or sum of the values of $\alpha_1, \alpha_2\ and \alpha_3$is equal to zero or not. We conduct the Wald test for the total period as well as the sub periods putting by testing the following null and alternate hypothesis:

$$H_0 : E = 0$$
$$H_1 : E \neq 0$$

The table also shows the values of the estimated coefficients and the value of F-statistic along with its level of significance. The results in the table show that from the period 2000 – 2014, the banking industry is in near equilibrium condition in the long run. The Wald test fails to reject the null hypothesis that E=0.The data for the sub-period shows near zero values of E which points towards the equilibrium conditions. The result for the sub-periods, which includes the recession years, shows empirical evidence of the presence of disequilibrium in the banking industry in the short run. The F-statistic also sustains at a higher level during this period with lower levels of significance which indicates a deviation from the equilibrium condition. This period of disequilibrium corresponds to the period of the global financial crisis.

The results of the dynamic panel, as well as fixed effect models, are presented and compared in Table 7.Alternative estimations are also done to find the robustness of the results in the case of un-scaled revenue and scaled revenue equation.

Table 7 shows the Tests of Equilibrium (Rolling Sample) in Return on Assets

Period	ln EE (α_1)	ln CF(α_2)	ln IL (α_3)	Sum (E)	F-Statistic(Wald test)
2000-2014	0.0635	-0.0176	-0.0745	-0.0286	F(1,785) = 0.1842
2000-2004	-0.0584	-0.0001	-0.1389	-0.1975	F(1,199) = 2.9606*
2001-2005	-0.0053	-0.0075	-0.0057	-0.0186	F(1,206) = 0.0211
2002-2006	-0.1158	0.0573	0.1103	0.0518	F(1,214) = 0.1617
2003-2007	0.0987	-0.0137	-0.1007	-0.0158	F(1,220) = 0.0154
2004-2008	0.3723	-0.0234	-0.1007	0.2482	F(1,225) = 2.5584
2005-2009	1.2682	0.0389	-0.0620	1.2451	F(1,230) = 22.6652***
2006-2010	0.5149	0.0841	-0.0488	0.5502	F(1,234) = 5.3125**
2007-2011	0.3159	0.0822	-0.1898	0.2083	F(1,231) = 1.2618
2008-2012	0.0901	0.0540	-0.2425	-0.0984	F(1,227) = 0.2601
2009-2013	-0.0633	0.0611	-0.2834	-0.2856	F(1,224) = 2.4904
2010-2014	-0.0503	0.0009	0.0029	-0.0465	F(1,221) = 0.1751

EE= Ratio of Employee Expenses to number of Employees, CF=Ratio of Capital Expenses to Fixed Assets, IL= Ratio of Annual Interest Expenses to Total Loanable

,,*** denote the rejection of null hypothesis at 10%,5%,1% respectively*

The banks in the sample are found to be earning their revenues as if under monopolistic competition as in many other emerging market economies.Monopolistic competition is a type of imperfect competition such that many producers sell products that are differentiated from one another as goods but are not perfect substitutes. In monopolistic competition, the firm takes the prices charged by its rivals and ignores the impact of its own prices on the prices of other firms.

