

COST EFFICIENCY OF SCHEDULED COMMERCIAL BANKS: EMPIRICAL EVIDENCE FROM INDIA

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Abstract

The paper endeavours to assess the Cost Efficiency (CE) scores of all Scheduled Commercial Banks operating in India. In order to have comprehensive vision the cost efficiency is evaluated across ownerships well to identify the best performing and worst performing banking sector. The study also determines the nature of Return to Scale (RTS) of the Indian banking industry. Further, the paper recognizes the number of banks operating as leaders and laggards according to Cost Efficiency and its component scores. The results of Data Envelopment Analysis (DEA) suggest that Indian Scheduled Commercial Banks have never achieved full Cost Efficiency score of 1 in any of the years from 2002-03 to 2012-13. The sector-wise findings highlight that Foreign Sector Banks are the most cost efficient banks followed by Private Sector Banks and at last the Public Sector Banks.

Keywords: Cost efficiency, Scheduled Commercial Banks, Return to scale, Leaders and laggards, Data Envelopment Analysis, India.

1. Introduction

Efficiency refers to the best allocation of resources to obtain the highest level of outputs. It is defined as the choice of alternatives which uses the minimum inputs to produce the given outputs (Markevitt and Lawton, 1994). Efficiency measures a bank's performance in relation to a yardstick at a given point of time (Ram Mohan and Ray 2004). It depicts how well a bank converts its resources into qualitative products and services at the minimum possible cost. Banks can take advantage of competitive environment only if these perform efficiently in the market (Bader *et al.*, 2008). If banks are fully efficient,

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these can have improved profitability which provides safety to absorb huge risks (Berger et al, 1993; Egesa, 2010). An efficient bank can provide more trustworthy services to the consumers at optimum prices which help to maintain faith, confidence and reliability of the customers in the banking sector (Zeitun and Benjelloun, 2013). Moreover, 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, 2011; Pančurová and Lyócsa, 2013). Efficiency of banking system is instrumental in the welfare of society as a whole as it aids in offering innovative and quality service to society at the minimum cost (Valverde *et al.*, 2003; Bader *et al.*, 2008 and Gulati and Kumar, 2011). Thus, the most imperative goal of a bank is to minimise its cost. In other words, a bank must be Cost Efficient. Cost efficiency is based on input oriented approach as it assesses a bank's competence in controlling its cost (Coelli *et al.*, 2005). Cost Efficiency depicts the relative performance of a bank as against the best practice bank which is producing the same output at the lowest operating cost under similar technological conditions as faced by the concerned bank. It tells how close a bank's cost is to the best practice bank's cost for producing the same level of outputs (Weill, 2004). In other words, Cost Efficiency depicts how much a bank can reduce its cost while 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. It is the ratio of the cost of a fully efficient bank with same output quantities and input prices (i.e. bank operating on the efficient cost frontier) to the given bank's actual costs, i.e. the bank whose efficiency is calculated (Cummins *et al.*, 2010). It can be written as the ratio of Minimum Cost to Observed Cost.

Farrell (1957) proposed that the Cost Efficiency (CE) of a bank consists of two components, i.e. Technical Efficiency (TE) and Allocative Efficiency (AE). Cost Efficiency is a multiplicative combination of Technical Efficiency (TE) and Allocative Efficiency (AE) such as $CE = TE * AE$ (Farrell, 1957). Technical Efficiency (input oriented) relates to quantities of inputs while Allocative Efficiency (input oriented) relates to prices of inputs (Barros and Mascarenhas, 2005). To be fully cost efficient, a bank must be both technically and allocatively efficient (Coelli, 1996). The segregation of Cost Efficiency into technical and allocative components helps to know the sources of cost inefficiency. Technical inefficiencies arise due to inadequate technologies or deficiency in the adoption of technology or due to use of less productive input factors while the allocative inefficiencies are due to a suboptimal allocation of input factors. Thus, the product of Technical Efficiency (input oriented) and Allocative Efficiency (input oriented) provides Cost Efficiency. A bank is said to be fully efficient in terms of Cost Efficiency when it uses inputs that are necessary to produce the given outputs

(Technical Efficiency) and with the given input prices, they are unable to minimize the cost proportions further (Allocative Efficiency).

Thus, to have deeper insights into the Cost Efficiency of Indian banks the article is set out in various sections. The first section introduces the theoretical framework with regard to bank's Cost Efficiency. The second section reviews the literature to identify the research gap. The third section outlines the objectives of the study. The fourth section discusses the database and research methodology adopted in the paper. Section fifth explains the results, and finally, sixth section concludes the article.

2. Review of Literature

The evaluation of Cost Efficiency of banks came in vogue amongst researchers in early 2000s. Isik and Hassan (2002) estimated Cost Efficiency of Turkish Banks for a period 1988–1996. The study found that the Cost Efficiency of Turkish Banking Sector decreased from 78% in 1988, to 71% in 1992 and to 68% in 1996. The dominant source of Cost Inefficiency was Technical Inefficiency which emerged because the Turkish banks did not operate at a correct scale. The study also evaluated the trends in Return to Scale. The results of Return to Scale showed that majority of Turkish Banks were facing diseconomies of scale as 47% of banks in 1988, 48% of banks in 1992 and 53% of banks in 1996 were operating at Decreasing Return to Scale (DRS). Niazi (2003) calculated Cost Efficiency of Pakistan Commercial Banks from 1991-2000. The study revealed that Cost Efficiency varied from 46.6% to 97.4% for all banks during the entire study period. The Cost Efficiency score of Foreign Banks, Private Banks and State-Owned Banks was 79.7%, 75.1% and 60.5% respectively suggesting that Foreign Banks were the most Cost Efficient Banks. Allocative Inefficiency was the main reason of Cost Inefficiency. The results of Return to Scale depicted that majority of Pakistani Banks were functioning on the correct scale i.e. Constant Return to Scale (CRS). Weill (2004) measured the Cost Efficiency of banks belonging to five European countries namely France, Germany, Italy, Spain and Switzerland for the period 1992-1998. The results of Bank Specialization showed that Co-operative Banks were most efficient followed by the Commercial and then Savings Banks. Girardone *et al.* (2004) examined Italian banks' Cost Efficiency for the years 1993 to 1996. The study reported that Credit Co-operative Banks had the highest Cost Efficiency followed by Popular, Savings and Commercial Banks. Burki and Niazi (2006) compared Cost Efficiency of Domestic and Foreign Banks of Pakistan for the period 1991 to 2000. The study found that the Cost Efficiency of all Pakistan Banks was 74.5%. Foreign Banks were much better as compared to Domestic Banks in the first-reform period, but in the second-reform period, the Cost Efficiency of Foreign Banks

