A New Measure of Competition in Indian Loan Market

Ansari, Jugnu

CAFRAL

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Abstract

This study endeavours at measuring bank competition in Indian loan market using a new competitiveness index, the Augmented Relative Profit Difference (ARPD), which quantifies the impact of marginal costs on performance, measured in terms of market shares. This study yields two major insights. First, the theoretical foundation of the ARPD is very robust as compared to other conventional measures. Second, applying this unbiased competition indicator to Indian bank loan markets shows that financial reform indeed has contributed to significant improvements in competition. As regards, the competition among specific types of banks, we found public sector banks and private sector banks are comparatively more competitive than foreign banks. The empirical finding indicates that the Indian loan market is monopolistic in nature.

1. Introduction

It is well known that Indian financial system is predominantly a bank-based financial system. The banking sector plays an important role in mobilization of deposits from the saving households and allocation of credit to productive sectors, apart from financing the Government through investment in treasury securities. Until the early 1990s, commercial banks under the aegis public sector performed all these functions in a highly regulated environment guided by social banking for economic development objective and fiscal policy dominated macro policy objectives. In such an environment, banks could not emphasize on competitiveness and viability of their business with regard to asset quality and profitability. In the wake of balance of payment crisis, India adopted reform with a view to alleviate structural impediments to higher economic growth through a competitive and open economy model. At this juncture it was realized that economic reform cannot take place meaningfully without a revamp of financial system. Thus, the reform of banking sector was pursued based on the recommendation of a high level committee. The reform of banking sector emphasized on promoting a diversified, efficient and competitive financial system with the ultimate goal of improving the allocative efficiency of resources through operational flexibility, improved financial viability and institutional strengthening.

In this pursuit, the banking sector reform encompassed various dimensions. Firstly, the level of competition was gradually increased within the banking system by allowing greater participation of domestic private and foreign banks while allowing banks greater freedom in pricing and allocation of credit. Secondly, measures were taken to develop various segments of financial markets such as money, bond, credit, foreign exchange and equity segments, with the introduction of newer instruments with a view to allow banks and financial institutions and also savers and investors opportunities for diversification, optimization of return and risk on their portfolios and effective management of liquidity and other risks. Thirdly, in order to ensure stability of the financial system, banks were subjected to international best practices in prudential regulation and supervision tailored to Indian requirements. The supervisory system was revamped under the ambit of the Board for Financial Supervision in view of the crucial role of supervision in the creation of an efficient banking system. Fourthly, measures were taken to improve the institutional arrangements including the legal framework and technology platform for effective, cost efficient and sound payment and settlement system.

Finally, in order to be consistent with the new institutional architecture for the financial system in general and the banking sector in particular, the monetary policy framework made a phased shift from direct instruments of monetary management such as cash reserve and statutory liquidity requirements to an increasing reliance on indirect instruments such as short term policy interest rate including repo and reverse repo rates. Thus, there was a shift from traditional quantum of money to interest rate channel of monetary transmission mechanism. This shift in policy framework envisaged that in an increasingly competitive and integrated financial market environment, banks

will be guided by market conditions and their balance sheet pressures along with regulatory and prudential requirements while pricing their assets and liability components, which in turn would have consequential effect on credit to private sector and the real economy.

A banking system that exhibits some degree of market power, however, may improve credit availability to certain banks, and it may provide incentives for banks to screen loans, which aids efficient allocation of resources. Market power in a banking system may contribute to stability by providing incentives that mitigate risk-taking behaviour, and by providing incentives to screen and monitor loans, which can improve the quality of banks' portfolios. Policies such as capital requirements, disclosure rules, and risk-based deposit insurance, however, may provide incentives for banks to behave prudently even in a competitive market.

A new approach to measure competition introduced and applied by Boone (2000, 2004, 2008). The so-called Boone indicator measures (RPD-Relative Profit Difference) the impact of efficiency on performance in terms of profits or market shares. The idea behind the Boone indicator is that competition enhances the performance of efficient banks and impairs the performance of inefficient banks, which is reflected in their respective profits or market shares. This approach is related to the well-known efficiency hypothesis, which also explains banks' performances by differences in efficiency (Goldberg and Rai, 1996; Smirlock, 1985). This method allows measurement of competition not only for the entire banking market, but also for separate product markets, such as the loan market, and for single types of banks, such as commercial and cooperative banks. In this study we have used this measure to evaluate competition in the Indian banking sector.

Generally, the policymakers aim to facilitate a banking system that supports economic efficiency and stability and they want to check whether the policy change had the desired effect. To illustrate, a competition authority may want to monitor an industry so that it can intervene when competition slackens by a policy change with the goal of intensifying competition in the industry. Competition in the financial sector matters for a number of reasons viz., for the efficiency of the production of financial services, the quality of financial products, and the degree of innovation in the sector. It has been shown, theoretically as well as empirically, that the degree of competition in the financial sector can matter for the access of firms and households to financial services and external financing, in turn affecting overall economic growth, although not all relationships are clear. The long-existing theory of industrial organization has shown that the competitiveness of an industry cannot be measured by market structure indicators alone, such as number of institutions, or Herfindahl and other concentration indexes (Baumol, Panzar, and Willig 1982). The threat of entry can be a more important determinant of the behavior of market participants (Besanko and Thakor 1992). Theory also suggests that performance measures, such as the size of the banking margins or profitability, do not necessarily indicate the competitiveness of a banking system. These measures are influenced by a number of factors, such as a country's macro performance and stability, the form and degree of taxation of financial intermediation, the quality of

the country's information and judicial systems, and bank-specific factors, such as scale of operations and risk preferences. As such, these measures can be poor indicators of the degree of competition.

