

# Cost Efficiency Vis-à-Vis Revenue Efficiency Analysis of Indian Scheduled Commercial Banks in a Dynamic Environment

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Received 15 January 2021  
Revised 10 March 2021  
Accepted 12 April 2021

## Abstract

The paper endeavours to analyze Cost Efficiency vis-à-vis Revenue Efficiency of Scheduled Commercial Banks (SCBs) as well as across ownership in India. Data Envelopment Analysis (DEA) has been employed to calculate the efficiency scores of SCBs over five points of time i.e. 2000-01, 2004-05, 2008-09, 2012-13 and 2016-17. The differences in the efficiency scores are examined by applying Analysis of Variance (ANOVA). The results of Cost and Revenue Efficiency of Indian Scheduled Commercial Banks highlight that the highest level of inefficiency subsist on the cost side as Scheduled Commercial Banks have higher Revenue Efficiency scores in comparison to Cost Efficiency scores. Cost Efficiency across ownership shows 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, 2012-13 and 2016-17. Revenue Efficiency scores shows that Public Sector Banks have higher scores as compared to Private and Foreign Sector Banks in the 2000-01 and 2004-05. Foreign Sector Banks are revenue efficient in 2008-09 and 2016-17 with Private Sector Banks taking the lead in 2012-13. The results of ANOVA reveal that there exists a statistically significant difference in Cost Efficiency and Revenue Efficiency among banks in different sectors over different points of time.

**Keywords:** Cost Efficiency, Revenue Efficiency, Scheduled Commercial Banks (SCBs), Data Envelopment Analysis, India.

## Introduction

Efficiency refers to the best allocation of resources to obtain the highest level of outputs. It measures a bank's performance in relation to a yardstick at a given point of time (Ram Mohan and Ray 2004). The efficiency is associated with how a bank simultaneously minimizes cost and maximizes revenue, while operating on the frontier (Tandon *et al.*, 2003; Kumar, 2006 and Chatterjee *et al.*, 2014). Banks can take advantage of competitive environment only if these perform efficiently in the market (Bader *et al.*, 2008). If banks are fully efficient, these can have improved profitability which in turn provides safety to absorb huge risks (Berger *et al.*, 1993 and Egesa, 2010). An efficient banking system helps to maintain financial stability in the economy and promotes economic growth (Rajan and Zingales, 1995; Levin, 1997; Cetorelli and Gambera, 2001; Egesa, 2010; Gulati, 2011b and Pančurová and Lyócsa, 2013). An efficient bank is able to provide more trustworthy services to the consumers at optimum prices. This helps to maintain faith, confidence and reliability of the customers in the banking sector (Zeitun and Benjelloun,



2013) which is the foundation of any service industry. Thus the efficiency of banking system is instrumental not only in the welfare of society but that of a country as a whole when it offers innovative and quality service at the minimum cost and simultaneously generates ample revenues towards country's GDP (Valverde *et al.*, 2003; Bader *et al.*, 2008 and Gulati and Kumar, 2011).

The literature on bank efficiency has expanded drastically since early nineties, and continues to flourish. Numerous studies have explored the efficiency performance of banks. 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. 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 earn financial benefits unless and until their prices are also taken into consideration (Portela and Thanassoulis, 2007). Considering this research gap, the researchers shifted their focus on cost minimisation approach i.e. Cost Efficiency. Cost Efficiency assesses the relative performance of bank as against the best practice bank which is managing its operating costs at the lowest for producing the same output under similar technological conditions (Bader *et al.*, 2008 and Kamarudin *et al.*, 2014). Therefore, some studies exclusively concentrated on the Cost Efficiency aspect of the banks as Niazi (2003), Girardone *et al.* (2004), Das *et al.* (2005), Burki and Niazi (2006), Sahoo *et al.* (2007), Pasiouras and Kosimidou (2007), Ahmed (2008), Uddin and Suzuki (2011), Gulati (2011a), Kumar (2013) and Raina and Sharma (2013). The literature on banking that merely focuses on Cost Efficiency has been criticized for ignoring the Revenue Efficiency of banks because high cost incurring bank i.e. cost inefficient bank might be able to generate higher revenues than the cost efficient bank (Berger and Mester, 1997 and Berger and Humphrey, 1997). This is due to the reason that banks offer products and services through technology, which increases their cost and makes them temporarily cost inefficient but it might make them revenue efficient by boosting their turnover. Keeping in mind the revenue aspect, Ram Mohan and Ray (2004) exclusively reviewed the Revenue Efficiency performance of banks. Revenue Efficiency measures the comparative performance of bank as against the best practice bank which is producing the maximum output from the inputs available (Bader *et al.*, 2008 and Kamarudin *et al.*, 2014). As a result, analysing Revenue Efficiency also provides a partial view about the performance of banks as it takes into account the output side only. Practically, banks need to consider both input and output aspects to enhance the efficiency performance i.e. they have to focus on cost reduction as well as on revenue expansion simultaneously.

Thus, to get a comprehensive view of bank's performance, it is imperative to study Cost and Revenue Efficiency concepts simultaneously. Only a few studies in the literature available have evaluated Revenue Efficiency along with Cost Efficiency of the banks as Loukoianova (2008), Wanniarachchige and Suzuki (2011), Pančurová and Lyócsa (2013) and García-Alcober *et al.* (2014). Loukoianova (2008) analyzed the Cost and Revenue Efficiency of Japanese banks from 2000 to 2006. The study reported that Japanese banks overall had Cost Efficiency of 69% and 70.8% according to Constant return to scale (CRS) and Variable Return to Scale (VRS) respectively. Average Revenue Efficiency of Japanese Banks was higher than Cost Efficiency as it stood at 93.3% and 87.8% according to Constant return to scale and Variable Return to Scale respectively. Wanniarachchige and Suzuki (2011) estimated the performance of 50 Indian Commercial Banks in terms of Cost and Revenue Efficiency during 2002-2009 using Data Envelopment Analysis. The results showed that Revenue Efficiency decreased from 0.810 in 2001-02 to 0.586 in 2008-09 and Cost Efficiency decreased from 0.701 in 2001-02 to 0.673 in 2008-09. The results of efficiency across ownership depicted that Foreign Banks were most revenue efficient as well as cost efficient followed by State-Owned, Nationalized and Domestic Private Banks respectively. Pančurová and Lyócsa