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chopped down. The results of Return to Scale showed that 43.7% of all Commercial Banks operating in Pakistan were operating on Constant Return to Scale (CRS). Chatterjee and Sinha (2006) evaluated the Cost Efficiency of 20 Public Sector Banks and 10 Private Sector Banks in India from 1996-97 to 2002-03. The results of the study depicted that overall Indian Scheduled Commercial Banks had Cost Efficiency of 0.713 in 1996-97 which declined significantly to 0.662 in 2002-03. Private Sector Banks had higher Cost, Technical, Allocative and Scale Efficiency as compared to Public Sector Banks. Sahoo *et al.* (2007) examined the Cost Efficiency of 81 Indian Commercial Banks across ownership for the period 1997-98 to 2004-05. The study revealed that there were significant differences in the Cost Efficiency scores among Nationalised and Private Banks, Nationalised and Foreign Banks, Private Banks and Foreign Banks. Ioanniset *al.* (2008) analysed Allocative, Technical and Cost Efficiency of all banks operating in Greek Banking System from 1994 to 2006. The results revealed that average efficiency of Greek Banking System showed enhancement over time as it augmented from 0.74 in 1994 to 0.82 in 2006. Kalluru and Bhat (2009) examined the Cost Efficiency of Indian Commercial Banks for the period 1992- 2006. The results of the study showed that the Cost Efficiency of all Indian Commercial Banks had decreased for the time period of the study. The ownership-wise results showed that Foreign Sector Banks were relatively more Cost Efficient followed by Private and Public Sector Banks in India. Brack and Jimborean (2009) compared the Cost Efficiency of European and American Banks over the period 1994-2006. The study found an enhancement in the Cost Efficiency scores for banks working in France and Spain while a decline for banks in Germany, Italy, United-Kingdom and United States. Staubet *al.* (2010) investigated the Cost, Technical and Allocative Efficiency of Brazilian Banks for the period 2000-2007. The study found that the average Cost, Allocative and Technical Efficiency (inefficiency) was 44.7% (55.3%), 66.9% (51.40%) and 63.3% (57.98%) respectively. The results of the study depicted that the main source of Cost Inefficiency was Technical Inefficiency till 2002, but Allocative Inefficiency became the major cause thereafter. Public Banks were the most efficient followed by Private Domestic Banks and there was relatively higher inefficiency among Foreign Banks. Kumar and Gulati (2010) analysed the Cost Efficiency of 27 Indian Public Sector Banks (PSBs) from 1992-93 to 2007-08. The study reported that on average PSBs had Cost, Technical and Allocative Efficiency Score of 0.796, 0.844 and 0.944 respectively. The study also reported that the Cost Efficiency of PSBs improved significantly in the second phase of reforms as compared to first phase of reforms. Kaur and Kaur (2010) examined the impact of merger on the Cost Efficiency of selected merged banks over the period 1990-91 to 2007-08. The results showed that the impact of merger on efficiency depicted that 6 out of 11 banks had positive impact of merger as

these banks showed better efficiency after merger. Gulati (2011) checked the impact of inclusion of non-interest income in the banks' output on the Cost Efficiency of Indian Banks from 1992-93 to 2007-08. The results of the study highlighted that dropping non-interest income understated true efficiency of the banks. Foreign Banks always ranked at top position in Model A, which included non-interest income but, according to Model B which dropped non-interest income, Public Sector Banks were more efficient than their counterparts. Private Sector Banks were consistently least Cost Efficient in both the sub-periods according to Model A. Cost Inefficiency among Indian Scheduled Commercial Banks was due to Allocative Inefficiency. Further, Technical Inefficiency was due to Pure Technical Inefficiency. Most of Indian Scheduled Commercial Banks experienced Increasing Return to Scale (IRS). Uddin and Suzuki (2011) studied the performance of Commercial Banks in Bangladesh after the execution of financial reforms from 2001-2008. The study observed that overall the average of Cost and Income Efficiency score was 0.793 and 0.449 respectively. Abu-Alkheil (2012) used DEA-approach to calculate Cost Efficiency (CE), Allocative Efficiency (AE), Technical Efficiency (TE), Pure Technical Efficiency (PTE), and Scale Efficiency (SE) of Islamic and Conventional Banks over the period 2008-2009 operating in European countries i.e. UK and Switzerland. The results showed that the average Cost Efficiency (CE) of Conventional Banks was 69.7% which was better than that of Islamic Banks which had the efficiency score of 49.3%. The results of Return to Scale reported that most of the Conventional Banks were operating on the Decreasing Return to Scale (DRS) while Islamic Banks were operating on either Constant or Increasing Return to Scale. Kumar (2013) analyzed the Cost Efficiency of Indian Public Sector Banks (PSBs) during 1992-1993 to 2007-2008. The results of the study showed that the average Cost Efficiency (inefficiency) of Indian Public Sector Banks was 79.6% (25.6%). The average Cost Inefficiency for Public Sector Banks was primarily due to Technical Inefficiency. Raina and Sharma (2013) examined the Cost Efficiency (CE) of 64 Indian Commercial Banks for the period 2005-06 to 2010-11. The results found that the average CE was 72.4%, Technical Efficiency (TE) 94.5% and Allocative Efficiency (AE) 76.7%. The results highlighted that TE was consistently higher than AE which suggested that Allocative Inefficiency was the main reason for Cost inefficiency.

Review of Literature suggests that Cost efficiency evaluation has gained prime significance across the globe especially since past two decades amongst researchers. A lot of empirical work has been undertaken in several countries to assess the cost efficiency performance of banking industry. With specific reference to India only handful of studies are available that evaluated the cost efficiency performance of the banks. Majority of these studies as Chatterjee and Sinha (2006), Sahoo *et al.* (2007), Kalluru and

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Bhat (2009), Kumar and Gulati (2010), Kaur and Kaur (2010), Gulati (2011) and Kumar (2013) cater to cost efficiency evaluation of an old period of time having diluted significance in the current years. A very critical time period of recession aftermath has not been considered by these studies. Raina and Sharma (2013) evaluated the Cost Efficiency during 2005-06 to 2010-11 and cover the recession time period but an evaluation over just 5 years seems to be less comprehensive. Moreover, the study does not analyse the differences in cost efficiency across bank ownership and thus fails to give much decisive findings. Control of cost is a pre requisite of commercial success. Hence, there is a need to reassess the issue in the Indian Scheduled Banks.

3. Objectives of the study

Keeping in mind the above research gap, the main purpose of this paper is to assess the Cost Efficiency (CE) scores of Indian Scheduled Commercial Banks operating in India. In addition, Cost Efficiency is analyzed across bank ownership as well, to identify the best performing and worst performing banking sector. Besides, the nature of Return to Scale (RTS) of Indian SCBs as a whole as well as across varied ownership is analyzed. The paper also measures the number of banks operating as leaders and laggards according to Cost Efficiency and its components scores.

4. Data base and Methodology

a. Database

The sample of the study includes all the Scheduled Commercial Banks operating in India during 2002-03 to 2012-13. The number of banks varies across time due to missing observations and non-availability of data for some banks for certain years. Resultantly, an effective sample of banks varies from year to year. The sample is given in Table: 1 as follows:

Table 1: Sample of Scheduled Commercial Banks across ownership

Year	Indian Scheduled Commercial Banks	Public Sector Banks	Private Sector Banks	Foreign Sector Banks
2002-03	82	27	28	27
2003-04	84	27	30	27
2004-05	83	28	29	26
2005-06	82	28	28	26

2006-07	77	28	25	24
2007-08	74	28	23	23
2008-09	68	27	20	21
2009-10	73	27	22	24
2010-11	72	26	20	26
2011-12	76	26	20	30
2012-13	76	26	20	30

Source: Authors' Own Calculations

The study is conducted for a period of 11 years from 2002-03 to 2012-13. These years represent different vital phases through which Indian Economy has travelled. The initial years witnessed prosperity for the Indian Banks as they were capitalising the benefits of various reforms introduced in the banking sector in the 1990's as Narasimham Committee Report I in 1991, Narasimham Committee Report II in 1998, Basel Norms in 1998, followed by Know Your Customer (KYC) and Anti-money Laundering (AML) regulations etc. The middle years were gloomy for the banks as the US financial bubble hit the global financial sector adversely and Indian Banks too faced the heat. The latter years signify the time period when the economy was trying to recover from global financial crisis. The present study gathers data from banks' annual reports and Reports on Trend and Progress in Banking. The source of financial data is website of Reserve Bank of India (RBI) which is considered as the most comprehensive database for research in banking.

