INDIAN BANKING INDUSTRY: AN OVERVIEW

Before the onset of the reform process, Indian banking was operating in a relatively regulated and protected environment. The banking system's branch network grew at a fast pace in the beginning of 1990s, but it was felt that the efficiency of the financial system was not to be measured only by quantitative growth in terms of branch expansion and growth in deposits and advances or merely by fulfillment of social obligations of development. "The financial strength and operational efficiency of the Indian banks and financial institutions which were working in a highly protected and regulated environment were not measuring up to international standards" (RBI, 1999). It was realized the Indian banking system was operating far away from the global benchmarks.

The financial sector reforms undertaken in the early 90s of the twentieth century paved way for remarkable changes in the functioning of the Indian banking business. With the entry of private sector banks and liberal branching policy for the foreign banks, the public sector banks have to face more competition. "At the same time, the growing size of financial activity relative to overall economic activity in a closely integrated world has implied that disruptions in financial markets or infrastructure in any economy can cause contagion, which can spread rapidly and have far greater adverse economic ramifications than was the case earlier" (Report on Trends and Progress of Banking in India 2001-02). Thus it is imperative to assess the functioning of the Indian commercial banks in the new dynamic environment.

It has been observed that those banks that are more efficient will perform better in the long term. Though many research studies have been conducted in the West on the efficiency of the banks, few empirical studies have been done in the emerging economies. Research studies have been carried out to evaluate the performance of the Indian banks examining related issues by Tyagarajan (1975), Rangarajan and Mampilly (1972) and Subramanyam (1993) amongst others. But none of these studies
relate to measuring the efficiency of the Indian banks. Late nineties witnessed few studies carried out to evaluate the efficiency of the banks in the Indian context.

Many research studies have studied the impact of deregulation on the efficiency of the banks and financial institutions. In some countries the impact of the deregulation has been favourable: Australia (Sturm and Williams, 2004), Taiwan (Shyu, 1998), Korea (Gilbert and Wilson, 1998), Norway (Berg et al., 1992), Turkey (Zaim, 1995), Portugal (Canhoto and Dermine, 2003), Thailand (Leightner and Lovell, 1998) whereas in others there has been no significant change or unfavourable change, for example, Spain (Grifell-Tatje and Lovell, 1996). Thus, it may be observed that deregulation literature from the rest of the world provides no conclusive findings to suggest Indian policy makers to foresee the impact of deregulation in India. Hence this study will provide some fresh insights with respect to the Indian environment.

**Focus of Current Study**

The reforms focus on the deregulation of policies, prescription of prudential norms on capital adequacy, income recognition, asset classification and provisioning for impaired assets and opening up the entry private sector and the foreign banks in India to increase competition in the Indian banking system. Competitive challenges perform a “magic trick” by maintaining, and even creating, efficiency in a system that otherwise would be running down over time (Sjostrom and Weitzman, 1996). Deregulation of interest rates and deposits and advances has led to an increased competition not only amongst the public sector banks but also from the private and the foreign owned counterparts. The corporate have an access to low cost funds both via the debt and the equity markets. Thus their dependence on the banks for raising capital is low. Thus, the public sector banks are losing their market share not only to the private counterparts but also to non-banking financial sector. The profitability of the banks is also under pressure due to prudential norms on capital adequacy and asset classification and provisioning norms.
Further, there has been always a notion on the differential performance of banks across different ownerships. It is generally felt that the ownership should be affecting the efficiency of the respective bank as the incentives for managers to efficiently allocate resources might differ under different ownership arrangements.

Thus this study will study the impact of deregulation of the Indian banking sector in terms of identifying those banks which are doing well in the competition created by deregulation. It will also be of great importance to study how banks are performing across the different ownership structures in a competitive arena following continuous efforts on the part of the regulators to strengthen the ongoing phase of reforms. “Policy makers are interested in the adoption of operating practices and market equilibria consistent with maximum productive efficiency” (Resti, 1997). It will help the decision makers to evaluate that how are the banks performing in increased competitive pressures following deregulation. A pertinent issue of deregulation is its impact upon the efficiency of the financial system, as a key objective of deregulation is to improve efficiency” (Berger and Humphrey, 1997). Luo (2003) also propounds that overall technical efficiency of the profitability performance can predict the likelihood of bank failure. This will also be helpful in taking decisions on closure of non-performing banks or branches or merging them with more efficient banks. That is, whether the banks which are not performing well should be merged with more efficient banks or whether they should exit. The policy makers can assess how the public sector banks are performing relative to their private sector and foreign counterparts. Knowledge of efficient banks is equally important for consumers as efficient banks tend to have lower service charges, better loan and deposit rates and quality services to offer.