In the following, the paper is presented in five sections. Section 2 reviews the literature. Section 3 discusses theoretical perspectives methodology and data followed by stylized facts in Section 4, and empirical analysis in Section 5. Section 6 concludes.

2. Review of Literature

The evidence of measuring the level of competition in Indian banking systems is scarce. There have been a few studies, to our knowledge, that have investigated the degree of competition in Indian financial industries. Prasad, A. and Ghosh, S. (2005) estimated the Panzar and Rosse (1987) H-statistic of Indian banks for the period of 1996 to 2004. They found that the Indian banking sector was in monopolistic competition equilibrium. Bhanu Murthy and Deb (2008) used Bodenhorn's Measure of Mobility to measure the competition in Indian private sector banks for the period of 1992-2002. They found the market structure of private banking sector monopolistic in nature.

Rather, testing for the degree of effective competition requires a structural, contestability approach, along the lines pursued in much of the industrial organization literature. As in other sectors, the degree of competition in the banking system should be measured with respect to the actual behavior of (marginal) bank conduct. The actual behavior should be related not only to banking market structure but also to entry barriers, including barriers on foreign ownership, and the severity of activity restrictions since those can limit the degree of intra-industry competition. Furthermore, the degree of competition from other forms of financial intermediation (capital markets, nonbank financial institutions, insurance companies) will play a role in determining banking system competitiveness.

As a first-order effect, one would expect increased competition in the financial sector to lead to lower costs and enhanced efficiency, even allowing for the fact that financial products are heterogeneous. Recent research has illustrated, however, that the relationships between competition and banking system performance, access to financing, stability, and growth are more complex. Market power in banking, for example, may be to a degree beneficial for access to financing (Petersen and Rajan 1995). The view that competition is unambiguously good in banking is more naive than in other industries, and vigorous rivalry may not be the first best for financial sector performance. This literature has also shown that technological progress lowering production or distribution costs for financial services providers does not necessarily lead to more or better access to finance.

A number of papers have investigated the competitive condition in banking systems. In one of the first papers, Berger and Hannan (1989) investigate the commonly observed relationship between market concentration and profitability using data for

U.S. banks from 1983-85. They try to separate the effects of noncompetitive price behavior from that of greater efficiency for firms with larger market shares and find that noncompetitive price behavior could explain the relationship. While many of the studies are not formal structure-performance-conduct tests, their results have been interpreted as being indicative of the degree of competition and/or its causes and consequences in the financial sector (Berger 1995). A number of recent studies have investigated the effects of regulations and specific structural or other factors presumed to relate to the competitive environment on banking performance. Barth, Caprio, and Levine (2004) document, among others, that tighter entry requirements are negatively linked with bank efficiency, leading to higher interest rate margins and overhead expenditures, while restricting foreign bank participation tends to increase bank fragility. These results are consistent with the view that tighter entry restrictions tend to limit competition and emphasize that it is not the actual level of foreign presence or bank concentration but the contestability of a market that determines bank efficiency and stability.

A number of papers have applied either the Bresnahan(1982) or the Panzar and Rosse(1987) methodology to the issue of competition in the financial sector, although mostly to the banking system specifically. Cetorelli (2004) provides more detail on these formal tests and reviews results of previous studies of empirical banking studies. One of the first applications of the Bresnahan test is that of Shaffer (1989). For a sample of U.S. banks, he finds results that strongly reject collusive conduct but are consistent with perfect competition. Using the same model, Shaffer (1993) finds that the Canadian banking system was competitive over the period 1965-89 despite being relatively concentrated. Gruben and McComb (2003) find that the Mexican banking system before 1995 was more competitive, that is, marginal prices were set below marginal costs. Shaffer (2001) uses the Bresnahan(1982) model for 15 countries in North America, Europe, and Asia during 1979-91. He finds significant market power in five markets and excess capacity in one market. Estimates were consistent with either contestability or Cournot type oligopoly in most of these countries, while five countries were significantly more competitive than Cournot behavior would imply.

Shaffer (1982) applied the PR model to a sample of New York banks using data for 1979 and found monopolistic competition. Nathan and Neave (1989) studied Canadian banks using the PR methodology and found results consistent with the results of Shaffer (1989) using the Bresnahan methodology, i.e., a rejection of monopoly power. Several studies have applied the PR methodology to European banking systems. Generally, the studies reject both perfect collusion as well as perfect competition and find mostly evidence of monopolistic competition (Bikker and Haaf, 2001). Some studies find differences between types of banks. For example, De Bandt and Davis (2000) find monopoly behavior for small banks in France and Germany while they find monopolistic competition for small banks in Italy and for the large banks in all three countries in their sample. This suggests that in these countries small banks have more market power perhaps as they cater more to local markets. The price cost margin (PCM) is widely used as a measure of competition. However, the theoretical foundations of

PCM as a competition measure are not robust. Theoretical papers like Amir (2002), Bulow and Klemperer (1999), Rosentahl (1980) and Stiglitz (1989) present models where more intense competition leads to higher PCM instead of lower margins.

Boone (2008) assumes that more efficient firms (that is, firms with lower marginal costs) will gain higher market shares or profits, and that this effect will be stronger the heavier competition in that market is. In order to support this intuitive market characteristic, Boone develops a broad set of theoretical models (Boone, 2000, 2001 and 2008, Boone et al., 2004) found to be more robust than any other methods, viz. PCM, HHI, H-statistic. Both competition and market power, however, can have positive implications for efficiency, and prudent regulation. It may be optimal to facilitate an environment that promotes competitive behavior (contestability), thereby minimizing the potential costs of market power while realizing benefits associated with any residual market power.