b. Data Envelopment Analysis (DEA)

DEA is a linear programming based technique which constructs the frontier from the most efficient banks and then measures how far the inefficient banks are from the efficient frontier. This frontier is constructed from observed input-output ratios by assuming that Production Possibility Set is convex and both inputs and outputs are freely disposable (Das *et al.*, 2005). A bank in DEA is known as Decision Making Unit (DMU). A DMU operating on the production frontier has an efficiency score of one which is efficient bank while a bank below the frontier is inefficient and has a score between zero and one. Charnes, Cooper and Rhodes (CCR Model) (1978) was the first who extended the idea of production frontier and production possibility set given by Farrell (1957) into Non parametric methodology- Data Envelopment Analysis (DEA). DEA can be used to measure the Technical Efficiency, Pure Technical Efficiency, Scale Efficiency, Cost Efficiency, Revenue Efficiency and Profit Efficiency. The present paper uses DEA to measure the Cost Efficiency of Banks. Cost Efficiency is an input oriented model, as it

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minimizes inputs at a given level of output quantities given the input prices. DEA can further help to identify the reasons of cost inefficiency among banks by decomposing it into Allocative Efficiency (AE) and Technical Efficiency (TE) (input oriented) components. Furthermore, Technical Efficiency (input oriented) can be decomposed into its two components i.e., Pure Technical Efficiency (PTE) and Scale Efficiency (SE) with the help of DEA. The following is the Mathematical programming equations used to calculate Cost Efficiency which is as follows:

$$\text{Min} = \sum_{r=1}^m p_i^0 x_{io}$$

Subjectto

$$\sum_{j=1}^n \lambda_j x_{ij} \leq x_{io} \quad i = 1, 2, \dots, m$$

$$\sum_{i=1}^n \lambda_j y_{rj} \geq y_{ro} \quad r = 1, 2, \dots, s$$

$$\lambda_j, x_{io} \geq 0 \quad \sum_{i=1}^n \lambda_j = 1$$

where,

n = DMU observation

j=nth DMU

m= input observation

r = sthoutput

i= mth input

y_{ro}= rth output that maximize revenue for DMU0

x_{io}= ith input that minimize cost for DMU0

y_{ij}= sth output for nth DMU

x_{ij}=mth input for nth DMU

λ_j= non-negative scalars

c. Selection of Banking Inputs and Outputs for measuring the Efficiency of Banks

Selection of inputs and outputs in case of bank efficiency is an arbitrary process (Ariff

and Can, 2008 and Berger and Humphrey, 1997). The banking literature highlights that there are mainly two approaches for selection of inputs and outputs namely, Production Approach and Intermediate Approach. Production Approach assumes that banks serve as the producer of services for account holders while Intermediate Approach assumes that banks act as financial intermediaries whose main role is to obtain funds from the savers and lend these funds further to the borrowers for making profit. To evaluate the efficiency of the banks, Intermediation Approach is mostly preferred as banks are considered and works as financial intermediaries (Yue, 1992; Das *et al.*, 2005; Ataulhah and Le, 2006; Varadiet *al.*, 2006; Sahooet *al.*, 2007; Chansarn, 2008; Ketkar and Ketkar, 2008; Karimzadeh, 2012). The reason for preference of Intermediation Approach is that almost all the activities of bank consist of converting huge deposits and funds into loans and financial investments (Favero and Papi, 1995 and Berger and Humphrey, 1997). Sticking with the Intermediation Approach, this paper uses four inputs and three outputs. The description of inputs, outputs and prices of inputs used in the study is given in the Table: 2 as follows:

Table 2: Description of input and output 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 the 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.

Source: Authors' Own Calculations

d. Preliminaries to DEA

Prior to application of DEA, there are two main issues which are required to be considered. The first issue is whether a Common Efficiency Frontier for the sample of all banks across time should be made or separate frontier should be constructed for all years. The second issue is whether it would be feasible to pool the data of Public, Private and Foreign Sector Banks into one sample to construct same frontier or it would be feasible to construct different frontiers for banks according to their ownership.

i. Separate vs. Common Frontier Approach across time

A common frontier 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 Atallah 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.

ii. Separate vs. Common Frontier Approach across Ownership

Another issue at this instance 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; Gulati, 2011). These studies constructed pooled as well as separate frontier, according ownership found that all the efficiency scores of separate frontier either coincide with or lie inside the common frontier. Thus, it was better to construct the common frontier across ownership (Cummins *et al.*, 1999; Isik and Hassan, 2002; Niazi, 2003; Burki and Niazi, 2006; Gulati, 2011). 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.

e. Return to Scale (RTS)

DEA can also help to determine Return to Scale and tell whether a DMU is operating at Decreasing Return to Scale (DRS), Increasing Return to Scale (IRS) or Constant Return

to Scale (CRS). DRS indicates that DMU is operating at a scale that is too large which portrays that a percentage increase in inputs of that DMU produces a less than proportional increase in outputs. IRS depicts that DMU is operating at a scale that is too small, which shows that the percentage increase in inputs of DMU produces a more than proportional increase in outputs. Lastly, CRS depicts that DMU is operating at a correct scale and an increase in inputs will result in a proportionate increase in the outputs.

f. Panel Data Tobit Regression Analysis

The Panel Data Tobit model is proposed by James Tobin (1958) to describe the relationship between a censored dependent variable and independent variables. The simple application of OLS estimation procedure in censored dependent variable may produce biased estimates if there is significant position of the observation equal to 1 (Saxonhouse, 1976; Resende, 2000; Kumar and Gulati, 2008; Gulati, 2011). The Panel Data Tobit model is applied due to the censored nature of the dependent variable i.e. efficiency scores are in range of 0 to 1.

5. Findings and Discussion

a. Cost Efficiency of Indian Scheduled Commercial Banks (SCBs)

Cost Efficiency scores for each bank is calculated over the total time period of 11 years from 2002-03 to 2012-13. Then these scores are aggregated to analyze the performance of Scheduled Commercial Banks. Table: 3 represents the Cost Efficiency and scores of its components for all Indian Scheduled Commercial Banks. These are presented as below:

Table 3: Cost Efficiency scores of Scheduled Commercial Banks Operating in India

Year	No. of Banks	CE	AE	TE (IO)	PTE	SE
2002-03	82	0.577	0.680	0.848	0.955	0.889
2003-04	84	0.657	0.720	0.908	0.974	0.931
2004-05	83	0.685	0.747	0.914	0.971	0.941
2005-06	82	0.551	0.684	0.800	0.946	0.847
2006-07	77	0.818	0.867	0.941	0.978	0.960
2007-08	74	0.773	0.835	0.925	0.974	0.949
2008-09	68	0.713	0.795	0.896	0.978	0.915

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Year	No. of Banks	CE	AE	TE (IO)	PTE	SE
2009-10	73	0.608	0.702	0.866	0.983	0.880
2010-11	72	0.634	0.717	0.882	0.961	0.918
2011-12	76	0.268	0.312	0.827	0.969	0.850
2012-13	76	0.493	0.567	0.870	0.966	0.898
Mean		0.616	0.693	0.880	0.969	0.907
Standard Deviation		0.150	0.150	0.043	0.011	0.038
Minimum		0.268	0.312	0.800	0.946	0.847
Maximum		0.818	0.867	0.941	0.983	0.960
CE: Cost Efficiency, AE: Allocative Efficiency, TE (IO): Technical Efficiency (Input Oriented), PTE: Pure Technical Efficiency, SE: Scale Efficiency						

