

Efficiency of Banks in a Developing Economy: The Case of India

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Abstract

The objective of this paper is to measure the productive efficiency of banks in a developing country, that is, India. The measurement of efficiency is done using Data Envelopment Analysis (DEA). Two models have been constructed to show how efficiency scores vary with change in inputs and outputs. The efficiency scores, for three groups of banks, that is, publicly owned, privately owned and foreign owned, are measured. The study shows that the mean efficiency score of Indian banks compares well with the world mean efficiency score and the efficiency of private sector commercial banks as a group is, paradoxically lower than that of public sector banks and foreign banks in India. The study recommends that the existing policy of reducing non-performing assets and rationalization of staff and branches may be continued to obtain efficiency gains and make the Indian banks internationally competitive which is a declared objective of the Government of India.

JEL classification: D61; G21; G34

Keywords: Bank efficiency; DEA analysis, Indian banks

Introduction

The objective of this study is to measure and to explain the measured variation in the performance and therefore the productive efficiency of Indian commercial banks. While many similar studies have evaluated the performance of banking sector in the US and other developed countries, very few studies have evaluated the performance of banking sectors in developing economies. Earlier though, Tyagarajan (1975), Rangarajan and Mampilly (1972) and Subramanyam (1993) have examined various issues relating to the performance of Indian banks, none of these studies have examined the efficiency of bank service provision in India. Some recent studies did measure the efficiency in service provision of Indian banks but they suffer from certain limitations as indicated in this paper.

The main impetus for this study was the appointment of the (second) Narsimham Committee (1997) by the Government of India, with a mandate to suggest a programme of banking sector reforms so as to 'strengthen India's banking system and make it internationally competitive'. This obviously requires that the relative efficiency of Indian banks is measured and compared with banking efficiency in other countries. Secondly, a scheme of voluntary redundancies for bank employees is under consideration by the Indian Banks' Association. In this context, the efficiency issues of banks in India have again come to the fore. Thirdly, Indian banking is particularly interesting because of the diversity of bank ownership forms. Indian banks can be classified into three ownership groups; publicly owned, privately owned and foreign owned. It is expected that there will be performance variation across groups of banks.

This study will quantify and explain the performance variation. Lastly, there is little reliable empirical research on bank efficiency in India although Bhattacharya et al. (1997), Chatterjee (1997) and Saha et al. (2000) have examined various issues relating to the performance of Indian banks. This study measures relative efficiency of Indian banks subsequent to the period used by the above studies. Additionally, it compares the efficiency of Indian banks with that of the banks in other countries.

The paper has been organized as follows. A brief review of the current state of the Indian banking sector is provided in section 2. In section 3 data and methodology are discussed. Section 4 presents the results and section 5 concludes.

2. An overview of the Indian banking sector

It is important to take stock of the special features of the banking sector in India, in order to put the efficiency issues in perspective. India is the largest country in South Asia with a huge financial system characterized by many and varied financial institutions and instruments. Indian banking sector was well developed even prior to its political independence in 1947. 'There was significant presence of both foreign and domestic banks and well developed stock market' (Bery, 1996, p. 245). The system expanded rapidly after nationalization of major commercial banks in late 1969 and 'now ranks in the top quarter among developing countries' (Khanna, 1995, p. 265).

Table 1 below presents important banking indicators of commercial banks in India as at the end of June 1998.

Table 1: Banking data commercial banks in India as of June 1998

	Number	Branches	Deposits (Rs. Billion)	Advances (Rs. Billion)
Public Sector Banks	27	45,293	5,317	2,599
Private Sector Banks	34	4,664	695	354
Foreign Banks	42	182	429	292

Source: Indian Bank's Association

Besides the above, as at the end of June 1998, there were 196 Regional Rural Banks with 14,517 branches, 28 State Cooperative banks with 651 branches, 351 District Central Cooperative Banks with 10,775 branches, 88,341 Primary Agricultural Cooperative Credit Societies, 20 State Agricultural and Rural Development Banks with 1,488 branches, and 706 Primary Land Development Banks with 646 branches (Sathye, 1997). There also are several Urban Cooperative Banks and 22,000 non-bank financial institutions (Khanna, 1995, p. 294).