By contrast, structural variables do not have a significant impact on competition, as measured by the H-statistic. Contestability appears to be more important than market structure in explaining the strength of competition in banking. In general three approaches have been used to measure competition in the banking sector. The fourth one called Augmented Relative Profit Difference (ARPD) method is proposed in this study and is used to measure competition in Indian Banking sector using panel data.

2.1 Structural measures of competition

Familiar measures of market structure, such as concentration ratios, the number of banks and the Herfindahl-Hirschman index (HHI), are still widely used in empirical work. These measures originated in the structure-conduct-performance (SCP) paradigm linking the structure of a market to influences on bank behaviour and thus sector performance. One prediction of the SCP approach is that higher concentration would encourage collusion and reduce efficiency. The SCP paradigm has well-known weaknesses. Structure may not be exogenous, but instead it might be the result of banks' behaviour. A more concentrated market structure could be the result of better, more efficient performance, contrary to the predictions of the SCP paradigm. There is no consensus on the best variable for measuring market structure in banking, while performance is typically measured with variables, such as net interest margins or profitability, which can be influenced by factors other than the degree of competition, such as a country's macroeconomic situation or the level of taxation.

2.2 Measures of market contestability

The second approach assesses competitive conditions in terms of contestability. The price cost margin (PCM) is widely used as a measure of competition. It is believed that there are two reasons why PCM is still such a popular empirical measure of competition. First, as long as there is no evidence that the theoretical counterexamples are important empirically, one would expect that PCM remains a popular competition

measure. The second reason for the popularity of PCM is that the data needed to get a reasonable estimate of PCM are available in most datasets. A concentrated banking sector can remain competitive if it is contestable, that is if entry and exit into the system is easy and if bank regulations and supervision promote a level-playing field across all banks. Variables like regulatory indicators of entry requirements, the presence of foreign ownership, formal and informal entry barriers and activity restrictions measure the threat of entry in the sector and thus its contestability through the degree of entry and exit. Indeed, the standard approach used by the literature to retrieve the PCM specifies a demand function and the derivation of its first-order equilibrium condition, in which it is shown that (e.g. in the Cournot case) for a given bank 'I' the FOC (First Order Condition) amounts to Li = α_i/ε, where α_i is the market share of the bank, ε is the elasticity of demand and Li is the PCM, or Lerner Index, calculated as (P - MC)/P, i.e. how far a bank's price is from its marginal cost. Two different empirical versions of the Lerner Index approach are available in the literature, and both can be directly used at the bank-level of analysis, since they only need the availability of balance sheet data. The basic one is a simple ratio between profits and assets of a single bank, as in the case of Aghion et al. (2005) and Nickell (1996).

However, theoretically, PCM is not a robust competition measure. There is an aggregation problem in PCM measure of competition. While aggregating from bank level PCM to industry level PCM by weighted average method, where the weight of a bank equals its market share in the industry, there are chances of wrong inference of competition measure using PCM. An increase in competition reallocates market share from inefficient banks to efficient banks. Since efficient banks have a higher PCM than inefficient banks, the increase in competition raises the weight in the industry average PCM of banks with a high PCM. This can raise the industry average PCM (Wolfram (1999). Boone (2004)), which is not correct indication of competition. Amir (2003) shows that, under certain conditions, an increase in competition through an increase in the number of banks in a market can result in an increasing average PCM. Given certain circumstances Stiglitz(1989) shows that profits per unit sales can rise in a recession. Thus, even though competition among banks increases during recessions, industry PCM also increases. Another potential source of error can be the reallocation effect. As a result of fiercer competition, the market share of the more efficient banks increases while that for less efficient banks decrease. Thus, the weighted average PCM can increase if the increase in the market share of the more efficient banks over-compensates the decrease of the respective individual PCMs. Therefore, the Lerner-Index i.e. PCM, is at least theoretically, potentially misleading.

2.3 Direct measures of competition

The third approach measures the intensity of competition directly, in the way prices or outputs respond to costs. Many recent studies of banking use the so-called H-statistic based on the Panzar and Rosse (1987) methodology, which proxies the reaction of output to input prices. The H-statistic is calculated by summing the estimated

elasticities of revenue to factor prices; a value of one indicates perfect competition, a value of zero (or less) indicates monopoly and intermediate values indicate the degree of monopolistic competition. The index ranges from a high of 1 to a low of 0, with higher numbers implying greater market power. The theoretical foundation for direct measures is stronger than for structural measures, but direct measures have drawbacks too. For example, the H-statistic imposes restrictive assumptions on banks' cost functions. This measure neglects differences among banks like size, product or geographic differentiation. Still, this approach is increasingly used in empirical research because it measures banks' behaviour and thus competition directly.

2.4 Boone's Augmented Relative Profit Difference (ARPD)measures of competition

Boone (2008) proposed a new competition measure termed as Relative Profit Differences (RPD). Despite theoretical robustness few studies applied the Boone-Indicator to real world data to date. The only paper published in a refereed journal, to our knowledge, is Bikker and Leuvensteijn (2008). Using data for the Dutch life insurance market, they calculate the Boone-Indicator using different approximations of the variable costs. The Relative Profit Differences (RPD) measure overcomes the problems of heterogeneity, aggregation and attrition that could have arisen in the previous sections. Moreover, this variable may be constructed using the same bank-level data necessary to calculate the PCM, without any additional data requirements. It could be the case that more efficient bank would report lower costs (then having a higher bank-level PCM) whereas less efficient ones would show higher costs (therefore lower bank-level PCM). Given a competition shock in the sector due to a more aggressive behaviour of the incumbents (e.g. a lower elasticity of substitution among products) with consequent lower prices, less efficient bank would exit and their market shares would be redistributed among more efficient ones, hence eventually increasing the aggregate PCM. That is a case where a positive competition shock determines a higher sector-level PCM, implying that, under particular circumstances, the PCM measure is not monotonic in competition. The RPD measure instead increases (decreases) not only for the enhanced (lower) competition that arises from lower entry barriers, but also for competition that reallocates output to more efficient incumbent bank within the sector, thus ensuring the respect of monotonicity with respect to the direction of the competition shock.

