How Cost Efficient are Indian Scheduled Commercial Banks?

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Abstract

The paper endeavours to analyze cost efficiency of Scheduled Commercial Banks (SCBs) in India. Non-parametric approach, namely, Data Envelopment Analysis (DEA) has been employed to calculate the efficiency scores of SCBs over four points of time i.e. 2000-01, 2004-05, 2008-09 and 2012-13. Further cost efficiency scores are decomposed into technical and allocative efficiency to detect the reasons behind cost inefficiency. The differences in the efficiency scores are examined by applying Analysis of Variance (ANOVA). The results of cost efficiency across ownership show that Public Sector Banks have higher cost efficiency in 2000-01. Private Sector Banks are cost efficient in 2004-05 while Foreign Sector Banks show higher cost efficiency scores in 2008-09 and 2012-13. The results of ANOVA reveal that there exists a statistically significant difference in cost efficiency among banks in different sectors in 2008-09 and 2012-13. With specific reference to India, less empirical work has been carried out with respect to Cost Efficiency. None of the studies has been able to give any concrete findings according to sector-wise performance of banks in terms of cost efficiency parameters.

INTRODUCTION

Efficiency is defined as the choice of alternatives which produces the largest outputs with the application of given resources or which uses the minimum inputs to produce the given outputs (Mckevitt and Lawton, 1994). It measures a firm's performance at a particular point of time in relation to the target firm i.e. the best operating firm in terms of performance (Ram Mohan and Ray, 2004). It is linked with how a bank simultaneously minimizes its cost and maximizes its revenue based on an existing level of production technology (Tandon et al., 2003; Ahmed, 2008; Kumar, 2006; Chatterjee et al., 2014). Efficiency is supposed to be attained when a bank is not in a position to reduce the quantity of inputs to produce the same level of outputs or when a bank is unable to generate more outputs from the available level of resources (Resti, 1997). It depicts the minimum level of resources utilized to achieve the given outputs or portrays the extent of consumption of available resources to obtain the maximum output (Saha and Ravishankar, 2000). The efficiency of a firm refers to how well firm uses its resources in comparison to the current best practice firm. It is measured by comparing the actually attained or realized value against the best achievable value (Lovell, 1993). It describes how much distance exists between the quantity of inputs and outputs used by the concerned firm and the quantity of inputs and outputs used by the efficient firm. Thus the information related to efficiency is required by every firm to determine whether the set standards by the firm are achieved or not.

Keywords:

Cost Efficiency, Scheduled Commercial Banks (SCBs), Data Envelopment Analysis, India.

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The efficiency of banking system is imperative for the welfare of a society as a whole when it offers innovative and quality service to society at minimum cost (Valverde et al., 2003; Bader et al., 2008; Gulati, 2011b). Moreover, high efficiency in the banking system leads to better financial stability of the economy and promotes economic growth (Rajan and Zingales, 1995; Levin, 1997; Cetorelli and Gambera, 2001; Egesa, 2010; Gulati, 2011b; Pančurová and Lyócsa, 2013). If banks are fully efficient, these can have improved profitability with more funds intermediated at greater prices and thus provide exclusive services to the consumers (Berger et al., 1993). Banks can take the advantage of competitive environment only if these perform efficiently in the market. Higher efficiency can lead a bank to earn higher profitability which provides safety to them to absorb huge risks (Egesa, 2010). The efficient bank can provide more trustworthy services to the consumers at optimum prices which will help to maintain faith, confidence and reliability of the customers in the banking sector (Zeitun and Benjelloun, 2013).

The literature on bank efficiency has expanded drastically since early nineties, and continues to flourish. Numerous studies have explored the efficiency performance of banks since then as Yue (1992), Bhattacharyya et al. (1997), Berger and Humphrey,1997), Rogers (1998), Saha and Ravisankar (1998), Jackson et al. (2000), Maudos et al. (2002), Isik and Hassan (2002), Sathye (2003), Ataullah et al. (2004), Ram Mohan and Ray (2004), Das et al. (2005), Sanjeev (2006), Debasish (2006), Varadi et al (2006), Ataullah and Le (2006), Sufian (2007), Sahoo et al. (2007), Chakrabarti and Chawla (2008), Chansarn (2008), Gupta et al. (2008), Kumar and Gulati (2008), Ketkar and Ketkar (2008), Sufian (2009), Tandon et al. (2009), Dash and Charles (2009), Yang (2009), Chauhan and Pal (2009), Gulati (2011a), Bala and Kumar (2011), Ahmad and Noor (2011), Sanusi et al. (2011), Joshi and Bhalero (2011), Gupta and Garg (2011), Yasmeen (2011), Dwivedi and Charyulu (2012), Prabhakar et al. (2012), Sharma et al. (2012), Chhikara and Bhatia (2012), Noor and Ahmad (2012), Karimzadeh (2012), Zeitun and Benjellon (2013), Raphael (2013), Singh and Gupta (2013), Kamarudin et al. (2014), Bhatia and Mahendru (2014), Bhatia and Mahendru (2015) and Bhatia and Mahendru (2016). The literature on efficiency of banks highlights that majority of the research articles have focused on Technical Efficiency i.e. reducing input to the maximum possible extent with given level of outputs or maximising the outputs with the given level of inputs (Yue, 1992; Bhattacharyya et al., 1997; Saha and Ravisankar, 1998; Khanam and Nghiem, 2004; Ketkar and Ketkar, 2008; Bala and Kumar, 2011; Uddin and Suzuki, 2011; Gulati, 2011; Sharma et al., 2012 and Zeitun and Benjelloun, 2013). Technical Efficiency considers the ability of banks in using its inputs optimally or producing its outputs efficiently but it does not take into consideration their prices. Merely considering inputs-outputs will not provide any useful information as it will not lead banks to maximise their profits (Portela and Thanassoulis, 2007). To earn maximum profits, bank managers have two options; either to maximise their revenues or to minimise their cost. But practically, bank managers don't have much command on their revenues while they definitely have control on following practices that help reduce cost to a certain extent. As a result, a bank can endeavour to be cost efficient and maximise its profits by offering eminent services at the minimum cost. Cost efficiency depicts the relative performance of the bank as against the best practice firm which is producing the same output at the lowest operating costs under the similar technological conditions as faced by the concerned firm. It tells how close a firm's cost is to what best practice firm's cost would be for producing the same level of outputs (Weill, 2004). In other words, cost efficiency depicts how much a firm can reduce its cost by producing the same amount of services. Under cost efficiency, the actual cost expended in producing particular bundle of outputs is compared to the minimum cost necessary for producing that same bundle. Considering the cost minimisation concept, cost efficiency evaluation has gained prime significance and even the existing literature on efficiency of banks has exclusively focused on measuring cost efficiency of banks. A snap shot of studies evaluating cost efficiency is given in a tabular format as follows in Table- 1:

Table- 1 Summary of studies measuring cost efficiency of banks by employing Data Envelopment Analysis

Author/ Year	Sample	Country	Time Period	Input	Output	Results
Isik and Hassan (2002)	National State Banks National Private Banks Foreign Banks Foreign Banks having branches	Turkey	1988–1996	• Labour • Capital • Loanable Funds	• Short-Term Loans • Long-Term Loans • Risk-Adjusted Off-Balance Sheet Items • Other Earning Assets	• The results showed downward trend in the cost efficiency of Turkish banking as it decreased from 78% in 1988 to 71% in 1992 and further to 68% in 1996. • Dominant source of the cost inefficiency was technical inefficiency. • Majority of Turkish banks were operating at Decreasing Return to Scale (DRS) 47% in 1988, 48% in 1992 and 53% in 1996.
Niazi (2003)	23-40 commercial banks	Pakistan	1991-2000	• Labour • Physical Capital • Operating Cost • Financial Capital	• Loan and Advances • Investments • Contra Accounts	• Foreign Banks were more efficient as compared to Private and State-Owned Banks • Foreign Banks had cost efficiency score of 79.7%, Private Banks of 75.1% and State Owned Banks of 60.5%. • Cost inefficiency among banks was due to allocative inefficiency.
Burki and Niazi (2006)	23-40 commercial banks	Pakistan	1991 to 2000	• Labour • Physical Capital • Operating Cost • Financial Capital	• Loans and Advances • Investments • Contra Accounts	• The mean cost efficiency for all Pakistan banks was 75%. • Cost efficiency of State-Owned, Private and Foreign Banks was 60%, 75% and 80%, respectively. • State-Owned Banks, Private Banks and Foreign Banks had no differences in their cost efficiency scores.
Ioannis et al. (2008)	34 banks, varying across years	Greek	1994 to 2006	• Personnel Outlays • Fixed Capital Expenditure	• Net Interest Income • Net Commission Income • Other Incomes	• Average efficiency of Greek banking system enhanced from 0.74 in 1994 to 0.82 in 2006. • Larger banks demonstrated higher efficiency followed by smaller banks.
Brack and Jimborean (2009)	10 biggest banks	Europe and America	1994-2006	• Fixed Assets • Labour • Borrowed Funds	• Volume Of Customer Deposits • The Volume Of Customer Credits • The Net Fee and Commission Income	• Cost efficiency of banks operating in France and Spain improved while it declined for Germany, Italy, the United-Kingdom and the United States. • United States banks had superior efficiency score of 95.9% all over the years but it declined during the end paper time period. • German Banks had lowest efficiency of 85.41%.
Staub et al. (2010)	Unbalanced panel data of 127 banks	Brazil	2000-2007	• Interest Expenses • Operational Expenses Net Of Personnel Expenses (Proxy For Capital Expenses) • Personnel Expenses	• Investments • Total Loans Net Of Provision Loans • Deposits	• The allocative and technical efficiencies (inefficiencies) was about 66.9% (51.40%) and 63.3% (57.98%) respectively. • Main source of cost inefficiency was technical inefficiency till 2002 but afterwards allocative inefficiency was the reason. • Public Banks were most efficient and there was relative inefficiency among Foreign Banks.
Gulati and Kumar (2011)	73 to 77 Scheduled Commercial Banks	India	1992-93 to 2007-08	• Physical Capital • Labour, • Loanable Funds • Equity	• Advances • Investment • Non-Interest Income	• Cost inefficiency in Indian banking sector was mainly due to allocative inefficiency. • FBs were always ranked at top position in Model A. • Public Sector Banks were efficient followed by Private and Foreign Banks in Model B, • Private Banks were consistently least cost efficient.

Author/ Year	Sample	Country	Time Period	Input	Output	Results
Uddin and Suzuki (2011)	4 Nationalized Commercial Banks 30 domestic Private Commercial Banks 4 Foreign Commercial Banks	Bangladesh	2001-2008	• Loanable Funds • Physical Capital • Labour	• Investment • Loans And Advances	• Both traditional and frontier based measures indicated that bank performance had improved in Bangladesh.
Abu-Alkheil (2012)	4 Banks	Two European countries	2008-2009	• Labour • Fixed Assets • Total Funds	• Total Loans • Other Earning Assets	• Cost efficiency (CE) performance of Conventional Banks and Islamic Banks was 69.7% and 49.3% respectively. • Conventional Banks were better than Islamic Banks due to their large size. • Most of Conventional Banks were operating on the decreasing return to scale of efficiency scores while Islamic Banks were operating at either constant or increasing return to scale.
Kumar (2013)	27 Public Sector Banks (PSBs)	India	1992-1993 to 2007-2008	• Physical Capital • Labour • Loanable Funds	• Net Interest Income • Non- Interest Income	• The average cost efficiency (inefficiency) in Indian public sector banking industry was 79.6% (25.6%). • Cost efficiency of the Indian public sector banking industry as a whole had improved significantly during the second phase of reforms relative to the first reforms.
Raina and Sharma (2013)	64 Commercial Banks	India	2005-06 to 2010-11	• Full-Time Employees • Fixed Assets • Loanable Funds.	• Net Interest Income • Other Income	• The average CE of Scheduled Commercial Banks was 72.4%, average Technical efficiency (TE) was 94.5%, whereas Allocative Efficiency (AE) was 76.7%. • Allocative efficiency was the main reason for cost inefficiency.
Baten et al. (2015)	17 Commercial Banks	Bangladesh	2001-2010	• Fixed assets • Labour • Borrowed fund	• Profit • Advance • Other earning • Off-balance Sheet Items	• Average Cost inefficiency 16.3% among all banks • Cost inefficiency was slightly higher for private banks than national commercial banks. • Janata Bank had highest Cost inefficiency of 44.7% whereas United Commercial Bank had lowest inefficiency of 5.3%.
Tuškan and Stojanović (2016)	28 European Banks	Europe	2008–2012	• Interest Expenses • Total operating expenses	• Interest Income • Total Operating Income	• Greater cost efficiency in European banks was attributed to deposit-oriented banking systems of post-transition countries
Bhatia and Mahendru (2018)	Vary from 74 to 96 Commercial banks	India	1991-92 to 2012-13	• Deposits • Borrowing • Labor • Fixed assets	• Investments • Loans and advances • Non-interest income	• SCBs exhibit higher CE scores in reformatory era as compared to the post-reformatory era. • The dominant reason identified behind cost inefficiency is allocative inefficiency.
Grmanová and Ivanová (2018)	13 Banks	Slovak	2009 to 2013	• Liabilities to banks and customers • Operating costs	• Loans and advances to banks and customers • Non-interest income	• In 2009, seven banks were efficient; in 2013 six banks were efficient. • Largest bank was efficient in all models • All banks that were efficient in 2013 were also efficient in 2009.
Herwadkar et al. (2019)	Vary between 75 in 2005 and 84 in 2018	India	2005-2018	• Number Of Employees • Fixed Assets	• Deposits • Loans And Advances, • Investments • Non-Interest Income	• Public sector banks (PSBs) turn out to be more efficient than private sector banks, due to cost cutting through innovative techniques. • Large banks are found to be more efficient than small banks as they can reap economies of scale.