(2013) estimated the Cost and Revenue Efficiency of 187 Commercial Banks operating in 11 Central and Eastern European Countries (CEEC) over 2005–2008 using Data Envelopment Analysis (DEA). The study observed that Cost Efficiency declined slightly from 33.6% in 2005 to 26.3% in 2008 while Revenue Efficiency increased from 42.1% in 2005 to 49.5% in 2008. The study found that all the countries had average Cost and Revenue Efficiency of 31.1% and 45.9% respectively from 2005-2008. García-Alcober *et al.* (2014) measured both Cost and Revenue Efficiency by applying Free Disposal Hull (FDH) and Data Envelopment Analysis (DEA). The results of the study showed that Commercial Banks were the most cost efficient banks while credit union banks had high Revenue Efficiency during pre-crisis and crisis time period. The robust tests results showed that efficiency scores had significant difference in pre crisis and post crisis period for all banks.

On exploring the literature covering Cost and Revenue Efficiency, it comes to light that only one study has been found for Indian banks that evaluated Cost and Revenue Efficiency simultaneously, namely, Wanniarachchige and Suzuki (2011). The study covers the time period till 2009, but it ignores the most critical time of recession aftermath wherein the economy took much time to stabilise itself and recoup its financial parameters. Also, the study limits itself to just 50 banks. The small sample size does not represent the whole banking sector and hence generalisation of results is difficult. In addition, efficiency is a relative measure of performance. Efficiency scores calculated on small sample may lead to biasness in results. Moreover, the study fails to identify the reasons behind cost and revenue inefficiency. Hence, there is a need to plug the gap and reassess all SCBs operating in India with respect to the Cost and Revenue Efficiency scores especially in the current dynamic environment. Dynamism leads to uncertainty and risk (Liem and Hien, 2019). Banking Sector has been witnessing the same since long; first due to LPG reforms then the macro-economic upheavals like recession, followed by electronic upgradation phenomenon etc. Thus, the present paper uses unbalanced panel data of the Indian Scheduled Commercial Banks existing and employs a non parametric approach namely, Data Envelopment Analysis (DEA) to estimate Cost Efficiency and Revenue Efficiency over the period 2002-03 to 2012-13.

The paper proceeds as follows. Section 1 introduces the topic of the study and reviews the available literature. Section 2 presents the objectives of the study. Section 3 explains the database and methodology used. Section 4 describes the various inputs-outputs and their prices used to measure the efficiency of the banks. Section 5 presents the results. Finally, Section 6 draws conclusions and outlines some suggestions for future work.

## Objectives of the Study

The primary objective of the study is to analyze and evaluate Cost and Revenue Efficiency scores of Scheduled Commercial Banks (SCBs) operating in India. In addition, cost and Revenue Efficiency is analyzed across bank ownership as well. The paper also determines reasons behind the cost and revenue inefficiency among Scheduled Commercial Banks (SCBs) operating in India.

## Database and Methodology

### Database

The sample of the study includes all commercial banks operating in India during 2000-01 to 2016-17. The number of observations varies across time due to missing observations for some banks for certain years. The effective sample of the study is given in a tabular format as follows in Table: 1



Table: 1 Sample of the Study

YEAR	Public Sector Banks	Private Sector Banks	Foreign Sector Banks	Indian Commercial Bank	Scheduled Bank
2000-01	27	31	37	95	
2004-05	28	29	26	83	
2008-09	27	20	21	68	
2012-13	26	20	30	76	
2016-17	27	21	43	91	

The study covers the time period of 2000-01 to 2016-17. It is split over five points of time i.e. 2000-01, 2004-05, 2008-09, 2012-13 and 2016-17 to assess the efficiency scores intermittently after a uniform gap of three years each in order to bring consistency and robustness in analyses. 2000-01 is beginning of electronic decade for banks after exhaustion of ten years from the reformatory phase. Since 2004-05, major changes in banking sector took place as Indian Financial Network (INFINET) was introduced which enabled faster connectivity within the financial sector. Further, e-banking, Basel Norms, Know Your Customer (KYC), Debt Recovery Tribunals and Anti-money Laundering (AML) etc were introduced during this phase. However, 2008-09 was depressing for the banks due to spill over effects of global financial recession. 2012-13 is assumed to be the post crisis period where the economy is perceived to have recovered it and 2016-17 marks the most recent time period. The present study gathers data from website of Reserve Bank of India (RBI) which is considered as the most reliable database for research in banking.

### Data Envelopment Analysis (DEA)

DEA is a linear programming based technique employed for assessing the relative performance of a set of firms against the best-observed performance. 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) and Revenue Efficiency (RE) 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,

$$\text{Cost Efficiency} = \text{Technical Efficiency (Input Oriented)} \times \text{Allocative Efficiency (Input Oriented)}$$

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.

A Revenue Efficiency model is an output oriented model that maximizes revenue for a given set of input quantities and output prices. Furthermore, to detect the reasons of revenue inefficiency, Revenue Efficiency is decomposed in to technical and allocative efficiency (output oriented). It can be written as:

$$\text{Revenue Efficiency} = \text{Technical Efficiency (Output Oriented)} \times \text{Allocative Efficiency (Output Oriented)}$$

Allocative Efficiency (AE) (output oriented) evaluates the capability of the bank in producing revenue



maximizing mix of outputs based on output prices (Kamarudinet *al.*, 2014). It refers to the ability to combine inputs and outputs in optimal proportion in the light of prevailing prices (Lovell, 1993). Technical Efficiency (TE) (output oriented) is the ability of the firm to maximize output from the given set of inputs. It refers to the ability to avoid waste by giving as much output as input usage permits (Lovell, 1993). The following is the mathematical programming equation used to calculate Cost and Revenue Efficiency present in Table: 2:

Table: 2 Mathematical Formulation of Efficiency

Cost Efficiency	Revenue Efficiency
$\text{Min} = \sum_{i=1}^m p_i^0 \tilde{x}_{io}$ <p style="text-align: center;"><b>Subjectto</b></p> $\sum_{j=1}^n \lambda_j x_{ij} \leq \tilde{x}_{io}$ <p style="text-align: center;"><math>i = 1, 2, \dots, m</math></p> $\sum_{i=1}^n \lambda_j y_{rj} \geq y_{ro}$ <p style="text-align: center;"><math>r = 1, 2, \dots, s</math></p> $\lambda_j, \tilde{x}_{io} \geq 0$ $\sum_{i=1}^n \lambda_j = 1$	$\text{Max} = \sum_{r=1}^s q_r^0 \tilde{y}_{ro}$ <p style="text-align: center;"><b>Subjectto</b></p> $\sum_{j=1}^n \lambda_j x_{ij} \leq \tilde{x}_{io}$ <p style="text-align: center;"><math>i = 1, 2, \dots, m</math></p> $\sum_{i=1}^n \lambda_j y_{rj} \geq \tilde{y}_{ro}$ <p style="text-align: center;"><math>r = 1, 2, \dots, s</math></p> $\lambda_j, \tilde{y}_{ro} \geq 0$ $\sum_{i=1}^n \lambda_j = 1$

**Source:** Zhu (2009)

where,

n = DMU observation

j = n<sup>th</sup> DMU

s = output observation

m = input observation

r = s<sup>th</sup> output

i = m<sup>th</sup> input

$q_r^0$  = unit price of the output r of DMU<sub>0</sub>

$y_{ro}$  = r<sup>th</sup> output that maximise revenue for DMU<sub>0</sub>

$x_{io}$  = i<sup>th</sup> input that minimise cost for DMU<sub>0</sub>

$y_{rj}$  = r<sup>th</sup> output for DMU<sub>j</sub>

$x_{ij}$  = i<sup>th</sup> input for DMU<sub>j</sub>

$y_{rj}$  = s<sup>th</sup> output for nth DMU

$x_{ij}$  = m<sup>th</sup> input for nth DMU

$\lambda_j$  = non-negative scalars



DEA can further help to decompose Technical Efficiency (both input and output oriented) into its components, Pure Technical Efficiency and Scale Efficiency (Coelli, 1998; Sufian, 2004). 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 divergence of a bank from the most productive scale size (scale inefficiency). In other words,  

$$\text{Technical Efficiency} = \text{Pure Technical Efficiency} \times \text{Scale Efficiency}$$

### 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 results of efficiency scores may vary depending on the selection of variables for each of the banks' efficiency (Forughi and De Zoysa, 2012 and Kamarudin *et al.*, 2014). The study based on efficiency of banks widely follows either Operating Approach or Intermediation Approach. 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. Intermediation approach is mostly preferred among researchers to evaluate the efficiency of the banks for the reason that intermediate approach suits more to the nature of the banking industry than production approach (Benston, 1965 and Berger and Humphrey, 1997). Following the intermediation approach, this article uses four inputs and two outputs. In order to calculate the Cost and Revenue Efficiency input and output prices are required. The description of inputs, outputs and their prices are presented in Table: 3.

Table: 3 Description of Input and Output Variables.

Variables	Description
<b>Input Variables</b>	
Deposits	Demand Deposits+ Term Deposit + Savings Deposits.
Borrowings	Borrowings from RBI and other Banks or Financial institutions.
Fixed Assets	Premises+ Fixed Assets under Construction+ Other fixed Assets.
Number of Employees	Number of Employees working in the banks.
<b>Output Variables</b>	
Investments	Investments in Approved Securities, Government Securities, other approved securities, shares, debentures.
Loans and Advances	Term Loans + Cash Credit, Overdraft + Bills purchased and discounted etc.
Non- Interest income	Commission +Bill Discounted +Fee.
<b>Input Prices</b>	
Price of Deposits	Interest paid on Deposits/ Deposits.
Price of Borrowings	Interest paid on borrowings from RBI and other agencies/Borrowing.
Price of Fixed Assets	(Rent, Taxes and Lighting + Depreciation on Banks' assets + Repair and Maintenance + Insurance)/ Fixed Assets.
Price of number of employees	Payment and provisions for employees/ number of employees.
<b>Output Prices</b>	
Prices of Investments	Income (interest and dividend received) from Investments/ Investments.
Prices of Loan and Advances	Interest received from loans and advances/ Loans and Advances.
Prices of Non-Interest Income	Price of non-interest income as unity throughout the years for all banks.



## Findings and Discussion

### Assessment of Cost Efficiency and Revenue Efficiency of Scheduled Commercial Banks in India

Table: 4 depicts year wise average Cost Efficiency, Revenue Efficiency and its components scores of all Scheduled Commercial Banks operating in India over five points of time as 2000-01, 2004-05, 2008-09, 2012-13 and 2016-17.

Table: 4 Cost Efficiency and Revenue Efficiency Scores of Indian Scheduled Commercial Banks

YEAR	No. of Banks	CE	AE (IO)	TE (IO)	PTE (IO)	SE (IO)	RE	AE (OO)	TE (OO)	PTE (OO)	SE (OO)
2000-01	95	0.548	0.643	0.854	0.943	0.905	0.690	0.807	0.854	0.946	0.902
2004-05	83	0.685	0.747	0.914	0.971	0.941	0.658	0.714	0.914	0.968	0.944
2008-09	68	0.713	0.795	0.896	0.978	0.915	0.722	0.804	0.896	0.979	0.914
2012-13	76	0.493	0.567	0.870	0.966	0.898	0.572	0.658	0.870	0.965	0.900
2016-17	91	0.514	0.694	0.742	0.976	0.761	0.529	0.714	0.742	0.977	0.759

### Cost Efficiency of Scheduled Commercial Banks in India

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) (in efficiency) 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.

The 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. Scheduled Commercial Banks operating in India could utilize only 51.4% of the inputs to produce the same level of outputs and they wasted 48.6% of its inputs in 2016-17. Allocative efficiency (input oriented) is 69.4% whereas Technical Efficiency (input oriented) is 74.2%. Further, pure technical (input oriented) and Scale Efficiency (input oriented) of Scheduled Commercial Banks is 97.6% and 76.1% respectively in the year 2016-17.