3. Theoretical perspectives

The competitiveness index (Augmented Relative Profit Difference) is devised by Boone (2008) which is robust as compared to traditional measure of competition. Several studies concluded that countries with lesser entry and activity restrictions tend to have stronger competition. By contrast, structural variables do not have a significant impact on competition, as measured by the H-statistic. Contestability appears to be more important than market structure in explaining the strength of competition in

banking. Another strand of studies, however, find that bank size matters for market power, and in the way predicted by the Structure-Conduct-Performance (SCP) paradigm. Competition is found to decrease significantly with bank size. This may be because large banks are in a better position to collude with other banks, or because large banks are more likely to operate in product or geographical markets where there are few competitors.

Boone (2008) proposes a new competition measure termed Relative Profit Differences (RPD) which is defined as follows. Let π(n) denote the variable profit level of a bank with efficiency level n ∈ R+ where higher n denotes higher efficiency. Consider three banks with different efficiency levels, n" > n′ > n, and calculate the RPD as follows.

$$RPD(n', N, I, \theta) = \frac{\pi(n'', N, I, \theta) - \pi(n, N, I, \theta)}{\pi(n', N, I, \theta) - \pi(n, N, I, \theta)} \tag{3.1}$$

The more intense the competition (brought about by either lower entry costs or more aggressive interaction among existing banks) the higher the value of RPD. More precisely, a rise in competition reallocates output from less efficient to more efficient banks. Since this output reallocation effect is a general feature of more intense competition, which is true for the RPD, a robust measure of competition from a theoretical point of view.

When RPD is used as a measure of competition, the following three assumptions are always explicitly made as postulated by Boone:

(i) Efficiency is one dimensional, i.e. banks under consideration act in a market with relatively homogeneous goods. If efficiency is, say, two dimensional, an increase in competition forces a bank to focus on the activity in which it is most productive. This may raise the bank-level price cost margin. If a bank's efficiency level is not observed, an increase in efficiency leads to a higher price cost margin which is then (incorrectly) interpreted as reduced competition.

(ii) a bank's efficiency level can be observed, i.e. we assume symmetry. Hence, banks act on a level playing field that ensures that changes in competition affect banks directly and not indirectly through changes in that playing field. It also implies that bank i's profits are the same as bank j's profits would be if bank j was in bank i's situation. Thus, within the theoretical framework of the indicator, this implies equal profit level for two equally efficient companies.

(iii) banks compete on a level playing field, i.e., we are able to rank banks with respect to their efficiency (n). If banks compete on an uneven playing field, changes in competition can affect the status of the level playing field and making it hard to interpret both RPD and PCM.

Given a competition shock in the banking sector due to a more aggressive behaviour of the incumbents (e.g. a lower elasticity of substitution among products) with consequent lower prices, less efficient bank would exit and their market shares would be redistributed among more efficient ones, hence eventually increasing the

aggregate PCM. That is a case where a positive competition shock determines a higher sector-level PCM, implying that, under particular circumstances, the PCM measure is not monotonic in competition. The RPD measure instead increases (decreases) not only for the enhanced (lower) competition that arises from lower entry barriers, but also for competition that reallocates output to more efficient incumbent bank within the sector, thus ensuring the respect of monotonicity with respect to the direction of the competition shock.

The aim of this Section is to introduce a general model with 'i' banks that can enter and compete in a market. Banks are ranked such that lower 'i' implies higher efficiency: n1≥ n2≥…≥ ni. Each bank 'i' choose a vector of strategic variables $a_i \in R_k$. This choice leads to output vector $q(a_i; a_{-i}; \theta) \in R^L_+$ for bank i, where θ is a parameter that affects the aggressiveness of banks conduct in the market. Further, the choices of the strategic variables also lead to a vector of prices $p(a_i; a_{-i}; \theta) \in R^L_+$ for bank 'i' products. Finally, we specify the costs of production for bank i as $C[q(ai; a_i; \theta), ni]$.We say that $n_i \in R_+$ measures a bank's efficiency level.

The equilibrium variable profits is defined as follows

$$\pi(ni, N, I, \theta) = p(ni, N, I, \theta)^T q(ni, N, I, \theta) - C[q(ni, N, I, \theta), ni] \qquad (3.2)$$

Thereby the efficiency index N needs to be one dimensional to ensure transitivity. Given that the production costs are captured by $C(q,n)$ with as output quantity, the relationship between efficiency and cost is assumed to be:

$$\frac{\partial C(q,n)}{\partial ql} > 0$$

$$\frac{\partial C(q,n)}{\partial n} \leq 0$$

$$\frac{\partial(\frac{\partial C(q,n)}{\partial ql})}{\partial n} \leq 0$$

for
$l \in \{1,2,…,L\}$ (3.3)

The proposition of the first two quotients on the left-hand side is clear-cut. The first states that banks have positive marginal costs. The second quotients defines that costs are lower the more efficient banks are. Finally, the quotient at the right-hand side states that marginal costs are lower for more efficient banks. Given these assumptions, banks play a two stage game. In the first stage, they decide whether or not to enter. This is determined by the entry costs and the expected profit. Only banks enter that are able to recoup entry costs. In the second stage, the remaining banks simultaneously choose

their actions to maximize profits. This gives a sub game equilibrium for each competitive state.