Chapter scheme

Being introductory in nature, Chapter I deals with the introduction, the background of the commercial banks operating in India, their present structure and the current environment in which they are operating. Thereafter, it gives an overview of
objectives of the study, the methodology, data collection methods and the limitations associated with the study.

Chapter II presents the survey of existing literature in the area of evaluation of efficiency of the banks. This chapter has been divided broadly in two sections: i) International context, where the review highlights the international studies; ii) Indian context, in which the studies carried out on the Indian banking system have been reviewed.

The theory and conceptual framework of this study are laid out in Chapter III. This chapter gives explanations on concepts used in this study: Concept of efficiency, Efficiency measurement tools: Non-parametric methods and Parametric methods, and a detailed discussion on the tool used in this study: Data Envelopment Analysis followed by elaboration of types of DEA models.

Chapter IV presents the methodology adopted in this study. It explains the concept of efficiency of the banking sector and states the objectives of the study. It highlights the choice of the DEA model over the parametric methods. Subsequently, it carries elaborate discussions on the constant debate on defining as to what should constitute the inputs and outputs in case of the banking sector. Finally, the chapter concludes with sampling and data collection for this study.

Chapter V and VI discusses the results and analysis for the study carried out while Chapter VII puts forth conclusions arising from the study, recommendations for banks management and policy makers and directions for future research.

SURVEY OF LITERATURE

Many research studies have thrown light on the efficiency of financial institutions with a focus on the U.S. banking system. Berger and Humphrey (1997) have reviewed 130 studies that have been carried out in 21 countries. They have
highlighted various measurement approaches used by researchers and found that Data Envelopment Analysis (DEA) was the most popular approach used.

In the Indian context, few studies have made an effort to measure the efficiency of the banking system over a time period of more than one year. It may be observed that out of 10 studies conducted in the Indian Banking included in this sector only 3 studies have taken study period of more than one year. Only five out of the ten studies have considered different ownership amongst banks. Most of the studies have taken the public sector banks into account. Thus it leaves a wide scope to evaluate efficiency of banks operating in India over a period of time and across different ownership structures.

CONCEPTUAL FRAMEWORK

Efficiency: Concepts and definitions

Various authors have defined the concepts of relative efficiency of firms. Forsund and Hjalmarsson (1974) for example, defined efficiency as, “The concept of efficiency is, in broad sense, used to characterize the utilization of resources, i.e., the efficiency is a statement about the performance of processes transforming a set of inputs into a set of outputs. Efficiency is a relative concept: the performance of an economic unit must be compared with a standard. Establishing a standard involves value judgments about objectives of economic activities”. Afrait (1972) stated, “Economic exactitude is efficiency so an economic error can be expressed as in efficiency”.

Farrell (1951) extended the work of Debreu (1951) and Koopmans (1951) to define a simple measure of firm efficiency which account for multiple outputs. He defined efficiency consisting of two components: technical efficiency and allocative efficiency.
**Technical efficiency** reflects the ability of a firm to obtain maximal output from a given set of inputs.

**Allocative efficiency** reflects the ability of a firm to use the inputs in optimal proportions, given their respective prices and the production technology.

The above two measures when combined provide a measure of total **economic efficiency**.

The technical efficiency scores obtained by the CRS DEA can be decomposed into two components: **scale inefficiency and “pure” technical inefficiency**.

**Measurement of Efficiency: Non parametric and Parametric Approach**

Various approaches have been used to determine the efficiency of the financial institutions. These approaches broadly fall under two types: Non parametric approaches and parametric approaches.