Table 8 shows the Fixed Effect and Dynamic Estimation of Total Revenue

	(TR) Dynamic Model			Fixed Effect Model		
	2000-2014	**2000-2007**	**2008-2014**	**2000-2014**	**2000-2007**	**2008-2014**
Ln (TR(-1))	0.326***	0.376***	0.083***	-	-	-
Constant	-0.009	0.001	0.011***	-0.886***	0.001	-1.797***
Ln (EE)	0.015***	-0.074***	0.007*	0.014	-0.020	0.003
Ln (CF)	0.031***	0.053***	0.011	0.001	0.009	-0.018
Ln (IL)	0.106***	0.284***	0.044***	0.132***	0.177***	0.078***
Risk	0.005***	0.008***	0.015***	0.011*	0.018	0.019**
Size	0.623***	0.576***	0.894***	0.924***	0.834***	0.037
Capital Ratio	0.089***	0.074***	0.145***	0.040*	0.050*	0.288***
GDP	0.015***	0.001*	0.009***	0.019***	0.012*	0.001
H-Statistic	0.230	0.424	0.069	0.147	0.166	0.063
Number of Observations	786	356	304	924	492	432
AR(1)	0.110	0.065	0.197	-	-	-
AR(2)	0.195	0.755	0.301	-	-	-
Hansen J test(*p-value*)/Adj. R^2	62.408	57.965	60.578	0.981	0.980	0.633
Null1 1: H=0	F(1,778) = 1014.429[c]	F(1,348) = 3113.936[c]	F(1,296) = 53.868[c]	F(1,849) = 24.117[c]	F (1,418) = 9.951[c]	F (1,360) = 4.561[c]
Null 2: H=1	F(1,778) = 12082.870[c]	F(1,348) = 5662.362[c]	F(1,296) = 6466.536[c]	F(1,849) = 808.030[c]	F (1,418) = 249.781[c]	F (1,360) = 1004.003[c]

EE= Ratio of Employee Expenses to number of Employees, CF=Ratio of Capital Expenses to Fixed Assets, IL= Ratio of Annual Interest Expenses to Total Loanable Funds, Risk=Ratio of Net Provisions for Non-Performing Assets to Total Asset, Size= Natural Logarithm of Total Assets, Capital Ratio=Ratio of Sum of Shareholder's Capital and Reserves to Total Assets, GDP=GDP Growth Rate

Null 1= There is monopoly (H_0: H=0), Null 2= There is perfect competition (H_0: H=1)

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

'a','b','c' denote rejection of null hypothesis at 10%,5% and 1% respectively.

Note: J-Statistic-The test for over-identifying restrictions in GMM dynamic model estimation.

AR(1)Arellano-Bond test that average auto-covariance in residuals of order 1 is 0 (H_0 implies no autocorrelation).AR(2) Arellano-Bond test that average auto-covariance in residuals of order 2 is 0 (H_0 implies no autocorrelation).

The results also support the finding that when the adjustment towards the equilibrium is partial and not instantaneous, the H-statistic is downward biased (Goddard and Wilson,2010).This is clearly evident from the relatively higher values of H-statistic in the case of dynamic estimations as compared to fixed effect estimations. Results show a negative first order autocorrelation in the errors, but this does not imply inconsistency in the results. Inconsistency would be implied if second order autocorrelation is present (Arellano and Bond,1990).

Table 9 shows the Fixed Effect and Dynamic Estimation of Interest Revenue

	Dynamic Model			Fixed Effect Model		
	2000-2014	**2000-2007**	**2008-2014**	**2000-2014**	**2000-2007**	**2008-2014**
Ln (IR(-1))	0.256***	0.192***	0.126***	-	-	-
Constant	-0.019***	-0.057***	-0.008***	-3.187***	-2.194***	-2.403***
Ln (EE)	-0.006**	0.0155***	0.031**	-0.031	-0.074	0.003
Ln (CF)	0.054***	0.090***	0.012***	0.018	0.030*	-0.002
Ln (IL)	0.124***	0.503***	0.085***	0.116***	0.210***	0.089***
Risk	-0.003***	-0.005	0.001***	-0.004	-0.001	0.012
Size	0.914***	0.801***	0.913***	1.077***	0.969***	1.075***
Capital ratio	-0.008	-0.054***	0.225***	-0.064**	-0.089**	0.281***
GDP	0.013***	0.031***	-0.011***	0.025***	0.010	0.001
H-value	0.232	0.754	0.148	0.103	0.167	0.090
Number of Observations	786	356	304	924	492	432
Number of Banks	67	65	63	68	67	65
AR(1)	0.103	0.066	0.855	-	-	-
AR(2)	0.402	0.991	0.228	-	-	-
Hansen J test(*p-value*)/Adj. R^2	0.183	0.270	0.293	0.979	0.970	0.991
H0: H=0	F (1,778) = 631.552[c] (25.131)	F (1, 348) = 10961.866c (104.699)	F (296) = 172.036[c] (13.116)	F (1,849) = 8.821[c] (2.970)	F (1,418) = 5.471[b] (2.339)	F (1,360) = 7.814[c] (-2.795)
H0: H=1	F (1,778) = 9608.959[c]	F (1, 348) = 505.010[c]	F (296) = 6699.872[c]	F (1,849) = 663.613[c]	F (1,418) = 136.412[c]	F (1,360) = 795.597[c]