Boone uses two parameters to model changes in competition. One is the conduct parameter θ, which mirrors the aggressiveness of banks. The second is the change in entry costs ε. Then, the output reallocation effect works in the following way:

$$\frac{dlnq(n)}{d\theta}$$

and

$$\frac{dlnq(n)}{d(\varepsilon)}$$

are increasing in n. (3.4)

Given these conditions, while an increase in competition can decrease the output of banks, this decrease will be smaller for more efficient banks. As a result the market share for the more efficient banks increases while that for the less efficient banks shrinks. Hence, competition rewards efficient banks. Given these setting, the RPD is calculated as a quotient of profit level differences.

$$RPD(n,N,I,\theta) = \frac{\pi(n'',N,I,\theta) - \pi(n,N,I,\theta)}{\pi(n',N,I,\theta) - \pi(n,N,I,\theta)}$$

Increasing competition raises this measure for any three banks with $n'' > n' > n$. As Boone (2008) proves, his measure of competition is robust to distortions out of the reallocation effect.

However, if there are more than three banks, comparing RPDs over time for each company is impractical. One convenient way, proposed by Boone (2008), is to plot the RPDs. Using a bank's normalized efficiency for the x-coordinates gives a function that is always bounded at one on both axes. The increase in competition leads to lower bank specific RPDs. To measure the change in competition one now calculates and compares the area under both curves. Since we have normalized values the area is bounded between zero and one, with zero implying perfect competition and one the complete absence of competition. The area in our example shrinks and thus correctly indicates fiercer competition.

The bank-level measure is constructed as follows:

$$RPD_{it} = \frac{\pi_t(i) - \pi_t(i_L)}{\pi_t(i_U) - \pi_t(i_L)}$$ (3.5)

Where π_t is profit at time t, i is the bank whose RPD is measured and [iL, iU] is the set of banks belonging to a given industry and ranked by cost-efficiency, from the less efficient iL to the more efficient iU. The inverse of normalized efficiency is

$$RCE_{it} = \frac{C_t(i_U) - C_t(i_L)}{C_t(i) - C_t(i_L)} \qquad (3.6)$$

One advantage of the RPD measure is that one does not need to observe all banks in an industry to calculate it properly, since the result holds for any subset of banks sampled, increasing competition would in any case pull down the whole curve. Another interesting feature of the RPD measure is that it is also strongly correlated with the within effect of the PCM decomposition previously analyzed (Boone et al., 2007). The latter allows to further assess the robustness of the within effect as a selection indicator.

4. Data and Methodology

We use annual bank balance sheet and income statement data for the 1996–2011 period retrieved from the 'Statistical Table Relating to Banks in India' published by RBI and Prowess Database of CMIE. Our data set covers all the major banks in public sector, private sector and foreign sector.

4.1 Relative Profit Difference (RPD) – a non- parametric measure of competition

Using bank level panel data set we test the empirical validity of the Augmented RPD measure for competition in Indian loan market. Our analysis reveals that the non-parametric RPD approach fails to correctly indicate competition. A proposed augmented Boone measure based on RPDs performs better. The non-parametric Relative Profit Difference (RPD) is defined as follows:

$$RPD_{it} = \frac{\pi_t(i) - \pi_t(i_L)}{\pi_t(i_U) - \pi_t(i_L)}$$

Where π_t is profit at time t, 'i' is the bank whose RPD is measured and [i_L, i_U] is the set of banks belonging to a given industry and ranked by cost-efficiency, from the less efficient i_L to the more efficient i_U. One convenient way, proposed by Boone (2008), is to plot the RPDs using a bank's normalized efficiency and normalized profits on the xy-coordinates. The increase in competition leads to lower bank specific RPDs. To measure the change in competition one now calculates and compares the area under curves. Since we have normalized values the area is bounded between zero and one, with zero implying perfect competition and one the complete absence of competition. In this case, the more competitive a sector, the more the curved line would be pulled to the bottom right. From the graph, the levels of competition within a sector can be computed as the area below the RPD curve. The smaller the area below the curve, the higher it is the level of competition within a sector.
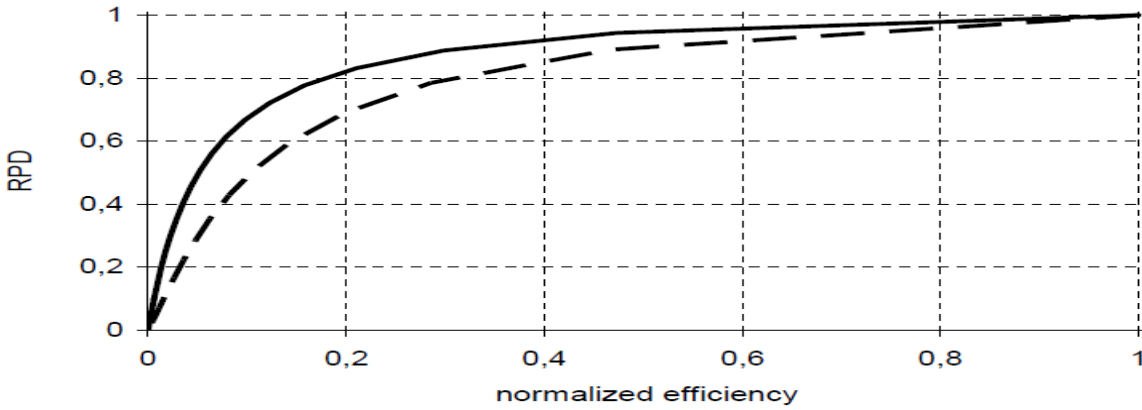
Figure 4.1.Efficiency and RPD

From the above Figure, it is obvious that as the slope of the curve decreases the area under the curve will decrease and hence the competition will increase accordingly. Using the same intuition an alternative parametric approach of Augmented RPD is proposed below.