The primary difference amongst these approaches as explained by Berger and Humphrey (1997) is the assumptions imposed on the data in terms of (a) the functional form of the best-practice frontier (a more restrictive parametric functional form versus a less restrictive nonparametric form), (b) whether or not account is taken of random error that may temporarily give some production units high or low outputs, inputs, costs, or profits, and (c) if there is random error, the probability distribution assumed for the inefficiencies (e.g., half-normal, truncated normal) used to disentangle the inefficiencies from the random error.” “Both require the specification of a cost or production function or frontier, but the former (parametric) involves the specification and econometric estimation of a statistical or parametric function/frontier, while the non-parametric approach provides a piecewise linear frontier by enveloping the observed data points” (Drake and Hall, 2003).

This study uses a non parametric approach called as Data envelopment analysis (DEA).
Data Envelopment Analysis : CCR and BCC model

Data envelopment analysis (DEA) is a non-parametric technique. As survey of literature suggests, DEA has gained more and more acceptability as a tool for efficiency analysis of financial institutions. Some recent research studies that have used DEA to measure efficiency of financial institutions are Dekker and Post (2001), Hartman et al. (2001), Kuosmanen and Post (2001), Seiford and Zhu (1999), Saha and Ravisankar (2000), and Athanassopoulos (1997).

The current study emphasises the fact that banks use certain inputs to produce certain outputs. Thus the efficiency of the banks will be measured with respect to how efficiently they are able to utilize their inputs. This study has used the DEA model to evaluate the efficiency of the Indian commercial banks. Hence, it is discussed in detail below.

The Constant returns to scale (CRS) model

This model was first proposed by Charnes, Cooper and Rhodes (CCR) (1978). Hence it is called as CCR model. It assumes constant returns to scale. Subsequently there have been many extensions to this model.

The Variable returns to scale (VRS) model and scale efficiencies.

This is also known as the BCC model named after Banker, Charnes and Cooper (1984). The essential difference between the VRS model and the CRS model is the addition of a new constraint to the linear programming model (1). With this added constraint, the reference set is changed from the cone in the case of the CRS model to the convex hull in the case of the VRS model.
METHODOLOGY

Research objectives

Objective 1. To measure the efficiency of commercial banks across different ownership structures operating in India for the five year period 1997-2001.

Objective 2. To establish a relationship between the efficiency estimates and the level of non performing loans existing in the commercial banks operating in India.

Objective 3. To study the robustness of the efficiency scores obtained by comparing efficiency scores calculated using the DEA model.

The hypotheses formulation is as under:

For Objective 1:

Hypothesis 1

$H_0$: The efficiency of the commercial banks operating in India has not changed over the five year period 1997-2001.

$H_1$: The efficiency of the Commercial Banks operating in India has improved over the five year period 1997-2001.

Hypothesis 2

$H_0$: The Government owned banks are as efficient as their private and foreign counterparts.

$H_1$: The Government owned banks are less sufficient as compared to their private and foreign counterparts.
Hypothesis 3

H₀: The banks have not changed in terms of their competitiveness following liberalization and deregulation.
H₁: The banks have become more competitive following liberalization and deregulation.

For Objective 2:

Hypothesis 4

H₀: There is no relationship existing between efficiency estimates and the level of non-performing assets.
H₁: There is a negative relationship between efficiency estimates and the level of non-performing assets.

For Objective 3:

Hypothesis 5

H₀: The efficiency scores obtained by any model used are robust and are a good indication for policy decisions.
H₁: The efficiency scores obtained by any model are not robust.

Choice of Model: Data Envelopment Analysis (DEA)