EE= Ratio of Employee Expenses to number of Employees, CF=Ratio of Capital Expenses to Fixed Assets, IL= Ratio of Annual Interest Expenses to Total Loanable Funds, Risk=Ratio of Net Provisions for Non-Performing Assets to Total Asset, Size= Natural Logarithm of Total Assets, Capital Ratio=Ratio of Sum of Shareholder's Capital and Reserves to Total Assets, GDP=GDP Growth Rate

Null 1= There is monopoly ($H_{0:}$ H=0), Null 2= There is perfect competition ($H_{0:}$ H=1)

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

'a','b','c' denote rejection of null hypothesis at 10%,5% and 1% respectively.

Note: J-Statistic-The test for over-identifying restrictions in GMM dynamic model estimation.

AR(1)Arellano-Bond test that average auto-covariance in residuals of order 1 is 0 (H_0 implies no autocorrelation).AR(2) Arellano-Bond test that average auto-covariance in residuals of order 2 is 0 (H_0 implies no autocorrelation).

Table 10: shows the Fixed Effect and Dynamic Estimations with dependent total revenue scaled by total assets

	Dynamic Model			Fixed Effect Model		
	2000-2014	**2000-2007**	**2008-2014**	**2000-2014**	**2000-2007**	**2008-2014**
Ln (TR_TA(-1))	0.340***	0.180***	0.042***	-	-	-
Constant	0.005***	0.0151**	0.0178***	-0.057	1.509***	-1.797***
Ln (EE)	0.104***	0.237***	0.0311***	0.110***	0.197***	0.003
Ln (CF)	0.023***	0.018***	0.002	0.018*	0.025*	-0.018
Ln (IL)	0.167***	0.416***	0.062***	0.193***	0.260***	0.078***
Risk	0.001	0.006***	0.021***	0.009	0.013	0.019**
Size	0.104***	0.289***	0.118***	0.118***	0.229***	0.037
Capital Ratio	0.011**	0.003	0.151***	0.022	0.033	0.288***
GDP	0.014**	0.006	0.005***	0.016***	0.012	0.001
H-value	0.448	0.820	0.099	0.321	0.482	0.063
Number of Observations	784	363	304	915	495	432
AR(1)	0.0289	0.022	0.223	-	-	-
AR(2)	0.2623	0.502	0.297	-	-	-
Hansen J test*(p-value)*	0.302	0.355	0.274	0.493	0.686	0.633
H0: H=0	F (1,776) = 16192.941[c]	F (1,355) = 69545.944[c]	F (1,296) = 538.476[c]	F(1,839) = 140.961[c]	F (1,421) = 165.754[c]	F(1,360) 4.561[b]
H0: H=1	F (1,776) = 23557.235[c]	F (1,355) = 3570.425[c]	F (1,296) = 22926.825[c]	F(1,839) = (632.401)	F (1,421) = 191.222[c]	F(1,360) 1004.003[b]

EE= Ratio of Employee Expenses to number of Employees, CF=Ratio of Capital Expenses to Fixed Assets, IL= Ratio of Annual Interest Expenses to Total Loanable Funds, Risk=Ratio of Net Provisions for Non-Performing Assets to Total Asset, Size= Natural Logarithm of Total Assets, Capital Ratio=Ratio of Sum of Shareholder's Capital and Reserves to Total Assets, GDP=GDP Growth Rate

Null 1= There is monopoly (H_0: H=0), Null 2= There is perfect competition (H_0: H=1)

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

'a','b','c' denote rejection of null hypothesis at 10%,5% and 1% respectively.

Note: J-Statistic-The test for over-identifying restrictions in GMM dynamic model estimation.