On exploring the literature covering Cost Efficiency, it comes to light that with specific reference to India, very less literature is found on cost efficiency (Kalluru and Bhat, 2009; Kaur and Kaur, 2010; Gulati and Kumar, 2011; Kumar, 2013; Raina and Sharma, 2013). Majority of these studies analyzed cost efficiency of Indian banks till the year 2008 (Kalluru and Bhat, 2009 and Gulati and Kumar, 2011), consequently ignoring the most critical time of recession aftermath. One study by Raina and Sharma (2013) evaluated cost efficiency during 2005-06 to 2010-11 and covers the recession time period but an evaluation over just 5 years seems to be less comprehensive. Indian Banking industry attracts more attention due to diverse ownership pattern i.e., Public Sector, Private Sector and Foreign Sector Banks. Banks belonging to different ownership follow diverse set of regulations but they all function in the same market. So, it is imperative to recognize as to which particular sector is leading to anxious results. But only one study i.e., Gulati (2011) analyzed cost efficiency of banks across ownership. But, the study didn't provide any conclusive results as Foreign Banks were ranked at top position in Model A whereas Public Sector Banks were efficient in Model B.

Thus, the present paper focuses to measure cost efficiency of Indian Scheduled Commercial Banks. The present study uses unbalanced panel data of Indian Scheduled commercial banks over the period 2001-2013 and employs the Non Parametric Approach -Data Envelopment Analysis (DEA) to estimate Cost Efficiency, Technical Efficiency (Input Oriented) and Allocative Efficiency (Input Oriented). Further, to identify the causes of output technical inefficiency, it is further divided into Pure Technical and Scale Efficiency.

The study proceeds as follows. Section 1 introduces the topic of the study and reviews the literature available. Section 2 presents the objectives of the study. Section 3 explains the methodology framework used to measure Cost Efficiency. Section 4 describes the data and the specification of banking inputs and outputs. Section 5 presents the results. Finally, section 6 outlines some conclusions.

2. Objectives of the study

The primary objective of the study is to analyze and evaluate cost efficiency scores of Scheduled Commercial Banks (SCBs) operating in India. In addition, cost efficiency is analyzed across bank ownership.

3. Database and Methodology

3.1. Database

The sample of the study includes all commercial banks operating in India during 2000-01 to 2012-13. The number of observations varied across time due to missing observations for some banks for certain years. The data for some banks was not available as the banks were no longer in existence or some banks had merged with the others. The effective sample of the study is given in a tabular format as follows in Table- 2

Table- 2 Sample of the Study

YEAR	Public Sector Banks	Private Sector Banks	Foreign Sector Banks	Indian Scheduled Commercial Banks
2000-01	27	31	37	95
2004-05	28	29	26	83
2008-09	27	20	21	68
2012-13	26	20	30	76

The study covers the time period of 2000-01 to 2012-13. It is split over four points of time i.e. 2000-01, 2004-05, 2008-09 and 2012-13 to assess the efficiency scores intermittently after a uniform gap of three years each. Also, 2000-01 marks the beginning of a new decade after exhaustion of India's gestation period from the reformatory phase in banking that started in 1991 with the liberalisation, privatisation and globalisation of Indian economy. By 2004-05, Indian economy was rather booming with the GDP of 7.05%, Industrial GDP growth of 9.81% and service sector growth of 8.28% (Ministry of Finance, 2014). However, 2008-09 marred the financial parameters of Indian economy due to the spill over effect of global financial recession. 2012-13 is assumed to be the post crisis period where the economy is perceived to have recovered itself. The present study gathers data from banks' Annual Reports and Reports on Trend and Progress in Banking. Official website of Reserve Bank of India (RBI) which is considered as the most comprehensive database for research in banking has also been used.