In one of his recent speeches, Shri Bimal Jalan insisted on the use of non-parametric methods to carry out meaningful study in the area of banking. "A serious limitation of the applicability of standard economic analysis to banking relates to the inadequacies of the data-base. Absence of long time series data storage in the banking industry often poses serious problems to the quest for the formal analytical relationships between variables. Even if such data exist, the presence of structural breaks may blur meaningful analysis based on traditional formulation. Economists need to think
innovatively to overcome this problem. Use of panel regression, non-parametric
techniques and multivariate analyses could go a long way in understanding and
validating behavioural relationships in banking” (Jalan, 2002). “DEA has proven to
be a valuable tool for strategic, policy, and operational problems, particularly in the
service and non-profit sectors. Its usefulness to benchmarking is adopted to provide
an analytical, quantitative benchmarking tool for measuring relative productive
efficiency. That is, DEA generally focuses on technological, or productive, efficiency
rather than economic efficiency” (Barr et al, 1999). Using DEA, the relative
efficiency scores of various Decision-Making Units (DMUs) in the particular sample
can be calculated. The DMUs could be the banks or branches of banks. The DEA
estimate compares each of the banks or branches in that sample with the one that is
the best practice observation / DMU in the sample. It separates the efficient DMUs in
the sample from the non-efficient ones.

A separate frontier for each of the years during the study period is taken as this is a
critical issue in a dynamic business environment because a bank may be most
efficient in one year and the situation may not be the same the next year. In the Indian
context it becomes all the more important as there is an ongoing restructuring in the
banking sector in the post liberalization era. A separate frontier will highlight the
changes taking place in the macroeconomy and the supervisory policies of RBI.
In this study the technical efficiency is being evaluated.

DEA: Choice of CCR v/s BCC

The CCR model assumes the constant returns to scale and the BCC model
assumes the variable returns to scale.

“The CRS assumption is only appropriate when all DMUs are operating at an optimal
scale” (Casu and Molyneux, 2000). But in practice, imperfect competition and
constraints on finance may not allow the DMU to operate at optimal scale.
Consequently, the use of the CRS will result in measures of technical efficiency (TE)
which are confounded by scale efficiencies (SE) in case the DMUs are not operating at the optimal scale. The BCC (allowing for VRS) model allows the technical efficiency (TE) to be decomposed into pure technical (PTE) and scale efficiency (SE). It helps to determine whether banks have been operating at most productive scale size (MPSS), increasing returns to scale (IRS) or decreasing returns to scale (DRS). The CCR model does not decompose the technical efficiency scores into the pure technical (PTE) and scale efficiency (SE).

In this study, technical efficiency is first evaluated using the CCR model. In the second stage (objective 3), the BCC model is employed to decompose the technical efficiency scores into pure technical (PTE) and scale efficiency (SE) scores so that the study can provide some useful insights regarding not only the overall mechanical efficiency of the banks, but also regarding the pure technical efficiency, that reflects the managerial competence and scale efficiency that reflects the efficiency in terms of scale of operations.

**Selection of inputs and outputs**

This study uses two different models on basis of specification of inputs and outputs: “Revenue focus” and “Business focus”. These are discussed below.

**Model 1: Revenue focus**

A significant impact of financial sector reforms has been the deregulation of the lending rates. The banks are free to decide upon their lending rates. As this component affects the interest income, the main source of revenue for the banks, it should be chosen as one of the outputs. Banks are now also focusing more and more on the non-interest income (fee based income), commissions and brokerage as this provides a hedge to the banks against the fluctuations in the interest rates caused in the macroeconomy. Thus, the model will aim to measure management’s success in controlling costs and generating revenues (see Avkiran, 1999).
The interest expense constitutes the largest proportion of the expenses in banks. With expanding branch networks and requirement of adequate manpower, the operating expenses (rentals and salaries) of the banks are also quite high. Anand (1993) observed that for the year 1991, banks expended approximately 25% of the operating costs on deposit mobilization. Thus, the inputs and outputs are as follows:

**Model 1**

Inputs – Interest expense ($x_1$), Non-interest expense ($x_2$),

Outputs – Interest income ($y_1$), Fee, commission and brokerage ($y_2$).

**Model 2: Business focus**

Banks no longer operate in a closed environment. Earlier banks had scarce liquidity available for lending. Earlier there used to be a stiff competition for the loan applicants for approval of their loan applications. Today in the post liberalized environment the situation has changed. Massive liquidity availability generated through deposits and other sources has forced the banks to ensure that they have enough assets: loans and investments- to match these liabilities. Thus, the second model is basically to see how well they are able to work as a business unit and enough business from the masses.