At the top of the banking system is the Reserve Bank of India, which is responsible for prudential supervision of banks, non-banks and for performing other central banking functions. There were two successive nationalization's of banks in India, one in 1969 and the other in 1980 and as a result public sector banks occupy a predominant role in Indian financial system. Despite a phenomenal expansion of number of branches, the population served per branch stood at 13,000 (RTPB, 1996,

p. 126). This is due to the fact that population of the country has been growing unabated (crossed 1 billion mark recently) and branch network cannot keep pace with it due to the costs involved. In the year 1997-98, the aggregate deposits of the public sector banks were of the order of Rs. 5,317 billion (51 per cent of GDP), that of private sector commercial banks were Rs. 695 billion (7 per cent of GDP) and foreign banks were Rs. 429 billion (4 per cent of GDP). The advances were Rs. 2599 billion (25 per cent of GDP), Rs. 354 billion (3 per cent of GDP), and Rs. 292 billion (3 per cent of GDP) respectively. The public sector banks control over 80 per cent of banking business. The banking system has developed well over the years in terms of its geographical coverage, deposit mobilization and credit expansion. With regard to technology, it is underdeveloped. Foreign banks have started a few ATMs in metropolitan centers in recent years.

Indian banking was subjected to tighter governmental control over the ownership from the late 1960s known as social control over banks: the government nationalized the banks later. The banks were subjected to directed credit, prescribed interest rates and substantial pre-emption of deposits. The banking services that were mostly confined to metropolitan areas were expanded to the rural areas. Thus, while at the end of 1964 only 10 per cent of the commercial banks were located in rural areas, the proportion increased to 45 per cent thirty years later. The share of advances to activities in the priority sector¹ increased substantially after nationalization. The overall priority sector credit target is presently 40 per cent of net bank credit for both public sector and private sector banks. For foreign banks, the target is 32 per cent. The

¹ Priority sector refers to the lending for agriculture and other rural sector of the economy, poverty alleviation programmes, exports, small-scale industries and such other purposes.

share of priority sector advances in total credit of commercial banks increased from 14 per cent in 1969 to 30 per cent in 1980 and to 39 per cent in 1985 (Thakur, 1990).

Since the early 1990s, the Government of India has implemented many banking sector reforms. These include lowering of the cash reserve ratio from 15 per cent (1993-94) to present 8.5 percent (July 2000), lowering of the statutory liquidity ratio from 38.5 per cent (1992-93) to 28.2 per cent (1995-96), a gradual deregulation of interest rates on deposits and lending, introduction of prudential norms in line with the international standards and the like. A system of flexible exchange rates on current account has been adopted. The Committee on the Financial System, appointed by the Government of India in 1991, identified directed investment and credit programs as the two main sources of declining efficiency, productivity and profitability among commercial banks. Consequently, the percentage of priority sector advances has declined to 37 per cent (1998) and percentage of rural branches network has come down to 42 per cent. These and similar other policy initiatives indicate the desire to make Indian banking more competitive by establishing a level playing field among the three groups of banks. As more than eight years have now elapsed since the initiation of the banking sector reforms, it is appropriate to take stock of the production efficiency of banks in India.

3. Methodology

It is usual to measure the performance of banks using financial ratios. Yeh (1996) notes that the major demerit of this approach is its reliance on benchmark ratios. These benchmarks could be arbitrary and may mislead an analyst. Further, Sherman

and Gold (1985) note that financial ratios don't capture the long-term performance, and aggregate many aspects of performance such as operations, marketing and financing. In recent years, there is a trend towards measuring bank performance using one of the frontier analysis methods. In frontier analysis, the institutions that perform better relative to a particular standard are separated from those that perform poorly. Such separation is done either by applying a non-parametric or parametric frontier analysis to firms within the financial services industry. The parametric approach includes stochastic frontier analysis, the free disposal hull, thick frontier and the Distribution Free Approaches (DFA), while the non-parametric approach is Data Envelopment Analysis (DEA) (Molyneux et al. 1996). In this paper, the DEA approach has been used. This approach has been used since "recent research has suggested that the kind of mathematical programming procedure used by DEA for efficient frontier estimation is comparatively robust" (Seiford and Thrall, 1990). Furthermore, after Charnes, Cooper and Rhodes (1978) who coined the term DEA, a 'large number of papers have extended and applied the DEA methodology' (Coelli, 1996).

The present study uses the latest available published data for the year 1997-98 compiled by the Indian Banks' Association (IBA, 1999). As per this database, in the year 1997-98, there were 27 public sector commercial banks, 34 private sector commercial banks and 42 foreign banks. Of these 103 banks, the data on some of the inputs and outputs of nine banks (1 private sector and 8 foreign) were not available. Hence these banks were excluded from the sample. The final sample thus had 27 public sector commercial banks, 33 private sector commercial banks and 34 foreign banks. Thus, the total observations consisted of 94 banks.