3.2 Methodology Framework: Data Envelopment Analysis (DEA)

Data Envelopment Analysis (DEA) a Non-Parametric Approach is a linear programming based technique employed for assessing the relative performance of a set of firms against the best-observed performance. Charnes, Cooper and Rhodes (CCR) Model (1978) was the first that extended the idea of production frontier and production possibility set given by Farrell (1957) into Non parametric

methodology- Data Envelopment Analysis (DEA). DEA identifies efficiencies of all firms in relation to the best practice firm in the sample. It constructs the frontier of the most efficient firms of the sample and then measures how far the other firms are from the frontiers. A firm in DEA is known as Decision Making Unit (DMU). DEA assigns each DMU a single efficiency score that allows ranking amongst DMUs in the sample (Sufian, 2009). The firm having score of one is the most efficient firm, while the firm having score between zero and one is less efficient. DEA also permits to diagnose the causes of inefficiencies in order to identify the areas for improvement i.e. whether the input has been excessively used or the output has been produced less. In the present paper, DEA is used to compute cost efficiency (CE) of banks. A cost efficiency model is an input oriented model, as it minimizes inputs at a given level of output quantities and input prices. To identify the reasons of cost inefficiency among banks, cost efficiency can further be decomposed into Allocative Efficiency (AE) (input oriented) and Technical Efficiency (TE) (input oriented) components. In other words,

Cost efficiency = Allocative Efficiency (Input Oriented) × Technical Efficiency (Input Oriented)

Allocative Efficiency (AE) (input oriented) evaluates the capability of the bank to utilize minimum inputs to generate the given outputs as well as considering the input prices. Technical Efficiency (TE) (input oriented) is the ability of the firm to minimize their input to produce the given set of outputs. DEA further helps to decompose the technical efficiency into its components, pure technical efficiency and scale efficiency (Coelli, 1998; Sufian, 2007). This decomposition helps to detect the reasons of technical inefficiencies which can be due to the inefficient implementation of the production plan in converting inputs to outputs (pure technical inefficiency) or due to the divergence of bank from the most productive scale size (scale inefficiency).

Cost efficiency = Allocative Efficiency (Input Oriented) × Pure Technical Efficiency (Input Oriented) × Scale Efficiency

Data Envelopment Analysis (DEA) has been used in many studies on banking efficiency lately as Yue (1992), Bhattacharyya et al. (1997), Saha and Ravishankar (2000), Ram Mohan and Ray (2004), Das et al. (2005), Ataullah and Le (2006), Varadi et al. (2006), Sahoo et al. (2007), Chansarn (2008), Ketkar and Ketkar (2008), Karimzadeh (2012), Gupta and Garg (2011), Dwivedi and Charyulu (2012), Prabhakar et al. (2012), Sharma et al. (2012), Chhikara and Bhatia (2012), Singh and Gupta (2013), Kumar (2013), Raina and Sharma (2013), Bhatia and Mahendru (2015) and Bhatia and Mahendru (2016).

3.3 Separate vs. Common Frontier Approach

Prior to evaluating the efficiency of banks, there are two main issues which are required to be discussed. The first issue is whether a common frontier or separate frontier for each year is to be constructed. A single Common frontier which envelops the pooled input-output data by taking all the years collectively forms a grand frontier which provides variation in the efficiency over time and space and shows the trend in the efficiency (Bhattacharyya et al., 1997 and Ataullah and Le, 2006). On the other hand, Isik and Hassan (2002) and Ahmad and Noor (2011) suggested that it is better to construct separate frontier for each year as it offers more flexibility than a single multiyear frontier. Constructing separate frontier each year helps to identify which bank is efficient or inefficient in terms of technology in a particular year. It also helps to reduce the problem related to random error in DEA.

The second issue is whether to take public, private and Foreign Sector Banks collectively for each year to construct the frontier or to make separate frontier for each sector separately. A plenty of discussion has been carried out on this issue in the previous literature (Cummins et al., 1999; Isik and Hassan, 2002; Niazi, 2003; Burki and Niazi, 2006 and Gulati, 2011). These studies constructed pooled as well as separate frontier, according to sector wise banks. Subsequently, both parametric and non parametric tests were applied to check whether there were differences in pooled and separate frontiers. The studies found that it was better to construct the common frontier as all the efficiency scores of separate frontier either coincide with or lie inside the common frontier (Cummins et al., 1999; Isik and Hassan, 2002; Niazi, 2003; Burki and Niazi, 2006 and Gulati, 2011). In other words, all sectors, i.e. public, private and Foreign Sector Banks use common technology and operate on the same frontier. As a result of the above discussion, this article constructs separate frontier for each year by taking public, private and Foreign Sector Banks collectively in a particular year. Since, constructing an annual frontier specific to each year is more flexible and consequently more appropriate than estimating a single multiyear frontier for banks in the sample (Bauer et al., 1993 and DeYoung and Hasan, 1998).

3.4 Selection of Banking Inputs and Outputs

For calculating the efficiency scores of banks, selection of inputs and outputs is an important but a controversial

issue in banking (Ariff and Can, 2008 and Berger and Humphrey, 1997). The study based on efficiency of banks widely follows either Operating Approach (Bhattacharyya et al., 1997; Saha and Ravisankar, 2000; Ram Mohan and Ray, 2004; Chansarn, 2008 and Ketkar and Ketkar, 2008) or Intermediation Approach (Yue, 1992; Das et al., 2005; Ataullah and Le, 2006; Varadi et al., 2006; Sahoo et al., 2007; Chansarn, 2008; Ketkar and Ketkar, 2008 and Karimzadeh, 2012). The operating approach considers banks as using purchased inputs to produce deposits and various categories of bank assets whereas intermediation approach considers banks as intermediaries that use deposits together with other inputs such as labor and capital to produce the outputs like loans and advances. Favero and Papi (1995) and Berger and Humphrey (1997) have pointed out that intermediation approach is appropriate for banks for the reason that the most activities of banks consist of converting huge deposits and funds into loans and financial investments. Following the intermediation approach, this article uses four inputs and two outputs. The description of inputs, outputs and the prices of inputs are presented in Table- 3.

Table - 3 Description of Inputs and outputs variables

Variables	Description
Input Variables • Deposits • Borrowings • Fixed Assets • Number of Employees	Demand Deposits+ Term Deposit + Savings Deposits. Borrowings from RBI and other Banks or Financial institutions. Premises+ Fixed Assets under Construction+ Other fixed Assets. Number of Employees working in banks.
Output Variables • Investments • Loans and Advances • Non- Interest income	Investments in Approved Securities, Government Securities, other approved securities, shares, debentures. Term Loans + Cash Credit, overdraft + Bills purchased and discounted etc. Commission +Bill Discounted +Fee.
Input Prices • Price of Deposits • Price of Borrowings • Price of Fixed Assets • Price of number of employees	Interest paid on deposits/ deposits. Interest paid on borrowings from RBI and other agencies/Borrowing. (Rent, taxes and Lighting + Depreciation on banks' assets + Repair and Maintenance + Insurance)/ Fixed Assets. Payment and provisions for employees/ number of employees.