AR(1)Arellano-Bond test that average auto-covariance in residuals of order 1 is 0 (H_0 implies no autocorrelation).AR(2) Arellano-Bond test that average auto-covariance in residuals of order 2 is 0 (H_0 implies no autocorrelation).

The presence second order autocorrelation is checked to substantiate whether there is inconsistency or not. We find that the second order autocorrelation is insignificant, which implies that there is no inconsistency in the results. Hansen J test shows a case of no over-identifying restrictions and the model seems to be valid in the present context.

Above table 7 exhibits the individual values of the coefficients of each of the independent variables for the complete period, and two sub-periods, which divides the complete term equally into two sub-periods. The value of H statistic for the full sample period is 0.230. The rejection of null hypothesis for H is equal to unity as well as zero, which leads to the rejection of the model for monopoly conjectural variations to short run oligopoly, and perfect competition for both the sub-periods, as well as for the entire period. Results indicate that revenues are earned as if under monopolistic competition as per the Panzar-Rosse Model. The value of the H statistic for the sub-periods 2000-2007 and 2008-2014 points towards a decrease in the degree of competition between the two sub-periods. Specifically in the post-recession period, government control and regulations increased which may have led to a decline in the degree of competition. One of the reasons for the decrease in competition can be the higher requirements or norms for the BASEL II standardized norms**.**Deregulation in the 1990's increased the opening up of financial markets. This also served as an important constituent to increase the competitiveness of banking markets in the first sub-period of the study.The fall in the level of H statistic may be attributed to the consolidation of the sector, with the major banks acquiring smaller banks to gain economies of scale, market share and transaction volume. Competition comes not just from foreign banks but also from the markets. With the growth of derivative transactions and financial markets, corporate and big houses may choose their sources of finance from various banking and non-banking agencies. Even the individuals may park their funds in deposit accounts, and also will be able to choose from money market mutual funds other financial instruments.Nevertheless, even during the post-reform period revenues were earned as if under monopolistic competition.

The coefficient value of lagged dependent variable of total revenue shows that the adjustment towards equilibrium is partial and not instantaneous.The unit price of labour and unit price of capital are all positively significant, however, the results consistently indicate that Interest expenses to total loans which are the unit price of funds significantly are the biggest contributor to the value of H-statistic in both static and dynamic model. This is a strong indicator of the

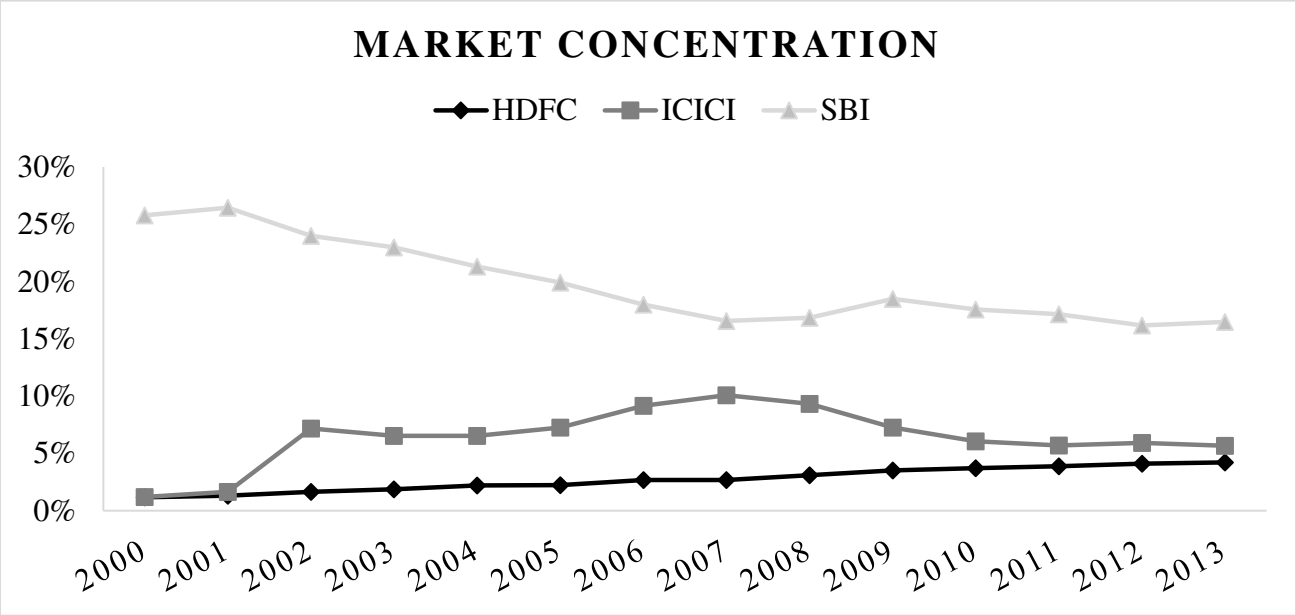
effects of interest rate liberalisation. The price of capital and price of labour are significant and positive for all the sub-periods as well as the full period sample. With respect to the control variables, capital to asset ratio is significant and positive. This confirms to the BASEL II guidelines wherein banks having higher access to available equity capital may achieve higher growth. So in this case, it implies increased revenue. Size of the banks or the total asset value has a positive and significant impact thus indicating that larger banks fetch higher revenues due to an increased market power. The variable of credit risk is positively significant, which lends support to the view that higher risk may lead to higher revenues. With regard to the macroeconomic factors, the effect of GDP is positive and statistically significant. This highlights the effect of business cycles on the revenue generation.