The first step in the analysis is the measurement of bank performance. Following Bhattacharya et al. (1997), performance has been associated with technical efficiency (hereafter referred to as 'efficiency'). It is the ability to transform multiple resources into multiple financial services. The efficiency has been calculated using variable returns to scale (VRS) input oriented model of the DEA methodology. To measure efficiency as directly as possible, that is, management's success in controlling costs and generating revenues (that is, x-efficiencies), two input and two output variables, namely, interest expenses, non-interest expenses (inputs) and net interest income and non-interest income (outputs) have been used (hereafter referred to as Model A). A second DEA analysis was run with deposits and staff numbers as inputs and net loans and non-interest income as outputs (hereafter referred to as Model B). In the Model B, where a less direct approach is taken to measure efficiency, deposits replace interest expense, staff numbers replace non-interest expenses and net loans become proxy for net interest income. The two models have been used to show how efficiency scores differ when inputs and outputs are changed.

The choice of inputs and outputs in DEA is a matter of long standing debate among researchers. Two approaches exist. One is called the production approach while the other an intermediation approach. The production approach uses number of accounts of deposits or loans as inputs and outputs respectively. This approach assumes that banks produce loans and other financial services. The intermediation approach on the other hand considers banks as financial intermediaries and uses volume of deposits, loans and other variables as inputs and outputs. Most of the DEA studies follow an intermediation approach. Within the intermediation approach, the exact set of inputs and outputs used depends largely on data availability. As already stated DEA is

sensitive to the choice of input-output variables. This is strength of the technique, since it reveals which of the input-output variables need to be closely monitored by bank management to improve efficiency. Avkiran (1999) has attempted a similar two-model analysis for Australian banks.

Data Envelopment Analysis

DEA is a linear programming technique initially developed by Charnes, Cooper and Rhodes (1978) to evaluate the efficiency of public sector non-profit organisations. Sherman and Gold (1985) were the first to apply DEA to banking. DEA calculates the relative efficiency scores of various Decision-Making Units (DMUs) in the particular sample. The DMUs could be banks or branches of banks. The DEA measure compares each of the banks/branches in that sample with the best practice in the sample. It tells the user which of the DMUs in the sample are efficient and which are not. The ability of the DEA to identify possible peers or role models as well as simple efficiency scores gives it an edge over other methods. As an efficient frontier technique, DEA identifies the inefficiency in a particular DMU by comparing it to similar DMUs regarded as efficient, rather than trying to associate a DMU's performance with statistical averages that may not be applicable to that DMU.

DEA modelling allows the analyst to select inputs and outputs in accordance with a managerial focus. This is an advantage of DEA since it opens the door to what-if analysis. Furthermore, the technique works with variables of different units without the need for standardisation (e.g. dollars, number of transactions, or number of staff). Fried and Lovell (1994) have given a list of questions that DEA can help to answer.

However, DEA has some limitations. When the integrity of data has been violated, DEA results cannot be interpreted with confidence. Another caveat of DEA is that those DMUs indicated as efficient are only efficient in relation to others in the sample. It may be possible for a unit *outside* the sample to achieve a higher efficiency than the best practice DMU *in* the sample. Knowing which efficient banks are most comparable to the inefficient bank enables the analyst to develop an understanding of the nature of inefficiencies and re-allocate scarce resources to improve productivity. This feature of DEA is clearly a useful decision-making tool in benchmarking. As a matter of sound managerial practice, profitability measures should be compared with DEA results and significant disagreements investigated. The DEA technique has been used in efficiency analysis of banks (rather than branches); some recent examples are Yue (1992), Berg et al. (1993), Favero and Papi (1995), Wheelock and Wilson (1995), Miller and Noulas (1996), Resti (1997) and Sathye (2001)².

4. Results

The efficiency scores of each of the banks included in the sample are shown in Appendix 1. In Table 2, some descriptive statistics about the banks in the sample has been presented.

² Readers interested in the details of the various frontier measurement techniques are encouraged to consult the works of Banker, Charnes, Cooper, Swarts and Thomas (1989), Bauer (1990), and Seiford and Thrall (1990), Aly and Seiford (1993) etc. There are a number of software options for running DEA. This study uses the software (DEAP) developed by Coelli (1996) to calculate the efficiency scores.