Source: Authors' Own Calculations

As seen from Table: 3, Cost Efficiency score of Indian Scheduled Commercial Banks is 0.577 in 2002-03. It follows an increasing pattern for two successive years with a score of 0.657 and 0.685 in 2003-04 and 2004-05 respectively. Then it declines to 0.551 in 2005-06. A tremendous increase in the scores is observed in 2006-07 when the scores stand at 0.818. For the next three years, it follows a declining trend till it lowers to 0.608 in 2009-10. In 2010-11, these increase to 0.634 but subsequently decline remarkably to 0.268 in 2011-12. Thereafter, it improves and reaches to 0.493 in 2012-13. Throughout the study time period, Cost Efficiency varies from a low of 0.268 to a high of 0.818. Estimates of Allocative Efficiency deviate from a minimum of 0.312 to the maximum of 0.867. Technical Efficiency (input oriented) fluctuates from a low of 0.800 to a high of 0.941 whereas Pure Technical Efficiency ranges between lowest score of 0.946 to highest score of 0.983. Likewise, Scale Efficiency varies from a low of 0.847 to a high of 0.960. The average Cost Efficiency (inefficiency) score of Scheduled Commercial Banks operating in India is 61.6% (38.4%), which depicts that they exploit 61.6% of their inputs to produce the current output. Allocative Efficiency (inefficiency) is 69.3% (30.7%) whereas Technical Efficiency (inefficiency) is 88.0% (12%). Pure Technical and Scale Efficiency (inefficiency) of Scheduled Commercial Banks is 96.9% (3.1%) and 90.7% (9.3%) respectively.

As seen from Table: 3, the average Cost Efficiency Score of Scheduled Commercial Banks is less as compared to the standard Cost Efficiency score of 1. The Cost Efficiency results of SCBs show an inconsistent pattern. After 2000s, Bank customers increased the usage of technologically advanced systems such as Electronic Clearing Service,

Electronic Funds Transfer (EFT), and Card based systems (credit, debit, ATM and smart cards). As a result, Scheduled Commercial Banks started investing more funds on technology up-gradation and Core Banking Solutions (Reserve Bank of India, 2005-06). Simultaneously, they had to make their employees tech-savvy, so huge funds were spent on training of the employees. This perhaps led to acceleration in their cost in the short term. A hike in Cost Efficiency scores is witnessed intermittently. Customers had started showing 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 5.5% in 2002-03, to 4.4% in 2003-04 and further to 3.8% 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 and further to 1.0% in 2006-07 (Reserve Bank of India, 2006-07). Though Cost Efficiency scores showed an improvement during these years, but, this in fact is only a camouflaged improvement not contributing virtually to the operational efficiency of the banks. Later on from 2007-08 onwards, the Cost Efficiency of banks grossly followed the declining trend till 2012-13. This seems to be owing to increased interest expenditure. The ratio of interest expended to total assets enhanced from 4.1% in 2006-07 to 4.8% in 2007-08 and further to 5.0% in 2008-09 (Reserve Bank of India, 2008-09). Moreover, Indian Banking Sector was influenced by the slowdown in the Indian economy and tepid global recovery from the ripples of global financial recession during 2011-12 and 2012-13. The loss of faith in the banking industry coaxed banks to increase interest rates which led to increased cost of term deposits as well as retail ones. The ratio of interest expended to total assets enhanced from 4.16% in 2010-11, to 5.17% in 2011-12 and further to 5.36% in 2012-13 (Reserve Bank of India, 2012-13). This all led to decline in the Cost Efficiency of SCBs.

The above results in Table: 3 highlight that Allocative Inefficiency seems to be the major cause of Cost Inefficiency among SCBs. The Allocative Efficiency scores are lesser as compared to the Technical Efficiency scores. This depicts that bank managers being still uncertain about the input prices so they are to some extent not able to select the cost minimizing combinations. Besides, decomposition of technical efficiency (input oriented) score depicts that scale inefficiency is the major reason behind technical inefficiency as scale efficiency scores among SCBs are lesser in comparison to Pure Technical Efficiency scores.

b. Cost Efficiency of Indian Scheduled Commercial Banks (SCBs) across Ownership

Cost Efficiency scores for each bank is calculated over the total time period from 2002-03 to 2012-13. Then, these scores are aggregated to analyze the performance of Scheduled Commercial banks across ownership. Table: 4 evaluates the Cost Efficiency and its components scores across ownership as follows:

Table 4: Cost Efficiency scores of Scheduled Commercial Banks across Ownership in India (2002-03 to 2012-13)

Year	Public Sector Banks					Private Sector Banks					Foreign sector Banks							
	No. of Banks	CE	AE	TE (IO)	PTE	SE	No. of Banks	CE	AE	TE (IO)	PTE	SE	No. of Banks	CE	AE	TE (IO)	PTE	SE
2002-03	27	0.615	0.692	0.878	0.986	0.891	28	0.556	0.671	0.828	0.964	0.86	27	0.562	0.677	0.839	0.915	0.919
2003-04	27	0.666	0.716	0.929	0.991	0.937	30	0.691	0.743	0.929	0.98	0.947	27	0.612	0.698	0.864	0.951	0.908
2004-05	28	0.684	0.738	0.926	0.986	0.94	29	0.702	0.766	0.907	0.956	0.95	26	0.668	0.735	0.908	0.971	0.932
2005-06	28	0.503	0.631	0.795	0.977	0.811	28	0.544	0.669	0.811	0.945	0.86	26	0.61	0.757	0.794	0.913	0.873
2006-07	28	0.863	0.903	0.956	0.985	0.971	25	0.828	0.855	0.963	0.986	0.977	24	0.755	0.837	0.9	0.964	0.93
2007-08	28	0.758	0.832	0.912	0.978	0.932	23	0.815	0.874	0.931	0.954	0.976	23	0.75	0.799	0.934	0.99	0.943
2008-09	27	0.65	0.755	0.866	0.983	0.88	20	0.698	0.803	0.869	0.953	0.911	21	0.808	0.838	0.96	0.996	0.964

Year	Public Sector Banks						Private Sector Banks						Foreign sector Banks					
	No. of Banks	CE	AE	TE (IO)	PTE	SE	No. of Banks	CE	AE	TE (IO)	PTE	SE	No. of Banks	CE	AE	TE (IO)	PTE	SE
2009-10	27	0.593	0.734	0.815	0.985	0.827	22	0.554	0.679	0.835	0.971	0.858	24	0.673	0.704	0.951	0.99	0.96
2010-11	26	0.646	0.718	0.9	0.99	0.909	20	0.664	0.757	0.878	0.956	0.919	26	0.6	0.685	0.868	0.937	0.926
2011-12	26	0.117	0.147	0.812	0.983	0.824	20	0.113	0.165	0.735	0.941	0.776	30	0.502	0.554	0.902	0.976	0.922
2012-13	26	0.368	0.419	0.884	0.98	0.902	20	0.431	0.544	0.807	0.952	0.847	30	0.642	0.711	0.899	0.964	0.929
Mean		0.588	0.662	0.879	0.984	0.893		0.6	0.684	0.863	0.96	0.898		0.653	0.727	0.893	0.961	0.928
Standard Deviation		0.201	0.21	0.053	0.004	0.053		0.201	0.196	0.067	0.014	0.063		0.091	0.082	0.049	0.029	0.025
Minimum		0.117	0.147	0.795	0.977	0.811		0.113	0.165	0.735	0.941	0.776		0.502	0.554	0.794	0.913	0.873
Maximum		0.863	0.903	0.956	0.991	0.971		0.828	0.874	0.963	0.986	0.977		0.808	0.838	0.96	0.996	0.964