Considering bank's core business of interest generation, which have been banks traditional business activity for many years, we use the natural logarithm of interest revenue (table interest revenue) to estimate PRH statistic pertaining to banks' core business as well. In a similar manner, we find estimates of H-statistic downward biased in case of Fixed Effect estimation leading to higher values of H-statistic. We find that in the line of banks, traditional business activity interest revenues are earned as if under monopolistic competition. The value of H-statistic is higher for the first sub-period than the second sub-period as well as the whole sample. This mainly pertains to the fact that the early part of the sample period was marked by an increase in a number of foreign banks due to liberalised entry norms as well setting up of new private sector banks, which then began competing with the public sector banks for market share and earn income specifically pertaining to interesting generation activity. This lead to an increase in competition as measured by the PRH statistic. In the case of interest revenue, the highest contributing factor to H statistic is interest expenses. The unit cost of labour is negatively and statistically significant while the effect of the unit cost of deposits is positive at any given conventional level of significance.

Following the steps of (Misspecifications of PRH), we also estimate the fixed effect and GMM estimations of total revenue scaled by the total asset. Based on the regression analysis, we reject the null hypothesis for both the cases where H-statistic is equal to zero, hence rejecting the fact that the industry has monopoly type of competition, and H-statistic is equal to one, hence rejecting the fact that the industry has perfect competition. Both the unit cost of labour and the unit cost of funds have a significant contribution to H-statistic.

The profit equation points out that the elimination of profits is partial and not instantaneous (the significant value of lagged variable of profit in the profit equation). Although the low persistence of profit values(in the sub-periods), are generally associated with higher competition, but in the case of the Indian banking sector, it may not be implausible to think that a low persistence of profit may arise from other sources, than only competition. Persistence of profits may be a result of incumbent firms enjoying their market power or dominance. As a future scope, we need to map the competitive dynamics of the industry which include the entry threat and market contestability factors.

Figure 4



Source: Based on Author's own calculations, based on total assets of the individual banks as compared to the market as a whole

Based on the H-statistic obtained (Table 7, 8), we obtain the information that the revenues are earned under monopolistic competition, and the two sub samples also show a decline in competitive levels. However, the figure above shows a decline in the market concentration of top few banks which would imply an increase in competition according to the classical approach. Table 1 shows by the concentration index (CR 5 and CR 10) and H statistic values (Table 1). Conventional views on the relation between competition and market structure such as the structure-conduct-performance paradigm (Bain,1951)) would suggest that more concentrated markets tend to be more collusive (lesser competitive).