4.2 Augmented RPD – a parametric measure of competition

Theoretically, the loan market competition increases in two ways. First, competition increases when the produced services of various banks become closer substitutes and when entry cost decline. Boone et al (2004) prove that market shares of more efficient banks, i.e., with lower marginal costs, increase both under stronger substitution and amid lower entry costs. So the following relationship between market share and marginal cost can be setup (Leuvensteijn, 2007).

$$\ln(s_i) = \alpha + \beta \ln(mc_i) \qquad (4.1)$$

where the loan market share of bank i, (s_i)=$(loan)_i$/total loan, and parameter β is the Boone measure of competition. The parameter β is expected to be negative because of inverse relationship between the market shares of loan of banks and marginal costs. The stronger competition is, the stronger this effect will be, and the larger, in absolute terms since marginal costs are unobservable, we have to calculate marginal costs from *Translog Cost Function (TCF)* with the linear homogeneity in the input prices and cost exhaustion restrictions using individual bank observations. Such a function assumes that the technology of an individual bank can be described by one multiproduct production function. Under proper conditions, a dual cost function can be derived from such a production function, using output levels and factor prices as arguments. A TCF is a second-order Taylor expansion around the mean of a generic dual cost function with all variables appearing as logarithms. It is a flexible functional form that has proven to be an effective tool in explaining multiproduct bank services. The TCF has the following form:

$$\ln(c_{it}) = \alpha_0 + \sum \alpha_{di} + \sum t\delta_t d_t + \sum\sum \beta_j \ln(x_{ijt}) d_i + \sum\sum\sum \gamma_{jk} \ln(x_{ijt}) \ln(x_{ikt}) d_i + v_{it} \qquad (4.2)$$

where the dependent variable c_{it} reflects the production costs of bank i(i= 1, .., N) in year t (t =1, .., T) in d_i dummy for type category of the bank, that is, public sector banks, private sector banks or foreign sector bank. The variable dt is a dummy variable, which is 1 in year t and other wise zero. The coefficient γ_{jk} indicates general substitution parameters between inputs and outputs. The explanatory variables x_{ikt} represent three groups of variables (k = 1,...,K.). The first group consists of ($K1$) bank output components, such as loans, securities and other services (proxied by other income). The second group consists of ($K2$) input prices, such as wage rates, deposit rates (as price of funding) and the price of other expenses (proxied as the ratio of other expenses to fixed assets). The third group consists of (K-$K1$-$K2$) control variables (also called 'netputs'), $e.g.$ the capital equity ratio. In line with Berger and Mester (1997), the equity ratio corrects for differences in loan portfolio risk across banks. The coefficients a, β_j, all vary with the bank type. The parameters δ_t are the coefficients of the time dummies and v_{it} is the error term.

The marginal costs of output category j = l (of loans) for bank 'i' of category h (say) in year t, mc_{ilt} are defined as:

$$mc_{ilt} = \frac{\partial c_{it}}{\partial x_{ilt}} = (c_{it}/x_{ilt})\frac{\partial \ln(c_{it})}{\partial \ln(x_{ilt})} \qquad (4.3)$$

The term $\partial\ln(c_{it})/\partial\ln(x_{ilt})$ is the first derivative of above equation of costs to loans. This leads to the following equation of the marginal costs for output category loans (l) for bank 'i' in category h during year t,

$$mc_{ilt} = (c_{it}/x_{ilt})(\beta_l + 2\gamma_l \ln(x_{ilt}) + \sum \gamma_{lk} \ln(x_{ikt}) d_i \qquad (4.4)$$

Given the estimated marginal costs from the previous section, we are now able to estimate the Boone measure. To do so, we use for each bank category the marginal costs of individual banks and their market shares and estimate the following equation

$$\ln(s_{it}) = \alpha + \sum \beta_t \ln(mc_{it}) + \sum \gamma_t d_t + u_{it} \qquad (4.5)$$

where 's' stands for market share, mc for marginal costs, i refers to bank i, and t to year t; d_t are time dummies, and u_{it} is the error term. This provides us with the coefficient β, the Boone indicator (BI). Under this static model, it is assumed that markets are always in their long-run equilibrium at each time period for which the data are observed, yielding statistics that are biased towards zero.

5. Empirical Evidence for India

Reforms were intended to usher in greater efficiency in the Indian banking system. Has this purpose been achieved? There are two ways in which this question can be looked at. One is to look at accounting measures of efficiency. Another is to look at economic measures of efficiency. One strand of literature on efficiency in Indian banking attempts to assess whether the segment that was said to be badly wanting in efficiency at the commencement of reforms, PSBs, has improved its performance; if this has happened, it augurs well for efficiency in the system as a whole.

5.1 Some stylized facts

We begin by looking at trends in accounting measures of efficiency.

    i.   Competition

One measure of competition is the share of top five banks in assets, deposits and profits. It can be seen that on all three indicators, the share of the top five banks has declined, which points to increased competition.

Table 5.1: Share of Top Five Banks - Assets, Deposits and Profits

Year	Assets	Deposits	Profits
1991-92	51.70	49.00	54.50
1998-99	44.70	44.40	49.10
2001-02	43.50	43.30	41.40
2007-08	38.40	37.30	37.20
2010-11	40.79	36.44	36.41

    ii.   Spread

One measure of spread is the ratio of net interest income (NIM) to total assets. One would expect the spread to decline consequent to deregulation. That is what deregulation is all about: it squeezes the margins of producers and leads to increase in volumes. India's banking sector has been relatively impervious to this trend. Table 4 shows the trend in NIM in the period since deregulation. The NIM was surprisingly steady from the start of deregulation until 2006-07. For three years thereafter, there was promise of a decline in NIM. In 2010-11, however, the NIM rose again and was slightly above the level at the start of deregulation. This has, of course, turned out to be a blessing for banks but it goes counter to the rationale for deregulation.