Banks are investing in fixed assets with advent of technology. ATM networks, sophisticated software and hardware are receiving more focus. “For instance, ATMs have emerged as an alternative banking channel which facilitates low cost transactions vis-a-vis traditional branch banking. The increased use of modern technology by foreign banks and new sector banks has helped them to increase their market share vis-a-vis public sector banks. Modern clearing operations, electronic funds transfer system and centralized funds management are some projects receiving priority of RBI to enhance customer service in the banking sector” (Muniappan, 2003). Also as human capital, though not assets in the real sense are a very important dimension as there has been a constant debate whether the employees
recruited by the banks are adequate or more than adequate. During last 7-8 years a large number of banks have opted for VRS schemes.

Thus, it will be investigated how well are the banks working as business units in conversion of deposits, fixed assets and expenses incurred on employees into advances and investments. This viewpoint is pertinent in today’s context. Thus in the “business focus” model the inputs and outputs chosen are as follows:

<table>
<thead>
<tr>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inputs - Deposits ($x_1$), Fixed assets($x_2$) and Expenses incurred on employees ($x_3$).</td>
</tr>
<tr>
<td>Outputs- Advances ($y_1$) and Investments ($y_2$).</td>
</tr>
</tbody>
</table>

**Sampling, Data Collection, Data Analysis and Data Presentation**

**Sampling**

The time frame chosen is five years 1996-97 onwards to the year 2000-01. In year 1994-95, the liberalization in the lending rates started, for example, the minimum lending rate for loans over Rs. 2 lakhs was freed. In 1996-97, freedom on deposit rates was given to banks, e.g., the banks could fix the deposit rates for terms above one year maturity. Thus, year witnessed freedom both in terms of lending rates and deposit rates. As these are constitute the main expenses and revenues of the banking business, the year can be taken as an important beginning year for this study. Since five year period was felt to be a sufficient time period to indicate a trend, this study has considered all the commercial banks which were operating in India during the period 1997-2001.

As per RBI reports, in the years 2000-01, the number of scheduled commercial banks operating in India were as follows:
Public sector banks: 27
Private sector banks: 31
Foreign banks in India: 42

There are two important aspects of DEA following which it is preferable to study the population of banks. Firstly, it is sample specific. Secondly, it gives the relative efficiency scores and not the absolute efficiency scores. This means that the best performing DMU out of the group will be shown as 100% efficient. The rest of the DMUs will be benchmarked against this one. Another way of expressing this is to say that an efficient unit does not necessarily produce the maximum output feasible for a given level of input (Miller and Noulas, 1996).

Data for few banks could not be included as they either joined late, or were closed down or merged with some other bank during the study period.

**Data Collection**

The data has been collected from secondary sources. The data used in this study is financial information available in the Annual reports of the banks and RBI publications.

**Data Analysis**

The data have been analyzed using a non-parametric model called as Data envelopment analysis (DEA) which has been discussed in detail in Chapter 3. The software used to carry out the calculations is DEAP.

**Data Presentation**

The results obtained from the data analysis have been presented in chapter 5 and 6. Tabular charts and graphs are used to present the data findings.
RESULTS AND ANALYSIS I & II

For these four hypotheses, the inputs and outputs are chosen as per the “revenue focus model” and the data is analyzed using the DEA CRS model. The results of the first four hypotheses are thus presented in chapter V. The results of the fifth hypothesis are discussed in the sixth chapter. For each hypothesis, analysis is done for the temporal trend followed by an ownership wise comparison.

The key results and analysis of the five hypotheses are as follows:

1. The banks show overall an increasing efficiency over the study period. Thus, the impact of deregulation has been observed to be positive in the Indian context. The efficiency has shown a clearly increasing trend for the first three years though it has shown a slight decline with respect to the best performing year (1999).

   The public sector banks and private sector banks have shown an increasing trend over the study period. The foreign banks do not clearly indicate a decreasing or an increasing trend over the study period.

2. The efficiency scores clearly indicate that in each of the years during the study period, foreign banks have outperformed both private sector and public sector banks. Private sector banks get a second position and public sector rank the last in all the five years.