The Efficiency in 2000-01 is somewhat low this might be due to the reason that importance was given to computerization in the beginning of 2000s. The massive cost incurred on infrastructure and technological up-gradations which escorted banks to low Cost Efficiency. A hike in Cost Efficiency scores is witnessed in 2004-05 due to reduced the wage bill on account of Voluntary Retirement Schemes (VRS) introduced in 2000-01. 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 the Cost Efficiency to 71.3% by the end of 2008-09. A deep decline in the Cost Efficiency of SCBs during 2012-13 seems to be on account of moderate global recovery from the ripples of global financial recession. This is perhaps due to the reason that SCBs' low-cost current and saving account (CASA) deposits posted marginally higher growth as compared to the previous year.

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 1 which 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.

### **Revenue Efficiency of Scheduled Commercial Banks in India**

Revenue Efficiency (inefficiency) of Scheduled Commercial Banks operating in India is 69.0% (31.0%) in 2000-01. This depicts that on an average Scheduled Commercial Banks operating in India could generate only 69.0% revenue from their available inputs. Average allocative efficiency (output oriented) (inefficiency) is 80.7% (19.3%) whereas Technical Efficiency(output oriented) (inefficiency) is 85.4% (14.6%). Pure technical and Scale Efficiency (output oriented) (inefficiency) of Scheduled Commercial Banks is 94.6% (5.4%) and 90.2% (9.8%) respectively. In 2004-05, Scheduled Commercial Banks operating in India could generate only 65.8% of revenue which is less than what they were expected to generate from the same inputs. Allocative efficiency (output oriented) is 71.4% whereas Technical Efficiency (output oriented) is 91.4%. Further, pure technical and Scale Efficiency(output oriented) of Scheduled Commercial Banks is 96.8% and 94.4% respectively for the year 2004-05.

The Revenue Efficiency (output oriented) (inefficiency) of Scheduled Commercial Banks operating in India is 72.2% (27.8%) in 2008-09. The average allocative efficiency, Technical Efficiency, Pure Technical Efficiency and Scale Efficiency(output oriented) is 80.4%, 89.6%, 97.9% and 91.4%, respectively. Scheduled Commercial Banks on an average could generate only 57.2% of revenue in 2012-13 which is again less than what they were expected to generate from the same inputs. In 2012-13, average allocative efficiency(output oriented) is 65.8% whereas Technical Efficiency (output oriented) is 87.0%. Further, Pure technical and Scale Efficiency(output oriented) of Scheduled Commercial Banks is 96.5% and 90.0%, respectively, for the year 2012-13. The Revenue Efficiency (output oriented) (inefficiency) of Scheduled Commercial Banks operating in India is 52.9% (47.1%) in 2016-17. The average allocative efficiency, Technical Efficiency, Pure Technical Efficiency and Scale Efficiency (output oriented) is 71.4%, 74.2%, 97.7% and 75.9%, respectively.

Revenue Efficiency of Indian Scheduled Commercial Banks in 2000-01 is not very high. Interest has been primary source of bank income, followed by non-interest income. The year 2000-01 witnessed deceleration both in the interest income and the non-interest income of banks. The ratio of interest income to total assets lowered to 6.7% in 2004-05 from 8.88% in 2000-01 and non-interest income to total assets fell to 1.5% from 1.32% in 2000-01 hampering the Revenue Efficiency of the banks further in 2004-05 (Reserve Bank of India, 2004-05). The asset quality of banks' improved in 2008-09 due to hard efforts put in by authorities. The same is reflected by declining ratio of gross NPAs to gross advances from 5.2% in 2004-05 to 2.3% in 2008-09 (Reserve Bank of India, 2008-09). This is attributable to the cascading effect





of decline in the growth of profits of Scheduled Commercial Banks (SCBs) due to the slowing down of credit off-take and lesser interest rates. A downfall in the Revenue Efficiency is noticed in 2012-13 and 2016-17. SCBs' interest earnings and non-interest incomes were adversely affected (Reserve Bank of India, 2016-17) which evidently showed its impact on Revenue Efficiency score.

The methodological framework of DEA highlights that Technical Efficiency and allocative efficiency (output oriented) constitute Revenue Efficiency. As a result, to determine the causes of revenue inefficiency, technical and allocative efficiency are required to be analyzed. Table:4 indicates that allocative inefficiency has always been smaller than technical inefficiency. Thus the dominant source of revenue inefficiency is technical inefficiency. The higher technical inefficiency comparative with allocative inefficiency implies that managers are relatively good at choosing the revenue maximizing mix of output at given output prices, but they are not good at producing maximum output from a given input. Furthermore, the decomposition of Technical Efficiency (output oriented) into its components could help in detecting the sources of technical inefficiency. Table: 4 shows Pure Technical Efficiency scores higher than Scale Efficiency scores for all the years under study. This suggests that the greater part of inefficiency among Scheduled Commercial Banks operating in India is attributed to scale inefficiency. Scale inefficiency cautions that banks are not operating on the optimum scale. They need to expand their business not only by opening new branches, but also by increasing their customer base by indulging in quality services and effective customer relation management to achieve economies of scale.

#### **Analysis of Cost Efficiency vis-à-vis Revenue Efficiency of Scheduled Commercial Banks in India**

As depicted from the results of Cost Efficiency and Revenue Efficiency, the highest level of inefficiency subsisted on the cost side as Scheduled Commercial Banks have higher Revenue Efficiency score in comparison to Cost Efficiency scores. SCBs had adopted modernisation and offered electronic banking, Mobile Banking, Credit Card, Automatic Teller Machines (ATM), Electronic Fund Transfers (EFTs), Real Time Gross settlement (RTGs) and National Electronic Fund Transfer (NEFTs) etc. These advancements increased their cost resulting into temporary cost inefficiency. But it is worth mentioning that these investments in technological advancements enhanced the revenues of banks by enabling them to provide quality services and helping them sustain their market share against Non-banking Financial Institutions and other financial houses. Also, Scheduled Commercial Banks (SCBs) exhibited greater emphasis on product diversification and adoption of information technology for providing quality services to customers which helped them to enhance their revenues. SCBs also framed customer orientated strategies in order to meet thrust towards retail banking and thus enhance the revenues.