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

Source: Authors' Own Calculations

Table: 4 discloses that the Cost Efficiency of Public Sector Banks stretches between a wide range of the lowest efficiency of 0.117 and highest of 0.863. The Cost Efficiency of Public Sector Banks is 0.615 in 2002-03 which improves during next two years i.e. to 0.666 in 2003-04 and to 0.684 in 2004-05. Later on, the Cost Efficiency score declines to 0.503 in 2005-06 followed by an increase to 0.863 in 2006-07. These scores follow a

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declining trend for three consecutive years till 2009-10 and turn out to be 0.593 in 2009-10. Subsequently, a rise is noticed in Cost Efficiency of Public Sector Banks to 0.646 in 2010-11. There is a major descend in the Cost Efficiency to 0.117 in 2011-12 though it trivially improves to 0.368 in 2012-13. Allocative Efficiency deviates from minimum of 0.147 to maximum of 0.903. Technical Efficiency (Input Oriented) varies from a low of 0.795 to a high of 0.956 while Pure Technical Efficiency varies from lowest of 0.977 to highest of 0.991 scores. Similarly Scale Efficiency of Public Sector Banks fluctuates from a low of 0.811 to a high of 0.971. On an average, Public Sector Banks operating in India could utilize merely 58.8% of its inputs which means that they are wasting their inputs to the extent of 41.2%. In other words, PSBs are wasting their resources to produce what they are producing at the present i.e. they could produce the same outputs from just 58.8% of their resources. Allocative Efficiency (inefficiency) is 66.2% (33.8%) whereas Technical Efficiency (input oriented) (inefficiency) is 87.9% (12.1%). Pure Technical is 98.4% (1.6%) and Scale Efficiency of PSBs is 89.3% (10.7%) respectively.

Table: 4, shows that the Cost Efficiency score of Private Sector Banks is 0.556 in 2002-03 which follows an increasing trend till 2004-05 when the Cost Efficiency is 0.702. Later on, in the next year i.e. 2005-06, a deep fall is noticed and the efficiency score turns out to be 0.544 followed by a sharp increase in 2006-07 to 0.828. Afterwards the score follow declining pattern for three following years and comes out to be 0.554 in 2009-10. In 2010-11, it improved and reached 0.664. A notable drop is observed in the score to 0.113 in 2011-12. In 2012-13, the score improves and it turns out to be 0.431 in 2012-13. Cost Efficiency of Private Sector Banks varies from low of 0.113 to high of 0.828. Allocative Efficiency Estimates of Private Sector Banks deviate from minimum of 0.165 to maximum of 0.874. Estimates of Technical Efficiency fluctuate from a low of 0.735 to a high of 0.963 while Pure Technical Efficiency of Private Sector Banks ranges between lowest of 0.941 to highest of 0.986 scores. Likewise, Scale Efficiency varies from a low of 0.776 to a high of 0.977. Private Sector Banks operating in India use only 60.0% of inputs which is very low as compared to full Cost Efficiency score. Allocative Efficiency (inefficiency) is 68.4% (31.6%) whereas Technical Efficiency (inefficiency) is 86.3% (13.7%). Further, Pure Technical and Scale Efficiency of Private Sector Banks is 96.0% (4.0%) and 89.8% (10.2%) respectively.

Cost Efficiency of Foreign Sector Banks varies from a low of 0.502 to a high of 0.808. Cost Efficiency of Foreign Sector Banks is 0.562 in 2002-03 which improves to 0.612 in 2003-04 and to 0.668 in 2004-05. The score follows an inconsistent pattern till 2008-09 when it turns out to be 0.808. Subsequently, a continuous drop in the score years is observed for three and it reaches to 0.502 in 2011-12. In 2012-13, the cost efficiency

score for Foreign Sector Banks improve to 0.642. Allocative Efficiency of Foreign Sector Banks deviates from minimum of 0.554 to maximum of 0.838. Technical Efficiency of Foreign Sector Banks varies from a low of 0.794 to a high of 0.960 while Pure Technical Efficiency fluctuates between lowest of 0.913 to highest of 0.996. Likewise, Scale Efficiency of Foreign Sector Banks fluctuates from a low of 0.873 to a high of 0.964. Foreign Sector Banks have the average Cost Efficiency (inefficiency) score of 65.3% (34.7%). Allocative Efficiency (inefficiency) is 72.7% (27.3%) while Technical Efficiency (inefficiency) is 89.3% (10.7%). Pure Technical Efficiency (inefficiency) is 96.1% (3.9%) and Scale Efficiency (inefficiency) of Foreign Sector Banks is 92.8% (7.2%) respectively.

It is noticed that all banks belonging to different sectors have low Cost Efficiency and its components scores. PSBs grossly have uncertainty in the Cost Efficiency scores during 11 years. Public Sector Banks are facing the problem of surplus manpower resources. They offered Voluntary Retirement Scheme (VRS) to the employees in 2000-01 which decreased their operating cost from 2.24% in 2002-03, to 2.19% in 2003-04, to 2.08% in 2004-05, to 2.05% in 2005-06, to 1.77% in 2006-07, further to 1.47% in 2008-09 (Reserve Bank of India, 2008-09). With the execution of reforms, the competition among banks operating in different sectors increased. It compelled PSBs to bring a change in their business strategies, accept computerization and adopt technology in their working. PSBs invested huge funds in technology to upgrade their services resulting in increased capital expenditure and leading to temporary inefficiency. Private Sector Banks reveal the same picture of Cost Efficiency as Public Sector Banks. Their cost inefficiency is more attributable to their human resource acquisition and maintenance cost. They employ qualified staff having specialized skills on high salary packages. They provide rewarding incentives to their employees and managers which enhances their operational cost. The same is evident from the rising ratio of operating expenses to total assets which enhanced from 1.98% in 2002-03 to 2.02% in 2003-04, to 2.03% in 2004-05 and further to 2.11% in 2005-06 (Reserve Bank of India, 2005-06). Foreign Sector Banks have stronger control over their cost. They tend to save their infrastructural cost as they do not exist in brick and cement and follow virtual banking. They operate only in the metropolitan cities and in fact have less than 1% of the total branch network (PWC, 2013). However, even Foreign Sector Banks could not become fully cost efficient as these too have enlarged employee base. The number of employees continuously increased from 11,053 in 2003-04 to triple the strength of 33,969 in 2007-08 (Reserve Bank of India, 2012-13). This definitely affects the operating cost of the Foreign Sector Banks. Moreover, the time period of 2007-08 till 2012-13 depicted comparatively a fall in the Cost Efficiency scores for all banks belonging to different sector as witnessed by gloomy business environment on account of global financial recession which affected the sentiments and faith of people

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in banking globally. Though, Reserve Bank of India follows a conservative pattern of banking along with strict regulations in terms of Know Your Customer Norms and other collaterals, still the psychological influences of US recession on Indian Banking sector could not be fully controlled. Moreover, all banks belonging to different sectors have the lowest efficiency score during 2011-12 which seems to be attributed to slowdown in the domestic economy (Reserve Bank of India, 2011-12 and 2012-13).