As may be observed, 70% of the banks amongst the top ten performers are the foreign banks. There are seven foreign banks and three private banks. There are no public sector banks amongst the ten top performers during the period 1997-2001. Out of the worst ten performers, 80% banks are the public sector banks. 20% banks are the private sector banks. No foreign bank is present in this category.
Interestingly, the best performer amongst the public sector banks, the Corporation Bank figures at 43rd position out of the total 94 banks taken for study. This surely reflects the weak state of the public sector banks.

3. The dispersion between the scores for the banks has decreased over the study period with an exception in the last year of the study period when it has increased. Thus, the standard deviation decreases over time for the period 1997-2000 but has increased in the year 2001.

The variability of the efficiency scores for PSBs is increasing over the study period thus indicating that the response of the public sector banks to the reforms has been varied. Some of them seem to have withstood all these pressures. The reforms are thus leading to winners and losers amongst the public sector banks. The private sector also shows an increasing trend, though the rate of growth is not very high. No conclusive pattern emerges for foreign banks. The dispersion amongst the public sector banks is very less as compared to foreign and private sector banks which is probably reflection of a single ownership of government having more or less same practices and policies of all the banks in the public sector. But interestingly it is rising over the five-year period reflecting the improved practices of some of the public sector banks.

4. A negative relationship is observed between the efficiency scores and the level of gross NPAs for the data taken for period 1997-2001. It is interesting to note that correlation coefficient between the overall technical efficiency & NPAs is negative, thus indicating an inverse relationship between the two.

5. Choice of different sets of inputs and outputs: Revenue focus v/s Business focus and CRS v/s VRS.
It is seen that different models used have given different results. Both the ‘Revenue focus’ and ‘Business focus’ models have given different results. The results of comparison with two different specifications of inputs and outputs in this study, clearly highlights that selection of inputs and outputs is a matter of great importance as the efficiency scores may vary as the inputs and outputs change. Also the results obtained using CRS and VRS approaches are different.

CONCLUSIONS, RECOMMENDATIONS AND DIRECTIONS FOR FUTURE RESEARCH

Conclusions

Impact of liberalization on the efficiency of the Indian banking sector

The results show that the impact of liberalization has been positive on the efficiency of the Indian banks. Thus, the efforts to bring in reforms initiated in the year 1992 have appeared to be doing well to the Indian banking sector. Deregulation as mentioned earlier is specifically undertaken to improve the performance of the industry being deregulated. As it is found out that the efficiency has generally improved following deregulation, the improvement in the resource allocation will benefit the masses and it subsequently lead to price reductions and expansion for consumers if competition is sufficient. Hence the reforms in the banking sector should be further strengthened.

Ownership wise analysis

Public and private sector have both improved their efficiencies over the study period. Foreign banks do not clearly indicate an increasing or a decreasing trend over the study period. Thus, public and private banks are becoming more efficient in utilizing the inputs, interest expenses and non interest expenses to produce outputs, interest income and no interest income.
Efficiency across ownership

Foreign banks have emerged as the most efficient banks as compared to the private sector banks and public sector banks as far as utilization of interest expenses and non-interest expenses to generate interest income and non-interest income is concerned.

As public sector banks still dominate the Indian market share, some more insights are provided for the public sector banks. The top five performers amongst the public sector banks are the Corporation Bank, The Oriental Bank of Commerce, The State Bank of Hyderabad, State Bank of Patiala and Bank of Baroda. These findings are comparable with the results brought out by Working Group on Restructuring of Weak Public Sector Banks headed by Shri M.S. Verma in the year 1999.

The worst performer amongst the public sector banks is the Indian bank, followed by UCO Bank. Then in their order of ranking are Syndicate Bank, Central Bank of India and the United Bank of India. The three worst performers- Indian bank, UCO Bank and United Bank of India –were also declared as weak banks by the Working group.

Competition amongst the banks across different ownership and amongst the ownership group

Indian banks as a group

The dispersion has decreased over the first four years of the study period with an increase only in the last year. Thus, the competition in general is increasing amongst the Indian banks. It may be concluded that in general, the impact of liberalization has been successfully given rise to increased competition in the Indian banking sector.
Indian banks across different ownership

Public sector banks, in general, display an increase in dispersion of efficiency scores over the five year study period. The gap in performance of the public sector banks is increasing. Thus implying that reforms are creating winners and losers amongst the public sector banks. With overall performance for PSBs increasing over the five year period, the increased dispersion may be indicator of improved practices of certain public sector banks.