4. Empirical Findings and Discussion

4.1 Cost efficiency of Scheduled Commercial Banks in India

Table - 4 depicts year wise average cost efficiency and its components scores of all Scheduled Commercial Banks operating in India over four points of time as 2000-01, 2004-05, 2008-09 and 2012-13.

Table - 4 Cost efficiency Scores of Indian Scheduled Commercial Banks

YEAR	No. of Banks	CE	AE (IO)	TE (IO)	PTE (IO)	SE (IO)
2000-01	95	0.548	0.643	0.854	0.943	0.905
2004-05	83	0.685	0.747	0.914	0.971	0.941
2008-09	68	0.713	0.795	0.896	0.978	0.915
2012-13	76	0.493	0.567	0.870	0.966	0.898

Cost efficiency (inefficiency) of Scheduled Commercial Banks operating in India is 54.8% (45.2%) in 2000-01. This depicts that on an average Scheduled Commercial Banks operating in India exploit only 54.8% of their inputs to produce the current output. Average allocative efficiency (input oriented) (inefficiency) is 64.3% (35.7%) whereas Technical Efficiency (input oriented) (inefficiency) is 85.4% (14.6%). Pure technical and Scale Efficiency (input oriented) (inefficiency) of Scheduled Commercial Banks is 94.3% (5.7%) and 90.5% (9.5%) respectively. In 2004-05, Scheduled Commercial Banks operating in India could utilize only 68.5% of the inputs to produce the same level of outputs and they wasted 31.5% of its inputs. Allocative efficiency (input oriented) is 74.7% whereas Technical Efficiency (input oriented) is 91.4%. Further, pure technical (input oriented) and Scale Efficiency (input oriented) of Scheduled Commercial Banks is 97.1% and 94.1% respectively for the year 2004-05. Cost efficiency (inefficiency) of Scheduled Commercial Banks operating in India is 71.3% (28.7%) in 2008-09. The average Allocative efficiency, Technical Efficiency, Pure Technical Efficiency and Scale Efficiency (input oriented) is 79.5%, 89.6%, 97.8% and 91.5%, respectively. Scheduled Commercial Banks on an average could use only 49.3% of resources in 2012-13 while they wasted the remaining resources. In 2012-13, average Allocative efficiency (input oriented) is 56.7% whereas Technical Efficiency (input oriented) is 87.0%. Further, Pure Technical (input oriented) and Scale Efficiency (input oriented) of Scheduled Commercial Banks is 96.6% and 89.8% respectively for the year 2012-13.

It is observed that cost efficiency and its components have never achieved full efficiency score of 1 in any of the years under review. Cost efficiency in 2000-01 is quite low. Liberalisation, privatisation and globalisation (LPG) brought in both threats and opportunities for banks in India. To sustain the pressure of LPG reforms, the decade of 2000 brought in the electronic phase of banking in India. Prominent importance was given to computerization in the beginning of 2000s. The huge cost incurred on infrastructure and technological up-gradations at a point of time seemed to have escorted banks to low cost efficiency in the early 2000s. A hike in cost efficiency scores is witnessed in 2004-05. Unfortunately, the efficiency did not enhance due to the operating capability of banks at this point of time. Actually, the customers were focusing on investing in tax saving schemes. As a result they had strong inclination towards investment in Postal Deposit Schemes that gave them tax benefits as against demand and time deposits of banks (Reserve Bank of India, 2004-05). This reduced the ratio of interest expenditure to total assets of SCBs from 7.79% in 2000-01 to 4.0% in 2004-05 (Reserve Bank of India, 2004-05). Also, Voluntary Retirement Schemes (VRS) introduced in 2000-01 slowed down the wage bill to total assets ratio from 1.4% in 2002-03, to 1.3% in 2003-04, to 1.2% in 2005-06 camouflaging cost efficiency parameters on the higher side. However, on the positive side, Indian Scheduled Commercial Banks made a noticeable shift in switching from paper-based transactions to electronic means as Real Time Gross Settlement (RTGS), National Electronic Fund Transfer (NEFT) and other electronic modes helped them to reduce their transaction cost and expand their outreach especially in the remote and rural areas raising cost efficiency to 71.3% by the end of 2008-09. A deep decline in cost efficiency of SCBs during 2012-13 seems to be on account of tepid global recovery from the ripples of global financial recession. The loss of faith in the banking industry coaxed banks to increase interest rates. As a result interest income to total assets ratio showed an increase from 6.84% in 2010-11 to 7.98% in 2012-13. This led to increased cost of term deposits escorting banks to low Cost Efficiency.

Cost efficiency is the multiplicative combination of Allocative Efficiency and Technical Efficiency (input oriented). As seen from Table- 4, Technical Efficiency scores (input oriented) have always been higher than Allocative Efficiency scores. Thus the dominant reason behind Cost Inefficiency is Allocative Inefficiency. Higher Allocative Inefficiency (input oriented) demonstrates that bank managers are quite incapable of selecting the cost minimizing mix of inputs at the given input prices. On the other hand, Technical Efficiency (input oriented) scores are still less than 1which is the standard efficiency score. Thus the detection of Technical Inefficiency reveals that Scale inefficiency is constantly higher than Pure Technical Inefficiency among SCBs. Thus SCBs need to think about their input usage to improve upon their Cost Efficiency.

4.2 Cost efficiency of Scheduled Commercial Banks in India Across Ownership

The Indian Banking is predominantly attractive because of the diversity of bank ownership structure. Indian banks are divided into three groups, i.e. Public, Private and Foreign Sector Banks. These groups of banks have a different set of regulations but they all function in the same market. It is imperative to recognize as to which particular sector is leading to anxious results in the overall efficiency scores. Hence, we now conduct an efficiency evaluation of SCBs across ownership. The sector wise average efficiency scores are presented as follows in Table- 5:

Table- 5 Cost efficiency Scores of Indian Scheduled Commercial Banks across Ownership