As seen from Table: 4, the foremost reason behind cost inefficiency of Public Sector Banks, Private Sector Banks and Foreign Sector Banks is Allocative Inefficiency. Furthermore, all banks operating in different sectors i.e., Public Sector Banks, Private Sector Banks and Foreign Sector Banks are facing the problem of Scale Inefficiency as their scale efficiency scores are less than their Pure Technical Efficiency scores. 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.

The results highlight that Cost Efficiency and its components scores of Public, Private and Foreign Sector Banks are different. In order to verify if this variation in Cost Efficiency scores among banks operating in various sectors is statistically significant or not, Panel Tobit Regression is applied by taking ownership wise two dummies as independent variables. One dummy for Public Sector Banks i.e., a value of 1 for Public Sector Banks and 0 to other banks is given. Similarly, another dummy of Private Sector Banks is formed. Regression is applied with the hypothesis that there exists no difference in Cost Efficiency and other components scores of Public Sector Banks, Private Sector Banks and Foreign Sector Banks. The results of the same are given in Table: 5 as follows:

Table 5: Tobit Regression Results of Cost Efficiency and its Components with Ownership Dummy as independent Variable

Efficiency	Constant	Public Dummy	Private Dummy	Log Likelihood
Cost Efficiency	0.6587917* (0.0253412)	-0.0666457*** (0.0371893)	-0.0327076 (0.0373255)	-110.47534
Allocative Efficiency	0.728857* (0.0238703)	-0.0623698*** (0.03487)	-0.021000 (0.0350891)	-78.646417
Technical Efficiency (IO)	0.9784565* (0.0224428)	-0.0791504** (0.0324005)	-0.073936** (0.0322973)	36.458821
Pure Technical Efficiency	1.128228* (0.0259267)	-0.0531954 (0.0339265)	-0.0917228* (0.0339042)	-67.680583
Scale Efficiency	1.000263* (0.0187322)	-0.0891679* (0.0269945)	-0.0632184** (0.0269945)	143.69594
, *Significant at 1%, 5% and 10% level of Significance respectively Parenthesis includes Standard Error Value				

Source: Authors' Own Calculations

Table: 5 highlights the results of Panel Tobit Regression by taking Foreign Sector Banks as reference group. The results of Panel Tobit Regression depict that there exists significant difference in Cost Efficiency and Allocative Efficiency scores of Public Sector and Foreign Sector Banks. The coefficient of Public dummy variable for Cost Efficiency and allocative efficiency is -0.0666457 and -0.0623698 , and both are significant at 10% level of significance. A negative coefficient for Technical Efficiency (Input Oriented) of Public dummy i.e., -0.0791504 which is significant at 5% level of significance. This shows that Foreign Sector Banks are superior performers in terms of Cost Efficiency, Allocative Efficiency and Technical Efficiency. Differences among Foreign and Public Sector Banks are insignificant for Pure Technical Efficiency. Scale Efficiency also has a negative coefficient of -0.0891679 and is significant at 1% level of significance. The coefficient of Private dummy variable for Cost Efficiency and Allocative Efficiency is -0.0327076 and -0.021000 , and both are insignificant. Technical Efficiency (input oriented) and Scale Efficiency as dependent variable shows a negative coefficient of Private dummy i.e., -0.0739358 and -0.0632184 which is significant at 5% level of significance. For Pure Technical Efficiency, Private dummy has the coefficient of -0.0917228 significant at 1% level of significance. The negative coefficient of Private dummy for Cost Efficiency and its components depicts that Foreign Sector Banks are superior performers than Private Sector Banks in terms of Cost Efficiency and its components.

According to Cost Efficiency scores, Foreign Sector Banks are placed on the first position, but the second position is taken by Private Sector Banks followed by Public Sector Banks. The difference between Private and Foreign Sector Banks is insignificant although as depicted by Panel Tobit Regression, it is significant among Public and Foreign Sector Banks. Public Sector Banks have higher Cost Inefficiency. Public Sector Banks are inefficient in utilizing their huge manpower as massive low skilled employees are bunched under the category of clerk and sub clerical staff in these banks (Jagannathan, 2014). Huge expenditure of salaries is incurred without a proportionate contribution to the productivity in this type of disguised employment. Labor is a very important input of Cost Efficiency but it seems that this cost escorted PSBs towards Cost Inefficiency.

c. Return to Scale (RTS) of Cost Efficiency of Indian Scheduled Commercial Banks

The primary source of cost inefficiency among Scheduled Commercial Banks (SCBs) emerges to be connected with scale inefficiency. So, it is important to further scrutinize the movement of Return to Scale of Scheduled Commercial Banks operating in India. In

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order to determine the Return to Scale, the number (percentage) of banks operating under a Constant Return to Scale (CRS), Increasing Return to Scale (IRS) and Decreasing Return to Scale (DRS) is evaluated. The same is presented in Table: 6.

Table: 6 Number (Percentage) of Scheduled Commercial Banks at different Return to Scale (RTS) according to Cost Efficiency and its Components scores

Year	Total	DRS	IRS	CRS
2002-03	82	57 (70)	6 (7)	19 (23)
2003-04	84	47 (56)	7 (8)	30 (36)
2004-05	83	47 (57)	9 (11)	27 (32)
2005-06	82	54 (66)	9 (11)	19 (23)
2006-07	77	33 (43)	8 (10)	36 (47)
2007-08	74	40 (54)	10 (14)	24 (32)
2008-09	68	40 (59)	3 (4)	25 (37)
2009-10	73	49 (67)	1 (1)	23 (32)
2010-11	72	45 (63)	6 (8)	21 (29)
2011-12	76	50 (66)	4 (5)	22 (29)
2012-13	76	45 (59)	7 (9)	24 (32)
DRS: Decreasing Return to Scale, IRS: Increasing Return to Scale, CRS: Constant Return to Scale.				

Source: Authors' Own Calculations

The results of Return to Scale for SCBs demonstrate that percentage of banks operating at DRS approximately followed a declining trend as the number (percentage) of banks decreased from 57 (70%) in 2002-03 to 45 (59%) in 2012-13. In contrast, the number (percentage) of banks operating at IRS fluctuated from minimum of 1 (1%) in 2009-10 to maximum of 10 (14%) in 2007-08 with an erratic pattern. In 2012-13, 7 (9%) of banks are operating on IRS. The number (percentage) of banks operating at CRS increased from 19 (23%) in 2002-03 to 24 (32%) in 2012-13 with a small deviation throughout this time period.