The results for concentration values and H-statistic values show that the overall market concentration also does not coincide with competitive conduct as measured by PRH statistic.

7. Conclusion

Panzar-RosseMethodology, using a reduced form revenue model in a dynamic framework and static framework, is used to assess the level and the nature of competition in the Indian Banking Industry.Our study is pivotal to the study of competition in the post-deregulation era, as this era also covers key changes regarding policy formulations on increasing the contestability of the markets. These policy formulations, firstly, culminated in a number of banking mergers and consolidations and various structural changes in the system as well. The hypotheses of perfect collusion as well as of perfect competition can be rejectedusing dynamic as well as fixed panel-econometric estimations using the micro data of banks' balance sheets and profit and loss accounts for the years 2000-2014. The banks in India are found to be earning their revenues as if under monopolistic competition, as in many other emerging-market economies. This implies that there may be few large banks which may be controlling the market and offer similar but not identical products. The results are consistent with other studies in the case of India and other emerging economies.

The results are robust to alternative estimation techniques, in both fixed effect as well as a dynamic framework. The results are also supported by traditional business activities (interest income versusand non-interest income). We particularly test for the presence of equilibrium using ROA as the dependent factor in a rolling sample analysis and three different sample periods. Fixed effect estimations point towards the presence of equilibrium in the long run, however, the dynamic estimations (GMM)show disequilibrium. To account for various misspecification in the Panzar-RosseH statistic, pointed out in earlier studies, we estimate the model alternatively using fixed effect as well as dynamic estimations through the Arellano Bond(1991) Generalised Method of Moments. Dynamic empirical investigations of the Panzar-Rosse Model are done to compare dynamic H statistic with static H statistic. Although the results confirm the downward bias of the H statistic, the presence of monopolistic competition cannot be ruled out.The division of the entire sample into two sub-period before 2007 and after 2007 shows a decrease in the level of competition between the two-sample periods. Among the factors which contribute to total revenue positively and significantly include the unit cost of labour, funds and

capital, out of which unit cost of funds is the highest contributing factor towards the H-statistic. The effect of Credit risk on revenue is significant and positive, which points towards higher risk to realize higher revenues. To assess the nature of competition in the core business activity of banks, we re-estimate the Panzar-RosseEquation with interest revenue as a dependent variable which also indicated towards monopolistic competition as well.

Although, the concentration ratio of top five and top ten banks has decreased across the years, which implies an increase in competitive conduct according to the classical theory and Structure Conduct Performance(SCP) hypothesis. This shows that the competitive conduct does not coincide with the concentration index in the case of Indian Banks. We have also seen that the competition has also decreased across the time-periods. Deregulation in the 1990's increased the opening up of financial markets.This also served as an important constituent to increase the competitiveness of banking markets in the first sub-period of the study.Even though there has been a decrease in the dominance of a few large banks, the competitiveness of commercial bankshas been threateneddue to the barriers to entry, consolidation exercises and over regulation.This may have hindered the high degree of competitiveness of the market. The movement of bank activities from traditional financial business to off-balance sheet activities might have led to convergence in the competitive levels. The empirical analysis provides support to the assumption that the structure of Indian Banking sector remains to be monopolistic competition even though the consolidation exercises have been on the forefront in the last few years. This feature of the Indian Banking market is consistent with other emerging-market economies or developing countries. However, the regulator needs to address the issue of any cartel formations by bigger banks to capture market share and business volume. The talks of the merger of six important banks to form two banks, the mergers of stronger banks with smaller banks, will further decrease competition.

As a policy implication; the study also highlights the possible link between banking sector competitiveness, profitability, financial intermediation and regulatory impact. Although the low persistence of profit values(in the sub-periods) are associated with higher competition, in the case of the Indian banking sector, it may be possible to outline that a low persistence of profit may arise from other sources than only competition. Persistence of profits may be a result of incumbent firms enjoying their market power or dominance.

As a future scope, we need to map the competitive dynamics of the industry which include the entry threat and market contestability factors.

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