	Public Sector Banks					Private Sector Banks					Foreign Sector Banks				
	Cost Efficiency														
YEAR	CE	AE (IO)	TE (IO)	PTE (IO)	SE (IO)	CE	AE (IO)	TE (IO)	PTE (IO)	SE (IO)	CE	AE (IO)	TE (IO)	PTE (IO)	SE (IO)
2000-01	0.578	0.641	0.896	0.976	0.919	0.496	0.595	0.837	0.922	0.909	0.569	0.685	0.839	0.937	0.891
2004-05	0.684	0.738	0.926	0.986	0.940	0.702	0.766	0.907	0.956	0.950	0.668	0.735	0.908	0.971	0.932
2008-09	0.650	0.755	0.866	0.983	0.880	0.698	0.803	0.869	0.953	0.911	0.808	0.838	0.960	0.996	0.964
2012-13	0.368	0.419	0.884	0.980	0.902	0.431	0.544	0.807	0.952	0.847	0.642	0.711	0.899	0.964	0.929

CE: Cost Efficiency, AE (IO): Allocative Efficiency (Input Oriented), TE (IO): Technical Efficiency (Input Oriented), PTE (IO): Pure Technical Efficiency (Input Oriented), SE (IO): Scale Efficiency(Input Oriented)

Table- 5 presents cost efficiency scores over four points of time for Public, Private and Foreign Sector Banks. It is observed that in 2000-01 cost efficiency (inefficiency) of Public Sector Banks operating in India is 57.8% (42.2%). Average allocative efficiency (input oriented) is 64.1% (35.9%) whereas Technical Efficiency is 89.6% (10.4%). Pure technical and Scale Efficiency of Public Sector Banks is 97.6% (2.4%) and 91.9% (8.1%) respectively. Public Sector Banks operating in India could utilize only 68.4% of resources in 2004-05 to produce what they are producing today and wasting 31.6% of resources. In 2004-05, average allocative efficiency is 73.8% (26.2%) whereas Technical Efficiency is 92.6% (7.4%). Further, pure technical and Scale Efficiency of Public Sector Banks is 98.6% (1.4%) and 94.0% (6.0%), respectively for the year 2004-05. In 2008-09, cost efficiency of Public Sector Banks operating in India is 65.0% (35.0%). Average allocative efficiency, Technical Efficiency, Pure Technical Efficiency and Scale Efficiency is 75.5%, 86.6%, 98.3% and 88.0%, respectively. Public Sector Banks use only 36.8% of inputs actually employed in 2012-13, to produce the same level of output in this year. In other words, the average input waste was 63.2% of inputs. In 2012-13, average allocative efficiency is 41.9% whereas Technical Efficiency is 88.4%. Further, pure technical and Scale Efficiency of Public Sector Banks is 98.0% (2%) and 90.2% (9.8%) respectively for the year 2012-13.

Private Sector Banks (on an average) could utilize only 49.6% of resources in 2000-01 thus wasting the rest of resources. In 2000-01, average allocative efficiency is 59.5% (40.5%) whereas Technical Efficiency is 83.7% (16.3%). Further, pure technical and Scale Efficiency of Private Sector Banks is 92.2% (7.8%) and 90.9% (9.1%), respectively, for the year 2000-01. Cost efficiency of Private Sector Banks operating in India is 70.2% (29.8%) in 2004-05. Average allocative efficiency, Technical Efficiency, Pure Technical Efficiency and Scale Efficiency is 76.6%, 90.7%, 95.6% and 95.0%, respectively. Cost efficiency (inefficiency) of Private Sector Banks operating in India is 69.8% (30.2%) in 2008-09. Average allocative efficiency is 80.3% whereas Technical Efficiency is 86.9%. Pure technical and Scale Efficiency of Private Sector Banks is 95.3% and 91.1% respectively. Private Sector Banks (on an average) could utilize only 43.1% of resources in 2012-13. Average allocative efficiency is 54.4% (45.6%) whereas Technical Efficiency is 80.7% (19.3%). Further, pure technical and Scale Efficiency of Private Sector Banks is 95.2% (4.8%) and 84.7% (15.3%), respectively, for the year 2012-13.

Cost efficiency (inefficiency) of Foreign Sector Banks operating in India is 56.9% (43.1%) in 2000-01. Average Allocative efficiency is 68.5% (31.5%) whereas Technical Efficiency is 83.9% (16.1%). Pure technical and Scale Efficiency of Foreign Sector Banks is 93.7% (6.3%) and 89.1% (10.9%), respectively. In the year 2004-05, cost efficiency (inefficiency) of Foreign Sector Banks operating in India is 66.8% (18.8%). Average Allocative efficiency, Technical Efficiency, Pure Technical Efficiency and Scale Efficiency is 73.5%, 90.8%, 97.1% and 93.2%, respectively, in 2004-05. Foreign Sector Banks operating in India could utilize only 80.8% of inputs in 2008-09. In 2008-09, average allocative efficiency (inefficiency) is 83.8% (16.2%) whereas Technical Efficiency is 96.0% (4.0%). Further, pure technical and Scale Efficiency of Foreign Sector Banks is 99.6% and 96.4%, respectively, for the year 2008-09. Foreign Sector Banks on an average could exploit only 64.2% of resources in 2012-13 to produce what they are producing while wasting 35.8% of resources. In 2012-13, average Allocative efficiency is 71.1% (28.9%) whereas Technical Efficiency is 89.9% (10.1%). Further, pure technical and Scale Efficiency (inefficiency) of Foreign Sector Banks is 96.4% (3.6%) and 92.9% (7.1%) respectively for the year 2012-13.

It is noticed that all banks belonging to different sectors have low cost efficiency as well as low component scores as none of the sectors has achieved the yardstick of 1 at any point of time. The inception of a new decade shows very low efficiency scores of banks in all the three sectors in 2000-01. Public Sector Banks have been facing the problem of surplus manpower resources since long (Bansal, 2010). This has over the years increased their cost without any productive returns. The accelerating wage bill to total assets moving from 1.84% in 1999-2000 to 2.03% in 2000-01 provides an evidence of this inefficiency. In order to reduce this cost, PSBs offered Voluntary Retirement Scheme (VRS) to the employees in 2000-01. This gradually decreased their operating cost from 2.24% in 2002-03 to 2.08% in 2004-05 showing better cost efficiency in our results (Reserve Bank of India, 2004-05). Payment of interest is a major cost for banks. The variation in interest rates is a major factor affecting the efficiency of banks. A decline in ratio of interest expenditure to total assets from 5.99% in 2000-01 to 3.88% in 2004-05 due to apathetic performance of deposits during 2004-05 (Reserve Bank of India, 2004-05) helped banks improve their scores of cost efficiency whereas a rise in this ratio to 5.14% in 2008-09 (Reserve Bank of India, 2008-09) and further to 5.57% in 2012-13 (Reserve Bank of India, 2012-13) deteriorated cost efficiency scores. Private Sector Banks reveal pattern of