Thus, during the total paper time period, the results suggest that the number of scale efficient banks are less as compared to scale inefficient banks, as the number (percentage) of banks operating on DRS and IRS are higher than the number and percentage of banks operating on CRS. Banks need to expand their business not only by opening new branches but also by increasing their customer base. For this they need to indulge in

quality services and effective Customer Relation Management. Further, Indian Scheduled Commercial Banks are required to give priorities to the customer perceived measures of quality i.e., reliability, responsiveness, assurance, tangibles and empathy (Bhatia and Mahendru, 2014). They need to focus on 7 Ps of marketing i.e. product, price, promotion, place, physical evidence, people and process which will provide SCBs a competitive edge over their Non-Banking Financial Company and enhance their scale and efficiency.

d. Return to Scale of Cost Efficiency of Indian Scheduled Commercial Banks across Ownership

Further, it is important to identify which particular sector in the Indian Banking Industry is responsible for these diseconomies of scale. Hence, Return to Scale across Bank ownership is studied. The results of RTS across ownership are presented as follows in Table: 7:

Table: 7 Number (Percentage) of Scheduled Commercial Banks across Ownership at Different Return to Scale (RTS)

Year	Public Sector Banks				Private Sector Banks				Foreign Sector Banks			
	DRS	IRS	CRS	Total	DRS	IRS	CRS	Total	DRS	IRS	CRS	Total
2002-03	24 (89)	0 (0)	3 (11)	27	19 (68)	4 (14)	5 (18)	28	14 (52)	2 (7)	11 (41)	27
2003-04	20 (74)	0 (0)	7 (26)	27	16 (53)	3 (10)	11 (37)	30	11 (41)	4 (15)	12 (44)	27
2004-05	24 (86)	0 (0)	4 (14)	28	16 (55)	5 (17)	8 (28)	29	7 (27)	4 (15)	15 (58)	26

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	2012-13	2011-12	2010-11	2009-10	2008-09	2007-08	2006-07	2005-06
	21 (81)	23 (88)	24 (92)	26 (96)	22 (81)	23 (82)	18 (64)	23 (82)
	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	5 (19)	3 (12)	2 (8)	1 (4)	5 (19)	5 (18)	10 (36)	5 (18)
	26	26	26	27	27	28	28	28
	16 (80)	16 (80)	14 (70)	16 (73)	13 (65)	9 (39)	10 (40)	20 (72)
	0 (0)	0 (0)	0 (0)	0 (0)	1 (5)	5 (22)	2 (8)	4 (14)
	4 (20)	4 (20)	6 (30)	6 (27)	6 (30)	9 (39)	13 (52)	4 (14)
	20	20	20	22	20	23	25	28
	8 (27)	11 (37)	7 (27)	7 (29)	5 (24)	8 (35)	5 (21)	11 (42)
	7 (23)	4 (13)	6 (23)	1 (4)	2 (9)	5 (22)	6 (25)	5 (19)
	15 (50)	15 (50)	13 (50)	16 (67)	14 (67)	10 (43)	13 (54)	10 (39)
	30	30	26	24	21	23	24	26
DRS: Decreasing Return to Scale, IRS: Increasing Return to Scale, CRS: Constant Return to Scale.								

Source: Authors' Own Calculations

The results of Return to Scale for PSBs demonstrate that percentage and number of banks operating at DRS approximately follow a declining trend as these decreased from 24 (89%) in 2002-03 to 21 (81 %) in 2012-13. On the other hand, numbers of banks operating at IRS remain 0 (0%) only. Number (percentage) of Public Sector Banks operating at CRS remains same with very little variations, as 3 (11%) of PSBs operate on CRS in 2002-03 and turn out to be 5 (19%) in 2012-13. Overall, enormous number of PSBs are operating on DRS while small number of banks operate on the most efficient Scale i.e. CRS. Private Sector Banks demonstrate that the percentage of banks operating on DRS show an increase from 68% in 2002-03 to 80% in 2012-13. On the other hand, number of banks operating at IRS declined from 4 (14%) in 2002-03 to 0 (0%) in 2012-13. Private Sector Banks operating at CRS depict that 18% Banks are operating on CRS in 2002-03 which increased to 20% in 2012-13. A tremendous increase in banks operating on CRS is noticed in 2006-07 as 13 (52%) of banks are efficient and operating accurately on the basis of Scale. On the whole, Private Sector Banks depict that maximum number of banks are operating on an incorrect Scale i.e. DRS. Foreign Sector Banks operating on DRS follow a declining behavior as the number (percentage) of banks declined from 14 (52%) in 2002-03 to 8 (27%) in 2012-13. The number of banks operating on IRS follow an escalating trend as these increased from 2 (7%) in 2002-03 to 7 (23%) in 2012-13. The number of Foreign Sector Banks operating at CRS demonstrate an increase from 11 (40%) in 2002-03 to 15 (50%) in 2012-13. Overall Foreign Sector Banks confirm that immense number of Foreign Sector Banks are operating on CRS.

Overall, the results of Return to Scale show that maximum number of banks operating on Decreasing Return to Scale (DRS) belong to Public Sector followed by Private Sector. This ensures that these banks are not able to utilize their inputs to the fullest extent to produce what they are producing at present Scale. PSBs are not able to utilize their capital investment effectively (Jagannathan, 2014). Actually, PSBs are forced to play an important role in financial inclusion by catering to the masses spread over the population of 1.2 billion. They are required to meet social objectives of the country by opening their branches in the rural areas. These areas cover people belonging to Agricultural Sector, Small Businesses, weaker sections, artisans etc which have low income and low savings. In order to attract them to deposit their money in the banks, PSBs reluctantly have to pay high rate of returns. Private Sector Banks have the next maximum number of banks belonging to DRS. Private Sector Banks spend lot of funds on promoting their products and services. They are offering innovative products to capture the share of even the

Public Sector Banks. These are extensively engaged in establishing their technologically equipped branches in the backward areas as well even when the literacy levels in these areas are comparatively low. People living in these areas believe that their funds are safe only in government owned banks i.e. Public Sector Banks. The huge cost incurred by these banks on setting up the infrastructural framework is not being recovered from rural population. As a result, Private Sector Banks are not able to utilize their inputs effectively. The results reveal that the highest number of banks operating on CRS belong to Foreign Sector. Foreign Sector Banks mainly focus on corporate clients and do not compete for the share of retail clientage. They have professional work culture and business philosophy. They are technologically more adaptive with a tech-savvy manpower. Moreover, these banks are mainly operating in metro cities where people are more literate with respect to usage of technology. Thus they are capable of recovering their operating cost which they have incurred on e-resources. As a result they operate on CRS. In nut shell, the results of RTS across ownership suggest that Public Sector Banks as well as Private Sector Banks need to rectify their Scale of operation in order to become fully efficient.

e. Leaders and Laggards of Cost Efficiency of Indian Scheduled Commercial Banks

In order to further minutely analyze the sector wise performance, it is necessary to identify the number of banks operating as leaders and laggards. On the basis of the average efficiency scores generated by DEA, Scheduled Commercial Banks (SCBs) across ownership have been divided into three categories: (1) Banks with an efficiency score of 1 are considered as leaders (2) banks, which have efficiency score less than one but greater than average efficiency score are rated as moderate performers while (3) banks with a average efficiency score of less than average are considered as laggards. Table: 8, presents a bird's eye view of the number of banks falling in each category as follows:

Table: 8 Number (Percentage) of Scheduled Commercial Banks identified as Leaders and Laggards