#### **Assessment of Cost Efficiency and Revenue 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 and Revenue Efficiency Scores of Indian Scheduled Commercial Banks across Ownership

		Public Sector Banks						Private Sector Banks						Foreign Sector Banks					
<b>Cost Efficiency</b>																			
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				
2016-17	0.401	0.707	0.568	0.980	0.578	0.397	0.664	0.597	0.972	0.613	0.634	0.691	0.922	0.976	0.944				
<b>Revenue Efficiency</b>																			
YEAR	RE	AE (OO)	TE (OO)	PTE (OO)	SE (OO)	RE	AE (OO)	TE (OO)	PTE (OO)	SE (OO)	RE	AE (OO)	TE (OO)	PTE (OO)	SE (OO)				
2000-01	0.749	0.831	0.896	0.978	0.917	0.625	0.751	0.837	0.925	0.906	0.702	0.837	0.839	0.940	0.889				
2004-05	0.732	0.786	0.926	0.987	0.939	0.626	0.683	0.907	0.957	0.948	0.615	0.672	0.908	0.962	0.943				
2008-09	0.681	0.785	0.866	0.984	0.880	0.743	0.850	0.869	0.955	0.909	0.754	0.785	0.960	0.997	0.964				
2012-13	0.518	0.587	0.884	0.980	0.901	0.624	0.767	0.807	0.953	0.846	0.585	0.647	0.899	0.961	0.935				
2016-17	0.552	0.973	0.567	0.981	0.577	0.408	0.685	0.597	0.974	0.612	0.685	0.743	0.922	0.978	0.942				

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), RE: Revenue Efficiency, AE (OO): Allocative Efficiency (Output Oriented), TE (OO): Technical Efficiency (Output Oriented), PTE (OO): Pure Technical Efficiency (Output Oriented), SE (OO): Scale Efficiency (Output Oriented)



## Cost Efficiency of Public Sector Banks in India

Table: 5 presents the Revenue and Cost Efficiency scores over five 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. Public Sector Banks operating in India could utilize only 40.1% of resources in 2016-17 to produce what they are producing from their resources. In 2016-17, average allocative efficiency is 70.7% whereas Technical Efficiency is 56.8%. Further, pure technical and Scale Efficiency of Public Sector Banks is 98.0% and 57.8% respectively for the year 2016-17.

## Cost Efficiency of Private Sector Banks in India

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. Private Sector Banks (on an average) could utilize only 39.7% of resources in 2016-17 thus wasting the rest of resources. In 2016-17, average allocative efficiency is 66.4% whereas Technical Efficiency is 59.7%. Further, pure technical and Scale Efficiency of Private Sector Banks is 97.2% and 61.3% respectively, for the year 2016-17.

## Cost Efficiency of Foreign Sector Banks in India

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. In the year 2016-17, Cost Efficiency (inefficiency) of Foreign Sector Banks operating in India is 63.4%. Average Allocative efficiency, Technical Efficiency, Pure Technical Efficiency and Scale Efficiency is 69.1%, 92.2%, 97.1% and 94.4%, respectively, in 2016-17.

### **Analysis of Cost Efficiency (Inefficiency) in Public vis-à-vis Private vis-à-vis Foreign Sector Banks**

Public Sector Banks have been facing the problem of surplus manpower resources since long depicted by wage bill to total assets provides an evidence of this inefficiency. In order to reduce this cost, PSBs offered Voluntary Retirement Scheme (VRS) to the employees in 2000-01 which gradually decreased their operating cost depicting better Cost Efficiency. A rise in interest expenditure 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 the Cost Efficiency scores. A high and rising proportion of banks' delinquent loans in case of public sector banks (PSBs) increased the provisioning for non-performing assets which resulted in stressed financial position of 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. Private Sector Banks lowered their interest expenditure which led to improvement in the Cost Efficiency. 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. The cost of deposits 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. Private sector banks witnessed higher growth in Current and saving account deposits which increased their cost of deposits hence leads to lower cost efficiency. Foreign Sector Banks too have been paying high rate of interest to attract customers. In 2004-05 the interest expenditure witnessed decrease owing to the reason that Benchmark Prime Lending Rates (BPLRs) (Reserve Bank of India, 2004-05). The ratio of operating expenditure to total assets decreased from 2.87% in 2004-05 to 2.76% in 2008-09. This tends to increase the Cost Efficiency of Foreign Sector Banks. In order to retain and sustain customers after US recession, Foreign Sector Banks had also offered high rate of interest on deposits. Foreign Sector Banks witnessed higher growth in Current and saving account deposits which increased their cost of deposits hence leads to lower cost efficiency.

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.

### **Revenue Efficiency of Public Sector Banks in India**

Table: 5 also highlights the Revenue Efficiency scores of banks in different sectors. Revenue Efficiency (inefficiency) of Public Sector Banks operating in India is 74.9% (25.1%) in 2000-01. Average Allocative efficiency is 83.1% (16.9%) whereas Technical Efficiency is 89.6% (10.4%). Pure technical and Scale Efficiency of Public Sector Banks is 97.8% (2.2%) and 91.7% (8.3%) respectively. Public Sector Banks operating in India could generate only 73.2% of revenue in 2004-05, which is less than what they were expected to generate from the same inputs. In 2004-05, average allocative efficiency is 78.6% (21.4%) whereas Technical Efficiency is 92.6% (7.4%). Further, pure technical and Scale Efficiency of Public Sector Banks is 98.7% (1.3%) and 93.9% (6.1%), respectively, for the year 2004-05. Revenue Efficiency of Public Sector Banks operating in India is 68.1% (31.9%) in 2008-09. Average allocative efficiency, Technical Efficiency, Pure Technical Efficiency and Scale Efficiency is 78.5%, 86.6%, 98.4% and 88.0%, respectively. Public Sector Banks on average could generate only 51.8% of revenue in 2012-13, which is less than what they were expected to generate from the same inputs. In 2012-13, average allocative efficiency is 58.7% whereas Technical Efficiency is 88.4%. Further, pure technical and Scale Efficiency of Public Sector Banks is 98.0% (2%) and 90.1% (9.9%) respectively for the year 2012-13. Revenue Efficiency of Public Sector Banks operating in India is 55.2% in 2016-17. Average allocative efficiency, Technical Efficiency, Pure Technical Efficiency and Scale Efficiency is 97.3%, 56.7%, 98.1% and 57.7%, respectively.