Table 5.2: Net Interest Income (Spread) to Total Assets(Average)					
Year	Public Sector Banks	Old Private Sector Banks	New Private Sector Banks	Foreign Banks in India	Scheduled Commercial Banks
1992-95	2.72	3.24	1.17	3.98	2.84
1999-00	2.70	2.33	1.95	3.92	2.73
2000-01	2.86	2.51	2.14	3.63	2.85
2003-04	2.94	2.60	1.98	3.46	2.86
2004-05	2.92	2.70	2.17	3.33	2.83
2007-08	2.15	2.43	2.40	3.79	2.35
2008-09	2.10	2.60	2.80	3.90	2.40
2009-10	2.29	2.56	3.00	3.96	2.17
2010-11	2.78	2.95	3.16	3.86	2.92

Efficiency, as measured by net profit to total assets, has shown an unambiguous improvement over the years and has touched the important figure of 1% in recent years. (Internationally, a 1% return on assets is considered a benchmark for good performance). It is striking that, in the years following the sub-prime crisis, said to be the worst crisis in the past century, return on assets has remained over 1% in Indian banking. This is a measure of how insulated Indian banking is and it is also a measure of the steady improvement in fundamentals in the sector.

Table 5.3: Net profit/ total assets (%)

Year	Public Sector Bank	Old Private Sector Bank	New Private Sector Bank	Foreign Banks in India	Scheduled Commercial Bank
1996-97	0.57	0.91	1.73	1.19	0.67
1997-98	0.77	0.80	1.55	0.96	0.82
1998-99	0.42	0.48	1.03	0.69	0.47
1999-00	0.57	0.81	0.97	1.17	0.66
2000-01	0.42	0.59	0.81	0.93	0.49
2002-03	0.96	1.17	0.90	1.56	1.01
2004-05	0.87	0.33	1.05	1.29	0.89
2006-07	0.83	0.70	0.91	1.57	0.90
2008-09	0.90	1.00	1.10	1.70	1.00
2009-10	0.97	0.95	1.38	1.26	1.05
2010-11	0.96	1.12	1.51	1.74	1.10

iii.   Operating Costs

The ratio of operating costs to total assets has declined dramatically in the post-reform years, driven largely by the decline in the ration in the PSB group. The most important reason is that the workforce remained constant in PSBs through the initial years in the face of rising volume of work, followed by a reduction caused by voluntary attrition. It is only in three years or so that recruitment has gathered pace in PSBs. Another reason is branch rationalization. The hard work of setting up branches had been accomplished in the nationalization era, so PSBs found that they did not have to invest in branches and could, in fact, afford to close down a few. Thus, efficiency in the system as a whole can be said to have improved, using a set of accounting measures.

Table 5.4: Intermediation costs to total assets ratio (per cent)

Year	Public Sector Bank	Old Private Sector Bank	New Private Sector Bank	Foreign Banks in India	Scheduled Commercial Bank
1996-97	2.88	2.52	1.94	3.00	2.85
1997-98	2.66	2.31	1.76	2.97	2.63
1998-99	2.66	2.26	1.74	3.59	2.67
2004-05	2.09	1.96	2.06	2.88	2.13
2006-07	1.77	1.85	2.11	2.78	1.91
2007-08	1.54	1.66	2.28	2.84	1.78
2008-09	1.50	1.70	2.20	2.80	1.70
2009-10	1.61	1.88	2.16	2.52	1.78
2010-11	1.70	1.94	2.23	2.71	1.86

5.2 Non-parametric RPD Estimation

The non-parametric Relative Profit Difference (RPD) is defined as follows

$$RPD_{it} = \frac{\pi_t\,(i) - \pi_t(i_L)}{\pi_t\,(i_U) - \pi_t(i_L)}$$

Where π_t is profit at time t, 'i' is the bank whose RPD is measured and $[i_L, i_U]$ is the set of banks belonging to a given industry and ranked by cost-efficiency, from the less efficient i_L to the more efficient i_U. One convenient way, proposed by Boone (2008), is to plot the RPDs using a bank's normalized efficiency and normalized profits on the xy co-ordinates as given in the above figure. The increase in competition leads to lower bank specific RPDs. To measure the change in competition one now calculates and compares the area under curves. Since we have normalized values the area is bounded between zero and one, with zero implying perfect competition and one the complete absence of

competition. In this case, the more competitive a sector, the more the curved line would be pulled to the bottom right. From the graph, the levels of competition within a sector can be computed as the area below the RPD curve. The smaller the area below the curve, the higher is the level of competition within a sector. The non-parametric values of RPD were calculated from the dataset and are compared with the two other commonly used measures of competition viz., PCM and H-stat, as given in the Table.5.6.

Table.5.6: Comparative study of different measures of competition

YEAR	RPD (Non-parametric)	H-stat	PCM
1996	0.357	0.666	0.514
1997	0.315	0.734	0.553
1998	0.347	0.646	0.504
1999	0.399	0.627	0.463
2000	0.479	0.633	0.427
2001	0.392	0.615	0.427
2002	0.185	0.440	0.344
2003	0.434	0.466	0.423
2004	0.513	0.646	0.454
2005	0.468	0.656	0.467
2006	0.429	0.458	0.462
2007	0.521	0.616	0.448
2008	0.620	0.584	0.397
2009	0.668	0.492	0.332
2010	0.691	0.503	0.381
2011	0.632	0.514	0.402

The results for the traditional Lerner index (PCM) a general decreasing level of bank competition up to around 2002 and an increasing level of bank competition afterwards. Moreover, the traditional Lerner index indicates a non-consistent trend of increase in the competition level for most of the years. Furthermore, the H-statistics is significantly different from zero and one for all years, rejecting the null hypothesis that India loan markets are in a state of either perfect competition or monopoly. This measure performed better than the PCM but not consistent as compared with the RPD measure.