cost efficiency akin to Public Sector Banks. Private Sector Banks had made huge investment in upgrading their technology at the inception of electronic era in 2000s. Such massive capital expenditure at a point of time led to anxious cost efficiency scores. The year 2004-05 granted Private Sector Banks the privilege to lower their interest expenditure to total assets from 6.54% in 2000-01 to 3.80% in 2004-05 (Reserve Bank of India, 2004-05). This led to improvement in cost efficiency of Private Sector Banks. They had also started focusing on the contemporary cost reduction tools. They improved upon P's of marketing including their product, price, promotional avenues, place, physical evidence, people and processes. This fostered the customer-bank relationship, increased customer satisfaction and gave banks competitive edge. These efforts reduced their transaction and operational cost resulting in improved Cost Efficiency. In 2008-09, a fall in the efficiencies is observed. Again, a hike in interest expenditure seemed to have escorted banks to poor cost efficiency score. The same is evident from the ratio of interest expenditure to total assets which increased from 3.80% in 2004-05 to 5.54% in 2008-09. At the macro level also, the efficiency scores were affected by the sub-prime crisis in USA. US recession had globally hit the sentiments and faith of people in banking. In order to retain their customers banks had to offer high rate of interest on deposits. The same is evident from the cost of deposits which increased from 6.43% in 2011-12 to 6.72% in 2012-13 (Reserve Bank of India, 2012-13). This brought cost efficiency score of Private Sector Banks to a low level. Foreign Sector Banks too have been paying high rate of interest to attract customers. The ratio of interest expense to total assets at 5.66% in 2000-01 is suggestive of the same. The year 2004-05 witnessed decrease in the interest expenditure owing to the reason that Benchmark Prime Lending Rates (BPLRs) of Foreign Sector Banks softened during the year (Reserve Bank of India, 2004-05). The same is depicted by the ratio of interest expenditure to total assets which became almost half from 5.66% in 2000-01 to 2.63% in 2004-05 (Reserve Bank of India, 2004-05). Moreover, Foreign Sector Banks operate only in the metropolitan cities and in fact have less than 1% of the total branch network they virtually operate (Pricewaterhouse Coopers (PWC), 2013). This assists them to have stronger control over their operating cost. It is depicted by the ratio of operating expenditure to total assets which decreased from 2.87% in 2004-05 to 2.76% in 2008-09. This tends to increase cost efficiency of Foreign Sector Banks. In 2012-13, a fall in cost efficiency is observed. In order to retain and sustain customers after US recession, Foreign Sector Banks had also offered high rate of interest on deposits. Increased cost of deposits was witnessed from 4.34% in 2011-12 to 4.67% in 2012-13 thus lowering their cost efficiency score. A noticeable observation suggests that cost efficiency scores of all banks belonging to different sectors declined in 2012-13. Indian economy witnessed high inflation and muted growth during this year. Perhaps, the fragile recovery of the Indian financial market from the ripples of global financial crisis attributed to cost inefficiency (Reserve Bank of India, 2011-12).

As seen from Table- 5, Technical Efficiency (Input Oriented) scores of all banks operating in different sectors are better than Allocative Efficiency scores in all the years of the study. Thus the foremost reason behind cost inefficiency of Public Sector Banks, Private Sector Banks and Foreign Sector Banks is allocative inefficiency. Further, the main source of technical inefficiency (input oriented) is attributed to scale inefficiency among Public Sector Banks, Private Sector Banks and Foreign Sector Banks. Thus, the results highlight that banks operating in different sectors are not operating on the most advantageous scale. It can be concluded that all banks are facing the problem of attaining the desired scale i.e. either they are operating on Increasing or Decreasing Return to Scale. Scale inefficiency seems to be a major cause of poor performance of banks operating in different sectors in India. This implies that majority of banks need to enlarge their scale of operations.

Thus, specifically considering points of time, Public Sector Banks have higher cost efficiency score in 2000-01, Private Sector Banks in 2004-05 while Foreign Sector Banks in 2008-09 and 2012-13. During 2000-01, Public Sector Banks have long and old existence. They also have large number of branches extended all over the country. They are deeply protected by the Government of India which holds 51% share in their share holding. Most importantly, the customers have trust and confidence in these banks. This helps them to be more efficient. But with the increase in the completion, Private Sector Banks started offering services through Electronic Banking, Mobile Banking, Credit Card, Electronic Fund Transfers (EFTs), Real Time Gross Settlement (RTGs) and National Electronic Fund Transfer (NEFTs) etc. This reduces their normal functioning cost in the long run. Moreover, they seem to have recognised the significance of issues relating to Service Quality Management and Total Quality Management. They provide prompt and quality services

to the customers. This all led to improved cost efficiency of Private Sector Banks. Later on, Foreign Sector Banks show higher cost efficiency scores. Foreign Sector Banks save their infrastructural cost as they do not exist in brick and cement and follow virtual banking. They save on the cost of advertising their products and services as their focus is on corporate clients and they do not compete for the share of retail clientage.

4.3 Robustness test Across Ownership

After examining the results derived from DEA, the issue of attention at this moment is whether the difference in cost efficiency is statistically significant for Public, Private and Foreign Sector Banks at different points of time. For checking the same, Analysis of Variances (ANOVA) is applied. The test is applied with the hypothesis that there is no difference in cost efficiency and their other components of Public, Private and Foreign Sector Banks. The results of ANOVA are given in the Table- 6 below:

Table- 6 Results of ANOVA for all efficiency scores

Year	Banks	Mean Scores	F test	Sig.
2000-01	Public Sector Banks	0.578	1.709	.187
	Private Sector Banks	0.496		
	Foreign Sector Banks	0.569		
2004-05	Public Sector Banks	0.684	0.187	.830
	Private Sector Banks	0.702		
	Foreign Sector Banks	0.668		
2008-09	Public Sector Banks	0.650	8.361*	.001
	Private Sector Banks	0.698		
	Foreign Sector Banks	0.808		
2012-13	Public Sector Banks	0.368	22.160*	.000
	Private Sector Banks	0.431		
	Foreign Sector Banks	0.642		
*, **Significant at 1% and 5% level of Significance respectively				

Table- 6 shows the robustness test. The results of ANOVA reveal that there exists a statistically significant difference among different sector banks in case of cost efficiency in the year 2008-09 and 2012-13. As cost efficiency has F value of 8.361 and 22.160 in 2008-09 and 2012-13 respectively and both are statistically significant at 1% level of significance. Overall, the results of ANOVA depict that cost efficiency score are different for Public Sector Banks, Private Sector Banks and Foreign Sector Banks at some point of time.