### **Revenue Efficiency of Private Sector Banks in India**

Private Sector Banks on an average could generate only 62.5% of revenue in 2000-01, less than what they were expected to generate from the same inputs. In 2000-01, average Allocative efficiency is 75.1% (24.9%) whereas Technical Efficiency is 83.7% (16.3%). Further, Pure Technical and Scale Efficiency of Private Sector Banks is 92.5% (7.5%) and 90.6% (9.4%) respectively for the year 2000-01. The Revenue Efficiency of Private Sector Banks operating in India is 62.6% (37.4%) in 2004-05. Average Allocative efficiency, Technical Efficiency, Pure Technical Efficiency and Scale Efficiency is 68.3%, 90.7%, 95.7% and 94.8% respectively. The Revenue Efficiency (inefficiency) of Private Sector Banks operating in India is 74.3% (25.7%) in 2008-09. Average Allocative efficiency is 85.0% whereas Technical Efficiency is 86.9%. Pure Technical and Scale Efficiency of Private Sector Banks is 95.5% and 90.9% respectively. Private Sector Banks operating in India could generate only 62.4% of revenue in 2012-13, which is less than what they were expected to generate from the same inputs. In 2012-13, average Allocative efficiency is 76.7% (23.3%) whereas Technical Efficiency is 80.7% (19.3%). Further, Pure Technical and Scale Efficiency of Private Sector Banks is 95.3% (6.5%) and 84.6% (15.4%) respectively for the year 2012-13. Revenue Efficiency of Private Sector Banks operating in India is 40.8% in 2016-17. Average allocative efficiency, Technical Efficiency, Pure Technical Efficiency and Scale Efficiency is 68.5%, 59.7%, 97.4% and 61.2%, respectively.

### **Revenue Efficiency of Foreign Sector Banks in India**

Revenue Efficiency (inefficiency) of Foreign Sector Banks operating in India is 70.2% (29.8%) in 2000-01. Average allocative efficiency is 83.7% (16.3%) whereas Technical Efficiency is 83.9% (16.1%). Pure technical and Scale Efficiency of Foreign Sector Banks is 94.0% (6.0%) and 88.9% (11.1%), respectively. In the year 2004-05, Revenue Efficiency (inefficiency) of Foreign Sector Banks operating in India is 61.5% (38.5%). Average allocative efficiency, Technical Efficiency, Pure Technical Efficiency and Scale Efficiency is 67.2%, 90.8%, 96.2% and 94.3%, respectively in 2004-05. Foreign Sector Banks operating in India could generate only 75.4% of revenue in 2008-09, which is less than what they were expected to



generate from the same inputs. In 2008-09, average allocative efficiency (inefficiency) is 78.5% (21.5%) whereas Technical Efficiency is 96.0% (4.0%). Further, pure technical and Scale Efficiency of Foreign Sector Banks is 99.7% and 96.4%, respectively for the year 2008-09. Foreign Sector Banks on an average could generate only 58.5% of revenue in 2012-13, less than what they had anticipated to generate from the same inputs. In 2012-13, average allocative efficiency is 64.7% (35.3%) whereas Technical Efficiency is 89.9% (10.1%). Further, pure technical and Scale Efficiency (inefficiency) of Foreign Sector Banks is 96.1% (3.9%) and 93.5% (6.5%) respectively for the year 2012-13. Revenue Efficiency of Foreign Sector Banks operating in India is 68.5% in 2016-17. Average allocative efficiency, Technical Efficiency, Pure Technical Efficiency and Scale Efficiency is 74.3%, 92.2%, 97.8% and 94.2%, respectively.

### **Analysis of Revenue Efficiency (Inefficiency) in Public vis-à-vis Private vis-à-vis Foreign Sector Banks**

In order to counter intense competition in the market, PSBs were forced to provide banking services at minimum returns. As a result the interest income to total assets of Public Sector Banks reduced from 18.88% in 1999-2000 to 18.46% in 2000-01. The trend continued till 2004-05 with the ratio lowering to 12.66%. In the successive years also market uncertainties resulting from global crisis did not let PSBs heave a sigh of relief, further lowering the Revenue Efficiency scores in 2008-09. The poor asset quality of PSBs added fuel to the fire. The rise in NPAs from 1.97% in 2008-09 till 2.02% in 2012-13 (Reserve Banks of India, 2013) further marred the Revenue Efficiency of PSBs. Private Sector Banks developed their customer base manifold by providing customers with innovative and prompt services (Jain, 2011). They had even started offering fee based services like merchant banking, cash management services, credit rating services, online trading facilities to the Demat account holders, tie up with the Government companies for opening salary accounts of the employees etc along with accepting deposits and lending funds. This seems to have accelerated their Revenue Efficiency scores from 0.625 in 2000-01, to 0.626 in 2004-05 and further to 0.743 in 2008-09. However, decreased relative Revenue Efficiency scores of Private Sector Banks in 2012-13 show their inability to generate maximum revenues from the available inputs given their output prices. Foreign Sector Banks (FSBs) lend loans and advances to them at lower interest rates as compared to their domestic counterparts. This affects their revenues. The same is evident from the ratio of interest income to total assets ratio which reduced from 7.68% in 2002-03, to 5.95% in 2004-05 (Reserve Bank of India, 2003-04). Thus, the Revenue Efficiency scores of Foreign Sector Banks diminished in 2004-05 as against 2000-01. The year 2008-09 witnessed augmentation in both the interest income as well as non-interest income of Foreign Sector Banks. This augmentation highlights their good performance thus enhancing their Revenue Efficiency scores. A significant observation also suggests that Revenue Efficiency of Foreign Sector Banks declined to their lowest in 2012-13. After the global financial crisis, Foreign Sector Banks had reduced their long term lending and shifted to short term exposures as far as granting of loans was concerned. Interest rate over short period is less as compared to when lending is made for a longer period of time, thus affecting the Revenue Efficiency.