5.3 Parametric Augmented RPD Estimation

It is evident from the Table 5.6 that the RPD value over the period is highly volatile. This volatility may be assumed to be due to the non-parametric measurement technique by using the normalized efficiency and normalized profitability. But this RPD measure gives a better idea of the state and process of competitiveness in the loan market as compared to the conventional H-statistics and PCM measure. In order to set it right, we have used the Augmented Relative Profit Difference (ARPD) measure suggested by Leuvensteijn (2008). We have estimated the marginal costs using *Translog Cost Function*. We found that the competition measured by using the ARPD in Table 5.2 is statistically significant in a consistent manner for all the group of banks. As it is known from the theory proposed by Boone (2008), higher the coefficient in absolute sense, higher is the competition. In this regard, we conclude that competitiveness in private sector banks and public sector banks has decreased as compared to foreign banks within the group. Over all the competition in the banking sector increased after 2002 except a marginal decrease during 2006-07. All the values of the coefficient lie between 0 and 1 which indicates the monopolistic nature of competitiveness in the loan market in India. The ARPD measure quantifies the impact of marginal costs on performance, measured in terms of market shares. Here the original Boone's RPD is improved by calculating marginal costs instead of approximating marginal costs by average variable costs.

Table 5.7: The Augmented RPD (ARPD) Measure of Competition

ARPD Measure	ALL	PSB	PVT	FRN
1996	-0.315(0.086)**	-0.304(0.084) **	-0.228(0.057) **	-0.338(0.308)
1997	-0.340(0.087)**	-0.329(0.085) **	-0.242(0.058) **	-0.357(0.300)
1998	-0.356(0.085)**	-0.345(0.086) **	-0.227(0.056) **	-0.672(0.341) *
1999	-0.307(0.086)**	-0.296(0.081) **	-0.189(0.057) **	-0.547(0.359)
2000	-0.384(0.091)**	-0.374(0.091) **	-0.235(0.061) **	-0.414(0.348) **
2001	-0.359(0.088)**	-0.346(0.087) **	-0.223(0.058) **	-0.420(0.395) *
2002	-0.453(0.091)**	-0.442(0.091) **	-0.299(0.059) **	-0.392(0.432) **
2003	-0.404(0.086)**	-0.395(0.086) **	-0.363(0.057) **	-0.470(0.343) **
2004	-0.384(0.080)**	-0.376(0.079) **	-0.357(0.054) **	-0.504(0.261) **
2005	-0.390(0.067)**	-0.432(0.067) **	-0.409(0.046) **	-0.320(0.201) **
2006	-0.341(0.061)**	-0.433(0.060) **	-0.431(0.041) **	-0.499(0.187) **
2007	-0.360(0.051)**	-0.543(0.051) **	-0.423(0.034) **	-0.475(0.174) **
2008	-0.388(0.061)**	-0.513(0.051) **	-0.421(0.042) **	-0.563(0.180) **
2009	-0.452(0.050)**	-0.603(0.051) **	-0.531(0.033) **	-0.644(0.193) **
2010	-0.448(0.059)**	-0.572(0.062) **	-0.543(0.032) **	-0.663(0.178) **
2011	-0.493(0.063)**	-0.656(0.059) **	-0.625(0.034) **	-0.694(0.184) **

It is observed after the banking crises the foreign banks are adversely affected in terms of competition as compared to both the public sector and private banks. The causes of fluctuations in the competition in the foreign banks are their risk taking behavior and global risk exposure. All in all, according to the ARPD measure, competitive conditions in the loan markets have increased over the study period and the structure loan market in India is monopolistic in nature. On and average the competition in loan market has increased. It is evident from the above Table 5.7, the level of increase in competitiveness index within public sector bank and private sector bank is in similar line but the competitiveness index within private sector banks have increased with very rapid pace. The foreign sector banks were comparatively less competitive up to 1999 but increased continuously till 2005. The competitiveness index of the foreign banks decreased during the onset of crisis period, but after the crisis the competition level in the foreign sector banks increased gradually.

6. Key Findings and Conclusions

This study endeavored at measuring bank competition in Indian loan market using a new competitiveness index the Augmented Relative Profit Difference (ARPD), which quantifies the impact of marginal costs on performance, measured in terms of market shares. The original Boone RPD is improved by calculating marginal costs instead of approximating marginal costs by average variable costs. The conventional measures of competition such as the Lerner index and Panzar-Rosse H-statistic did not perform well as compared to those estimated using the Augmented RPD approach. We argue that traditional measures of competition fail to measure competition in the Indian banking sector properly, and we provide arguments – both theoretically and empirically – to support this.

Using balance sheet information for a large sample of banks operating in India during 1996–2011, we show that competition actually increased in the past decade when using the ARPD measure introduced by Boone et al. (2007) and Boone (2008) as a theoretically robust competitiveness index to measure competition in loan market. This study yields two major insights. First, the theoretical foundation of the ARPD is very robust as compared to other conventional measures. This makes the ARPD a much better measure to gauge competition in a single sector of an industry, say Indian loan markets, than conventional approaches. This is a very general insight that can be useful for investigations of competitive conditions in banking markets in a particular sector, viz., loan market. Second, applying this unbiased competition indicator to India loan markets shows that financial reform indeed has contributed to significant improvements in competition. Again, we find contradictory results for the conventional measures.

As regards, the competition among specific types of banks, we found public sector banks and private sector banks are comparatively more competitive than foreign

banks. All in all, according to the Augmented RPD measure, competitive conditions in the loan markets over time increased and the ARPD values lie between zero and one. This finding indicates that the Indian loan markets are monopolistic in nature.

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