Table 2: Descriptive statistics of efficiency scores by bank ownership

		Model A				Model B			
	N	Mean	SD	Min	Max	Mean	SD	Min	Max
Public sector	27	0.89	0.08	0.67	1	0.60	0.18	0.28	1
Private sector	33	0.78	0.11	0.55	1	0.45	0.20	0.05	1
Foreign banks	34	0.84	0.14	0.56	1	0.80	0.19	0.44	1
All banks	94	0.83	0.12	0.55	1	0.62	0.24	0.05	1

The mean efficiency score of Indian banks was 0.83 as per Model A and 0.62 as per Model B of the study. The efficiency score fits within the range of the scores found in other overseas studies but is lower than the world mean efficiency. “The mean efficiency value was 0.86 with a range of 0.55 (UK) to 0.95 (France)” (Berger and Humphrey, 1997, p. 17). A mean efficiency score that is lower than the world mean implies that there is a need for Indian banks to further improve efficiency so as to achieve world best practice. The government also needs to help banks by creating an appropriate policy environment that promotes efficiency.

In Table 3, we present number of banks by ownership in four quartiles of efficiency scores.

Table 3: Number of banks in four quartiles of efficiency scores by bank ownership

	Model A				Model B			
	Public	Private	Foreign	Total	Public	Private	Foreign	Total
Lowest efficiency (Q1)	1	12	10	23	5	15	3	23
Next to lowest quartile (Q2)	7	13	4	24	10	12	2	24
Next to Highest efficiency quartile (Q3)	10	5	9	24	9	4	11	24
Highest efficiency quartile (Q4)	9	3	11	23	3	2	18	23
Total	27	33	34	94	27	33	34	94
Banks on the Frontier (efficiency score = 1)	4	1	10	15	3	1	12	16

The above table shows that as per Model A, of the 15 banks on the frontier, 10 were foreign banks while as per Model B, out of the 16 banks on the frontier 12 were foreign banks. Further, it could be seen that as per Model A, out of the 23 banks in the highest efficiency quartile (Q4), 11 (48%) are foreign banks. As per Model B, out of 23 banks 18 (78%) are in the Q4. This means that as a group more foreign banks are in the highest efficiency quartile than public or private sector banks. Their preponderance in Model B is, particularly, noteworthy. It shows that foreign banks are much more efficient as a group in use of inputs of staff and deposits as compared to public or private sector banks. As a group, the private sector commercial banks have displayed lower efficiency level in both the models.

The banks that were on the efficiency frontier under both models included State Bank of India, Bank of Baroda (two public sector banks), IndusInd bank (one private sector) and Citi Bank, Bank of America, Deutsche Bank, Bank of Mauritius, Cho

Hung Bank, Sonali Bank and Arab Bank (seven foreign banks). The minimum efficiency score in Model B for private sector bank was 0.05. This was because two banks, Bank of Nainital and Bareilly Bank had scores of 0.05 and 0.06 respectively. These outlier cases are because of peculiarity of the region in which these banks operate. They are flush with deposits but have few avenues for lending. These banks invest funds in government securities (which is not considered here as output due to non-availability of data) hence these banks show low efficiency scores.

The scores computed using Model A and Model B need some explanation. As already stated DEA is a flexible technique and produces efficiency scores that are different when alternative sets of inputs and outputs are used. In Model A, we have used prices of inputs (interest and non-interest expenses) as the input variables while in Model B, mainly quantities of inputs (deposits and staff numbers) have been used as input variables. Foreign banks as a group appear to be more efficient users of input quantities to produce a given output as compared to the public sector banks and private sector banks. This means that there are inefficiencies in use of these two inputs (deposits and staff numbers) among the public sector and private sector banks which these banks need to remedy to achieve increased efficiency. On the other hand, foreign banks need to focus on pricing aspects (interest and non-interest income and expenses) of their inputs and outputs to achieve higher efficiencies. The lower scores for private sector banks in both the models could be because these banks are in the expansion phase and could have higher amount of fixed assets employed which have yet to start generating return.

The efficiency estimates as per this study compare well with the score estimated by Bhattacharya et al. (1997). In their study the efficiency scores ranged from 79.19 to

80.44 in the years 1986 through 1991. In the study of Saha et al. (2000) where efficiency scores have been estimated only for 25 public sector banks the estimates ranged from 0.58 to 0.74 in the year 1995 and the mean score was 0.69. The inputs and outputs, number of firms in the sample and the year are different in the present study compared to these two studies. Bhattacharya et al. analyse data for the pre-deregulation years while this study does so after sufficient period has elapsed since deregulation. The banks have taken steps to lower the ratio of non-performing assets, which has been brought down from 24 per cent in 1993-94 to 20 per cent in 1994-95 (Rangarajan, 1995). This would have helped in increasing interest income an input in Model A. The banks need to continue their efforts to reduce the percentage of non-performing assets to improve efficiency. Another important reason affecting the efficiency of public sector banks, in particular, is the high establishment expenses as a percentage of total expenses. In the year 1997-98, the ratio was 20.13 for public sector banks, 9.87 for private sector commercial banks and 7.66 for foreign banks. The public sector banks have recently introduced a voluntary redundancy scheme for staff, which if successful will help bring down this ratio and thus improve efficiency scores further.