In order to further check as to between which groups of banks the difference is significant, Post Hoc test was applied. Table- 7 shows the Multiple Comparisons Post Hoc test- Tukey HSD.

Table- 7 Multiple Comparisons Post Hoc Test - Tukey HSD

Years	(I) Banks	(J) Banks	Mean Difference (I-J)	Std. Error
2000-01	Public Sector Banks	Private Sector Banks	0.08155	0.05011
		Foreign Sector Banks	0.00844	0.04819
	Private Sector Banks	Public Sector Banks	-0.08155	0.05011
		Foreign Sector Banks	-0.07311	0.04635
	Foreign Sector Banks	Public Sector Banks	-0.00844	0.04819
		Private Sector Banks	0.07311	0.04635
2004-05	Public Sector Banks	Private Sector Banks	-0.01774	0.05537
		Foreign Sector Banks	0.0167	0.05692
	Private Sector Banks	Public Sector Banks	0.01774	0.05537
		Foreign Sector Banks	0.03444	0.05645
	Foreign Sector Banks	Public Sector Banks	-0.0167	0.05692
		Private Sector Banks	-0.03444	0.05645
2008-09	Public Sector Banks	Private Sector Banks	-0.04835	0.03974
		Foreign Sector Banks	**-0.15862***	0.0392
	Private Sector Banks	Public Sector Banks	0.04835	0.03974
		Foreign Sector Banks	**-0.11028****	0.04209
	Foreign Sector Banks	Public Sector Banks	**0.15862***	0.0392
		Private Sector Banks	**0.11028****	0.04209

2012-13	Public Sector Banks	Private Sector Banks	-0.06329	0.0478
		Foreign Sector Banks	**-0.27361***	0.04307
	Private Sector Banks	Public Sector Banks	0.06329	0.0478
		Foreign Sector Banks	**-0.21032***	0.0464
	Foreign Sector Banks	Public Sector Banks	**0.27361***	0.04307
		Private Sector Banks	**0.21032***	0.0464
*, **Significant at 1% and 5% level of Significance respectively				

The Tukey Post Hoc test reveals that mean difference between foreign-public and foreign-private is statistically significant for cost efficiency in the year 2008-09 and 2012-13. The mean difference between foreign-public is 0.15862 and between foreign-private is 0.11028 and is statistically significant at 1% and 5% level of significance respectively. In addition, the mean difference in cost efficiency in 2012-13 between foreign-public (0.27361) and foreign-private (0.21032) and are statistically significant at 1% level of significance. Foreign Sector Banks are performing significantly better than both Public Sector and Private Sector Banks in terms of cost efficiency in 2008-09 and 2012-13. The cost of funds of Foreign Sector Banks with 4.2% is very less as compared to Private (6.0%) and Public Sector Banks (5.5%) in 2008-09. Similarly, in 2012-13, Foreign Sector Banks have just 4.05% of cost of fund in contrast to Public and Private Sector Banks which have 6.27% and 6.12% of cost of funds respectively. Basically, FSBs have professional work culture and business philosophy. Moreover, they are mainly operating in metro cities where people are more tech-savvy. FSBs are able to recover their operating cost which they have incurred on e-resources. Moreover, they mainly focus on corporate clients and do not compete for the share of retail clientage. This reduces their promotion and advertising cost as well.

5. Conclusion

The snapshot of results is as follows:

- Scheduled Commercial Banks are not able to maintain their input-output synchronization in terms of cost. Indian Scheduled Commercial Banks should focus on Asset Liability Management and should correlate their inputs i.e., deposits, borrowings, employees and fixed assets with their outputs i.e., loan and advances, investments and non-interest income in order to improve the efficiency of the banks.
- There exists a room for improvement for SCBs. Bank managers need to establish equilibrium between inputs and outputs of banks keeping in mind their prices in the country's dynamic environment. Further, they are required to choose their input-output mix taking into consideration their prices. They are required to keep in mind the input-output prices according to the country's dynamic environment so that they can take benefit of the favorable economic environment and protect themselves from the adverse affects.
- Public Sector Banks have higher cost efficiency score in 2000-01, Private Sector Banks in 2004-05 while Foreign Sector Banks in 2008-09 and 2012-13. Thus suggesting that for growth and survival in the cut throat competitive environment, banks in different sector have to follow the prompt and resourceful customer service, which calls for suitable customer centric policies & customer friendly procedures.

The results highlight that Public Sector Banks have shown high level of inefficiency in performance in terms of cost at all the four points of time. Undoubtedly there are some flaws on the part of PSBs, such as they are not able to use their huge manpower and large branch network effectively. In order to improve their efficiency, they should make an endeavour to educate and instruct their employees about the updated technology as followed by other rivalries. Moreover, there exists lack of freedom among PSBs to operate in a competitive manner, as not only Reserve Bank of India but somewhere Government of India is also interfering in their operations by setting the society oriented targets for them. Indian Banks need to frame the policies taking into consideration the customer's needs and requirements. Customer perceived measures of quality in terms of reliability, responsiveness, assurance, tangible and empathy should need to be priorities of their business.

The present study has made an effort in evaluating the cost efficiency scores of Indian Scheduled Commercial Banks at essential points of times. The research can further be extended by studying the efficiency of banks over several years. A comparison of efficiency scores in reformatory and post reformatory time period or the crisis time period too can be made. Besides, various bank specific, industry specific and economy specific factors too can be considered for determining their impact on cost efficiency of banks.

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