The methodological framework highlighted that Technical Efficiency and allocative efficiency (output oriented) comprise of Revenue Efficiency. Table: 5 indicates that allocative inefficiency has always been higher than technical inefficiency. Thus the dominant source of revenue inefficiency is allocative inefficiency. The higher allocative inefficiency comparative to technical inefficiency implies that managers are not efficient in choosing the revenue maximizing mix of output given the output prices. Further, the Technical Efficiency components depict that all sector banks are operating at incorrect scale as depicted by low Scale Efficiency as compared to Pure Technical Efficiency. Scale inefficiency cautions that banks are not operating on the optimum scale. They need to expand their business not only by



opening new branches, but also by increasing their customer base by indulging in quality of services and effective customer relation management to achieve economies of scale.

### **Cost Efficiency vis-à-vis Revenue Efficiency of Scheduled Commercial Banks in India Across Ownership**

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, 2012-13 and 2016-17. Similarly, on the revenue side, Public Sector Banks have higher Revenue Efficiency scores in 2000-01 and 2004-05, Foreign Sector Banks in 2008-09 and 2016-17 and Private Sector Banks in 2012-13.

Holistically, the efficiency score across ownership highlights that Public Sector Banks have the highest level of inefficiency on the cost side as compared to private sector and Foreign Sector Banks. Disguised employment has been major troubling factor for PSBs. It leads to hiked salary bills with negligible productivity (Bhatia and Mahendru, 2015). PSBs are also not able to utilise their capital investment effectively (Jagannathan, 2014). In meeting their social objectives they open their branches in the rural areas. But this investment does not pay back itself as the customer is comparatively less literate and lesser tech-savvy. This makes them cost inefficient. However, relative to Cost Efficiency, Revenue Efficiency scores of PSBs are better. 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 on these banks. This helps them to earn better revenues. Private Sector Banks seem to be better on the revenue side at most of points of time. Private Sector Banks have been the pioneers in 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 Revenue Efficiency of Private Sector Banks. Foreign Sector Banks show more inefficiency on the revenue side as these have higher Cost Efficiency score in comparison to Revenue Efficiency scores. Foreign Sector Banks save their infrastructural cost as they do not exist in brick and mortar 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.

### **Robustness Test Across Ownership**

After examining the results derived from DEA, the issue of attention at this moment is whether the difference in the Revenue Efficiency and 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 Revenue Efficiency and 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

Efficiency Year	Cost Efficiency				Revenue Efficiency			
	Banks	Mean Scores	F test	Sig.	Banks	Mean Scores	F test	Sig.
2000-01	Public Sector Banks	0.578	1.709	.187	Public Sector Banks	0.749	3.456**	.036
	Private Sector Banks	0.496			Private Sector Banks	0.625		
	Foreign Sector Banks	0.569			Foreign Sector Banks	0.702		
2004-05	Public Sector Banks	0.684	0.187	.830	Public Sector Banks	0.732	2.378	.099
	Private Sector Banks	0.702			Private Sector Banks	0.626		
	Foreign Sector Banks	0.668			Foreign Sector Banks	0.615		
2008-09	Public Sector Banks	0.650	8.361*	.001	Public Sector Banks	0.681	1.526	.225
	Private Sector Banks	0.698			Private Sector Banks	0.743		
	Foreign Sector Banks	0.808			Foreign Sector Banks	0.754		
2012-13	Public Sector Banks	0.368	22.160*	.000	Public Sector Banks	0.518	1.976	.146
	Private Sector Banks	0.431			Private Sector Banks	0.624		
	Foreign Sector Banks	0.642			Foreign Sector Banks	0.585		
2016-17	Public Sector Banks	0.401	15.962*	.000	Public Sector Banks	0.552	36.063	.000
	Private Sector Banks	0.397			Private Sector Banks	0.408		
	Foreign Sector Banks	0.634			Foreign Sector Banks	0.685		

\*, \*\*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, 2012-13 and 2016-17. As Cost Efficiency has F value of 8.361, 22.160 and 15.962 in 2008-09, 2012-13 and 2016-17 respectively and are statistically significant at 1% level of significance. Revenue Efficiency has F score of 3.456 and 36.063 in the year 2000-01 and 2016-17, which means that the difference is significant at 5% and 1% level of significance respectively. Further, the results show that the difference among groups in case of Cost Efficiency and Revenue Efficiency scores is statistically insignificant for the rest of the years.

Overall, the results of ANOVA depict that cost and Revenue 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**