The private sector banks also display an increase, though it is infinitesimal. On the other hand the dispersion for the foreign banks is decreasing over the first four years with an increase only in the last year, 2000-01.

The dispersion amongst the public sector banks is very less as compared to foreign and private sector banks.

Efficiency and Non-performing assets

Indian banks as a group

The relationship between the efficiency and the non-performing assets has been found to be negative. The correlation is measured at -0.2861 between efficiency scores for the five-year period and the respective level of gross NPAs.

Indian banks across different ownership

The public sector banks show a significant negative relationship between efficiency measures and the levels of NPAs. The correlation coefficient is -0.52358 for efficiency and gross NPAs. The private sector banks too indicate a significant negative relation with correlation coefficient at -0.46968 for efficiency and gross NPAs. The foreign banks also show a negative relationship, though the correlation
coefficient for foreign banks is substantially lower than the public sector banks and the private sector banks. The correlation coefficient is 0.20099 for gross NPAs.

**Efficiency scores across different models**

*Efficiency scores are sensitive to the choice of selection of inputs and outputs.*

The banks display different efficiency scores under the different models.

**Efficiency scores**

In both the cases of “revenue focus” and “business focus” the efficiency scores using CRS and VRS approaches are different as may be observed in table 1 given below. These issues are discussed in detail in chapter 7.

**Table 1: Summarized results for average efficiency (OTE, PTE and SE):**

**Revenue focus v/s Business focus**

<table>
<thead>
<tr>
<th>Measure of efficiency *</th>
<th>All Banks</th>
<th>Public Sector Banks</th>
<th>Private Sector Banks</th>
<th>Foreign Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td>OTE (CRS)</td>
<td>0.4978</td>
<td>0.3084</td>
<td>0.4896</td>
<td>0.6452</td>
</tr>
<tr>
<td>PTE (VRS)</td>
<td>0.7926</td>
<td>0.8752</td>
<td>0.7084</td>
<td>0.7994</td>
</tr>
<tr>
<td>SE</td>
<td>0.6334</td>
<td>0.3542</td>
<td>0.674</td>
<td>0.805</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>All Banks</th>
<th>Public Sector Banks</th>
<th>Private Sector Banks</th>
<th>Foreign Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td>OTE (CRS)</td>
<td>0.6028</td>
<td>0.5568</td>
<td>0.5544</td>
<td>0.6798</td>
</tr>
<tr>
<td>PTE (VRS)</td>
<td>0.8198</td>
<td>0.9326</td>
<td>0.684</td>
<td>0.8526</td>
</tr>
<tr>
<td>SE</td>
<td>0.7428</td>
<td>0.6026</td>
<td>0.8014</td>
<td>0.804</td>
</tr>
</tbody>
</table>

*Average for 5 years (1997-2001)*
Dispersion amongst banks (Table 2)

Table 2: Standard Deviation of efficiency over 1997–2001

<table>
<thead>
<tr>
<th>Measure of dispersion</th>
<th>Standard deviation (S.D.)</th>
<th>All Banks</th>
<th>Public Sector Banks</th>
<th>Private Sector Banks</th>
<th>Foreign Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.D. of OTE</td>
<td>0.5149</td>
<td>0.1403</td>
<td>0.5218</td>
<td>0.5408</td>
<td></td>
</tr>
<tr>
<td>S.D. of PTE</td>
<td>0.3705</td>
<td>0.2063</td>
<td>0.3685</td>
<td>0.4651</td>
<td></td>
</tr>
<tr>
<td>S.D. of SE</td>
<td>0.5407</td>
<td>0.1335</td>
<td>0.4406</td>
<td>0.4321</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measure of dispersion</th>
<th>Standard deviation (S.D.)</th>
<th>All Banks</th>
<th>Public Sector Banks</th>
<th>Private Sector Banks</th>
<th>Foreign Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.D. of OTE</td>
<td>0.5189</td>
<td>0.3713</td>
<td>0.5066</td>
<td>0.5631</td>
<td></td>
</tr>
<tr>
<td>S.D. of PTE</td>
<td>0.4459</td>
<td>0.1902</td>
<td>0.4659</td>
<td>0.4167</td>
<td></td>
</tr>
<tr>
<td>S.D. of SE</td>
<td>0.4794</td>
<td>0.3531</td>
<td>0.3437</td>
<td>0.5285</td>
<td></td>
</tr>
</tbody>
</table>

Recommendations

In view of above conclusions, following are the recommendations that may be adopted by the banks’ management and the policy makers.