5. Conclusion

Using published data, this paper worked out the production efficiency score of Indian banks for the year 1997-98. The scores were calculated using the non-parametric technique of Data Envelopment Analysis. The study shows that as per Model A, the public sector banks have a higher mean efficiency score as compared to the private sector and foreign commercial banks in India. As per Model B, they have lower mean

efficiency score than the foreign banks but still higher than private sector commercial banks. Most banks on the frontier are foreign owned. The study recommends that the existing policy of bringing down non-performing assets as well as curtailing the establishment expenditure through voluntary retirement scheme for bank staff and rationalization of rural branches are steps in the right direction that could help Indian banks improve efficiency over a period of time so as to achieve world best practice.

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Attachment 1: Efficiency score of Indian banks in the year 1997-98

Efficiency Scores

Bank	Model A	Model B
SBI	1	1
SBH	0.93	0.611
SBP	0.924	0.56
SBT	0.877	0.555
SBBJ	0.866	0.581
SBM	0.829	0.544
SBS	0.803	0.588
SBIND	0.772	0.543
BOI	0.957	1
BOB	1	1
CANBANK	1	0.751
PNB	0.969	0.742
CBI	0.943	0.615
UBI	0.961	0.687
IOB	0.868	0.651
SYNBANK	0.895	0.564
INDBANK	0.674	0.651
UCO	0.786	0.488
ALLABANK	0.864	0.536
OBC	1	0.638
UNITED	0.87	0.28

DENA	0.909	0.614
CORPBANK	0.982	0.501
BOM	0.894	0.397
VIJAYA	0.798	0.391
ANDHRA	0.851	0.415
PSB	0.794	0.417
FEDERAL	0.847	0.623
VYASYA	0.81	0.458
JKBL	0.981	0.43
KNTBANK	0.9	0.511
BOR	0.731	0.475
BOMDR	0.703	0.431
SOUBANK	0.795	0.501
UWB	0.786	0.479
KARUR	0.816	0.496
CATHOLIC	0.734	0.494
TMB	0.859	0.452
DCB	0.812	0.482
LAXMIVILAS	0.693	0.463
BHARAT	0.776	0.382
SANGLI	0.713	0.271
DHANLAKSH	0.775	0.454
CITYUNION	0.768	0.462
NEDUNGADI	0.709	0.464
BENARES	0.625	0.217

LORD	0.782	0.427
NAINITAL	0.653	0.046
BAREILLY	0.561	0.065
RATNAKAR	0.583	0.15
GANESH	0.548	0.122
INDUSIND	1	1
GLOBAL	0.952	0.739
UTI	0.873	0.681
ICICI	0.874	0.486
TIMES	0.765	0.447
HDFC	0.887	0.364
IDBI	0.796	0.449
PUNJAB	0.766	0.852
CENTURIN	0.826	0.622
ANZ	1	0.696
CITI	1	1
HSBC	0.865	0.635
STANCHART	0.788	0.794
BOA	1	1
DEUTSCHE	1	1
AMEX	0.722	0.786
ABN	0.857	1
BRITISH	1	0.476
TOKYO	0.893	0.597
BNP	0.867	0.611

LYONNAIS	0.852	0.777
SOCIETE	0.863	0.706
NOVA	0.93	0.878
CREDITAGRI	0.656	0.655
ABUDHABI	0.83	0.44
OMAN	0.751	0.447
BAHRAIN	0.877	0.439
SANWA	1	0.665
DRESDNER	0.598	0.811
INDONESIA	0.565	0.512
BARCLAYS	0.73	0.846
COMMERZ	0.666	0.842
SUMITOMO	0.561	0.787
ING	0.86	1
MAURITIUS	1	1
SINGAPORE	0.685	0.723
SIAM	0.922	1
CEYLON	0.949	0.913
CHOHUNG	1	1
SONALI	1	1
FUJI	0.7	1
ARAB	1	1
CHINATRUST	0.778	1