Efficiency	Cost Efficiency			Revenue Efficiency				
	(I) Banks	(J) Banks	Mean Difference (I-J)	(I) Banks	(J) Banks	Mean Difference (I-J)		
Years								
2000-01	Public Sector Banks	Private Sector Banks	0.08155	0.05011	Public Sector Banks	Private Sector Banks	0.1234**	0.04787
		Foreign Sector Banks	0.00884	0.04819		Foreign Sector Banks	0.04616	0.04603
	Private Sector Banks	Foreign Sector Banks	-0.08155	0.05011	Private Sector Banks	Public Sector Banks	-0.1234**	0.04787
		Foreign Sector Banks	-0.07311	0.04635		Foreign Sector Banks	-0.07724	0.04428
	Foreign Sector Banks	Public Sector Banks	-0.00884	0.04819	Foreign Sector Banks	Public Sector Banks	-0.04616	0.04603
		Private Sector Banks	0.07311	0.04635		Private Sector Banks	0.07724	0.04428
Public Sector Banks	Private Sector Banks	-0.01774	0.05537	Public Sector Banks	Private Sector Banks	0.16551	0.0582	
2004-05	Public Sector Banks	Foreign Sector Banks	0.0167	0.05692	Private Sector Banks	Foreign Sector Banks	0.1167	0.05983
		Foreign Sector Banks	0.01774	0.05537		Public Sector Banks	-0.11551	0.0582
	Private Sector Banks	Foreign Sector Banks	0.03444	0.05645	Foreign Sector Banks	Public Sector Banks	0.01118	0.05933
		Foreign Sector Banks	-0.0167	0.05692		Public Sector Banks	-0.1167	0.05983
	Foreign Sector Banks	Private Sector Banks	-0.03444	0.05645	Foreign Sector Banks	Private Sector Banks	-0.01118	0.05933
		Private Sector Banks	-0.04835	0.03974		Private Sector Banks	-0.06209	0.04666
Public Sector Banks	Foreign Sector Banks	-0.15862*	0.0392	Foreign Sector Banks	Foreign Sector Banks	-0.07342	0.04602	
2008-09	Private Sector Banks	Public Sector Banks	0.04835	0.03974	Private Sector Banks	Public Sector Banks	0.06209	0.04666
		Public Sector Banks	0.04835	0.03974		Public Sector Banks	0.06209	0.04666
	Foreign Sector Banks	Private Sector Banks	-0.11028**	0.04209	Foreign Sector Banks	Private Sector Banks	-0.01133	0.04941
		Private Sector Banks	0.15862*	0.0392		Public Sector Banks	0.07342	0.04602
	Foreign Sector Banks	Public Sector Banks	0.11028**	0.04209	Private Sector Banks	Public Sector Banks	0.01133	0.04941
		Public Sector Banks	-0.06329	0.0478		Private Sector Banks	-0.11058	0.05478
2012-13	Public Sector Banks	Foreign Sector Banks	-0.27361*	0.04307	Public Sector Banks	Foreign Sector Banks	-0.06694	0.04935
		Foreign Sector Banks	-0.27361*	0.04307		Foreign Sector Banks	-0.06694	0.04935
	Private Sector Banks	Public Sector Banks	0.06329	0.0478	Private Sector Banks	Public Sector Banks	0.16558	0.05478
		Public Sector Banks	0.06329	0.0478		Public Sector Banks	0.16558	0.05478
	Foreign Sector Banks	Private Sector Banks	-0.21032*	0.0464	Foreign Sector Banks	Private Sector Banks	-0.03863	0.05317
		Private Sector Banks	0.27361*	0.04307		Public Sector Banks	0.06694	0.04935
2016-17	Foreign Sector Banks	Public Sector Banks	0.21032*	0.0464	Foreign Sector Banks	Public Sector Banks	-0.03863	0.05317
		Public Sector Banks	-0.00585	0.5881		Private Sector Banks	0.14402**	0.03609
	Public Sector Banks	Foreign Sector Banks	-24204**	0.4963	Public Sector Banks	Foreign Sector Banks	-0.13221**	0.03045
		Foreign Sector Banks	-24204**	0.4963		Public Sector Banks	-0.13221**	0.03045
	Private Sector Banks	Public Sector Banks	0.00585	0.5881	Private Sector Banks	Public Sector Banks	-0.14402**	0.03609
		Public Sector Banks	0.00585	0.5881		Private Sector Banks	-0.14402**	0.03609
Foreign Sector Banks	Private Sector Banks	0.23620**	0.5381	Foreign Sector Banks	Private Sector Banks	-0.27623**	0.03302	
	Private Sector Banks	0.24204**	0.04963		Public Sector Banks	0.13221**	0.03045	
Foreign Sector Banks	Private Sector Banks	0.23620**	0.5381	Foreign Sector Banks	Private Sector Banks	0.27623**	0.03302	

\*, \*\*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, 2012-13 and 2016-17. 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. The mean difference between foreign-public is 0.24204 and between foreign-private is 0.23620 and both are statistically significant at 5% level of significance.

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. On the other hand, Revenue Efficiency scores depict that the mean difference between Public-Private is 0.1234, with p value of 0.013 which was significant at 5% level of significance in 2000-01. The mean difference between foreign-public is 0.13221 and between foreign-private is 0.27623 and both are statistically significant at 5% level of significance. PSBs have old existence and reputable position in the market, their being the Government protected banks, helps them to earn greater revenues. Moreover, PSBs with the introduction of reforms and competition in the market extended their business to fee based services like letter of credit, bank guarantee, factoring, underwriting and custodial services etc. The cumulative effect of all these efforts seemed to have accelerated their revenue efficiency in the year 2000-01.

## Conclusion

Scheduled Commercial Banks are not able to maintain their input-output synchronization in terms of cost and revenue. 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. The results of the study indicate that Foreign Sector Banks are most Cost Efficient Banks in the recent time period i.e. 2008-09 and 2012-13. No doubt, banks operating in different sectors are regulated and fully controlled by Reserve Bank of India; still, there are some differences among them in terms of their working, customer base, employee base, spread of their branches and working environment etc. Like, Foreign Sector Banks have disciplined work environment and employ trained and specialised staff with the main focus on corporate clients. On the other hand, both domestic banks i.e. Public Sector and Private Sector banks operate in the rural, urban and semi-urban areas.

Certainly, PSBs and Private Sector Banks have similar norms, but their existence, goals and interference from Government builds a gap among them. Public Sector Banks have the obligation to fulfil social objectives along with achieving profit whereas Private Sector Banks focus mainly on the profit maximisation objective. Thus, there is a need that banks operating in different sectors to be more professional. Private Sector Banks and Foreign Sector Banks too must equally share society oriented targets with Public Sector Banks so that social responsibilities along with revenues is evenly divided. Reserve Bank of India is making efforts towards this end. It has revamped the priority sector lending norms according to which Foreign Sector Banks with more than 20 branches too have to move towards 40% Total Priority Sector Target by 2018 while FSBs with less than 20 branches have to attain this target by 2019-20. Thus it is hoped that the gap between the banks operating under divergent ownership would be reduced in the near future and Indian banking sector as a whole would become more efficient.

The present study has made an effort to consider a major research gap by simultaneously evaluating the Cost and Revenue 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 and Revenue Efficiency of banks.

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