- As deregulation has resulted in an improvement in the efficiency of the banking sector, it is thus suggested that more reforms should be given impetus in this area. If efficiency improves, the improvement in resource allocation
will benefit society and should lead to price reductions following reduction in wastages and / or service expansion for consumers if competition is adequate. As it follows from the hypothesis 1 that the impact of liberalization has been favourable, freedom to banks in deciding the deposit and lending rates should be continued.

The average efficiency levels are still low (e.g. 50%), thus implying that inputs are being wasted to the tune of 50%. Measures should be adopted by the banks to reduce wastages.

- Thus, great reduction in expenses is desired, especially for the public sector (Hypothesis 2), where efficiency is measured at 30%. The banks may have to right size the number of staff in banks. In continuation to the trend that began few years banks, more VRS schemes are envisaged. Cheaper rental options for the branch offices should be explored. The operational costs can be reduced by upgrading banking technology.

- Hypothesis 3 suggests that the dispersion in efficiency scores of the public sector banks is generally increasing over the study period, thus implying that the liberalization is creating winners and losers in the public sector. The regulators to observe and review the performance of banks for whom the performance is deteriorating and suitable corrective measures be taken. This is specially relevant in today’s context when the Indian financial sector is aiming for a global presence. The aspirations of Indian banks can be met only if they are able to face the full force of global competition on their home ground. Thus, it also calls for a greater attention to the regulation. It might be necessary to close the loss making banks before they are declared insolvent. The PSBs should be able to have a self sustained existence on their own and government should not protect the weak banks any more as they have been doing for a long time.
Using the variable returns to scale (VRS) approach in hypotheses 5, it has been observed that the main reasons for the overall technical inefficiencies of the public sector banks are the scale inefficiencies.

Thus, reasons behind scale inefficiencies should be investigated: Loss making branches may be closed down or merged with more efficient ones.

Hypothesis 4 has established a negative relationship between the NPAs and efficiency. This implies that if the levels of NPAs are reduced, the efficiency of the banks will increase. The banks need to improve their credit quality. The credit managers need to be equipped with better skills. Loan appraisal and monitoring of loans should be strengthened. These issues can be handled by the banks’ management themselves. They should adopt systems from the global banks, in which quality of credit appraisals is far superior; supervision is strict and administrative penalties for mistakes.

The recommendation to the policy makers is that the legislative support initiatives such as Securitization and Reconstruction of Financial assets and Enforcement of Security Interest Act, 2002 and Corporate Debt restructuring (CDR) mechanism should be strengthened.

A variety of input/output combinations may be used. The inputs and outputs should be chosen with a specific objective / policy formulation in mind. (Hypothesis 5) There is no “the best model” to measure efficiency. Banks’ efficiency is a multi perspective concept and thus should be evaluated in a plethora of ways before taking any decision on the policy formulation or operational issues as to how a bank works. Before efficiency is evaluated, the benchmark or yardstick should be specified for a particular dimension. For example, in this study two different models were constructed: one with a revenue focus and the other one with a business focus. It could be chosen with utmost care what inputs and outputs should go into the calculation of
efficiency, as different models and specifications can produce different efficiency results for a given institution.

Directions for future research

Considerable research has been on efficiency but that are certain areas of further research in this area. “Differences in efficiency estimate are not only blamed on input and output definitions, but also depend on variation in data sources, efficiency concepts and measurement methods used. (Mlima and Hjalmarsson, 2002)”

- Comparison using non-parametric and parametric techniques
- Inclusion of different variables as inputs and outputs
- Relating efficiency with issues of today’s relevance- size, profitability, market power, the loan ratio, and bank’s capitalization.