Public Sector Banks										Banks									
										Year									
										Total									
										Leaders		Moderates		Laggards					
										CE	AE	TE (IO)	PTE	SE	CE	AE	TE (IO)	PTE	SE
2010-11	2009-10	2008-09	2007-08	2006-07	2005-06	2004-05	2003-04	2002-03	2002-03	2002-03	27	27							
0 (0)	0 (0)	0 (0)	0 (0)	1 (4)	3 (11)	1 (4)	0 (0)	2 (7)	2 (7)	2 (7)	0 (0)	2 (7)							
0 (0)	0 (0)	0 (0)	0 (0)	1 (4)	3 (11)	1 (4)	0 (0)	2 (7)	2 (7)	2 (7)	0 (0)	2 (7)							
2 (8)	1 (4)	5 (19)	5 (18)	10 (36)	5 (18)	4 (14)	7 (26)	3 (11)	3 (11)	3 (11)	7 (26)	3 (11)							
18 (69)	16 (59)	13 (48)	19 (68)	18 (64)	13 (46)	18 (64)	19 (70)	19 (70)	19 (70)	19 (70)	19 (70)	19 (70)							
2 (8)	1 (4)	5 (19)	5 (18)	10 (36)	5 (18)	4 (14)	7 (26)	3 (11)	3 (11)	3 (11)	7 (26)	3 (11)							
11 (42)	13 (48)	10 (37)	12 (43)	15 (54)	3 (11)	11 (39)	15 (56)	11 (41)	11 (41)	11 (41)	15 (56)	11 (41)							
12 (46)	13 (48)	14 (52)	13 (46)	18 (64)	8 (29)	14 (50)	17 (63)	13 (48)	13 (48)	13 (48)	17 (63)	13 (48)							
11 (42)	12 (44)	8 (30)	11 (39)	6 (21)	11 (39)	7 (25)	8 (30)	11 (41)	11 (41)	11 (41)	8 (30)	11 (41)							
0 (0)	4 (15)	6 (22)	2 (7)	1 (4)	7 (25)	1 (4)	1 (4)	1 (4)	1 (4)	1 (4)	1 (4)	1 (4)							
10 (38)	13 (48)	9 (33)	8 (29)	7 (25)	10 (36)	8 (29)	8 (30)	12 (44)	12 (44)	12 (44)	8 (30)	12 (44)							
15 (58)	14 (52)	17 (63)	16 (57)	12 (43)	22 (79)	16 (57)	12 (44)	14 (52)	14 (52)	14 (52)	12 (44)	14 (52)							
14 (54)	14 (52)	13 (48)	15 (54)	9 (32)	17 (61)	13 (46)	10 (37)	12 (44)	12 (44)	12 (44)	10 (37)	12 (44)							
13 (50)	14 (52)	14 (52)	12 (43)	12 (43)	12 (43)	17 (61)	12 (44)	13 (48)	13 (48)	13 (48)	12 (44)	13 (48)							
8 (31)	7 (26)	8 (30)	7 (25)	9 (32)	8 (29)	9 (32)	7 (26)	7 (26)	7 (26)	7 (26)	7 (26)	7 (26)							
14 (54)	13 (48)	13 (48)	15 (54)	11 (39)	13 (46)	16 (57)	12 (44)	12 (44)	12 (44)	12 (44)	16 (57)	12 (44)							

Banks	Foreign Sector Banks																								
	Year	Leaders					Moderates					Laggards													
	Total	CE	AE	TE (IO)	PTE	SE	CE	AE	TE (IO)	PTE	SE	CE	AE	TE (IO)	PTE	SE									
	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	3 (10)	4 (15)	4 (15)	11 (41)	18 (67)	11 (41)	5 (19)	10 (37)	18 (67)	13 (48)	12 (44)	8 (30)	6 (22)	
	27	27	26	26	24	23	21	24	26	23	21	5 (24)	5 (21)	5 (19)	13 (67)	19 (90)	14 (67)	10 (42)	7 (27)	13 (50)	13 (50)	9 (39)	3 (13)	7 (33)	8 (30)
	5 (19)	4 (15)	5 (19)	5 (19)	4 (17)	5 (22)	5 (24)	5 (21)	5 (19)	3 (10)	3 (10)	5 (21)	5 (24)	5 (21)	16 (67)	21 (88)	16 (67)	10 (42)	7 (27)	10 (42)	9 (38)	9 (38)	2 (10)	7 (33)	7 (33)
	15 (58)	12 (44)	15 (58)	10 (38)	12 (50)	10 (43)	13 (62)	16 (67)	13 (50)	15 (50)	15 (50)	19 (90)	21 (88)	20 (77)	27 (90)	27 (90)	27 (90)	20 (77)	13 (50)	13 (50)	13 (50)	9 (39)	3 (13)	7 (33)	7 (33)
	22 (85)	20 (74)	22 (85)	19 (73)	18 (75)	19 (83)	14 (67)	16 (67)	13 (50)	15 (50)	15 (50)	14 (67)	21 (88)	20 (77)	27 (90)	27 (90)	27 (90)	20 (77)	13 (50)	13 (50)	13 (50)	9 (39)	3 (13)	7 (33)	7 (33)
	15 (58)	12 (44)	15 (58)	10 (38)	12 (50)	10 (43)	13 (62)	16 (67)	13 (50)	15 (50)	15 (50)	19 (90)	21 (88)	20 (77)	27 (90)	27 (90)	27 (90)	20 (77)	13 (50)	13 (50)	13 (50)	9 (39)	3 (13)	7 (33)	7 (33)
	9 (35)	11 (41)	9 (35)	7 (27)	7 (29)	8 (35)	5 (24)	10 (42)	7 (27)	10 (42)	10 (42)	5 (24)	10 (42)	7 (27)	10 (42)	10 (42)	10 (42)	7 (27)	13 (50)	13 (50)	13 (50)	9 (39)	3 (13)	7 (33)	7 (33)
	11 (41)	12 (44)	11 (41)	8 (31)	10 (42)	8 (35)	7 (33)	10 (42)	13 (50)	11 (37)	15 (50)	7 (33)	10 (42)	13 (50)	13 (50)	13 (50)	10 (42)	13 (50)	13 (50)	13 (50)	9 (39)	3 (13)	7 (33)	7 (33)	
	5 (19)	5 (19)	3 (12)	3 (12)	5 (21)	4 (17)	1 (5)	2 (8)	0 (0)	6 (20)	3 (10)	3 (12)	3 (12)	0 (0)	0 (0)	0 (0)	2 (8)	0 (0)	0 (0)	0 (0)	8 (27)	8 (27)	2 (10)	7 (33)	7 (33)
	1 (4)	1 (4)	1 (4)	0 (0)	1 (4)	1 (4)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	8 (27)	8 (27)	2 (10)	7 (33)	7 (33)
	7 (26)	7 (26)	4 (15)	6 (23)	4 (17)	5 (22)	0 (0)	0 (0)	3 (12)	8 (27)	6 (20)	4 (15)	6 (23)	3 (12)	3 (12)	0 (0)	0 (0)	3 (12)	3 (12)	3 (12)	8 (27)	8 (27)	2 (10)	7 (33)	7 (33)
	10 (37)	12 (44)	12 (46)	14 (54)	13 (54)	10 (43)	11 (52)	9 (38)	14 (54)	17 (57)	14 (47)	11 (52)	9 (38)	14 (54)	16 (53)	16 (53)	9 (38)	6 (25)	6 (25)	6 (25)	8 (27)	8 (27)	2 (10)	7 (33)	7 (33)
	11 (41)	10 (37)	10 (38)	13 (50)	10 (42)	10 (43)	9 (43)	9 (38)	8 (31)	16 (53)	12 (40)	9 (43)	9 (38)	8 (31)	16 (53)	16 (53)	9 (38)	6 (25)	6 (25)	6 (25)	8 (27)	8 (27)	2 (10)	7 (33)	7 (33)
	10 (37)	10 (37)	8 (31)	13 (50)	7 (29)	9 (39)	7 (33)	6 (25)	13 (50)	9 (30)	12 (40)	7 (33)	6 (25)	13 (50)	9 (30)	9 (30)	6 (25)	6 (25)	6 (25)	6 (25)	8 (27)	8 (27)	2 (10)	7 (33)	7 (33)
	6 (22)	6 (22)	3 (12)	7 (27)	5 (21)	3 (13)	2 (10)	3 (13)	6 (23)	3 (10)	6 (20)	2 (10)	3 (13)	6 (23)	3 (10)	3 (10)	3 (13)	6 (23)	6 (23)	6 (23)	8 (27)	8 (27)	2 (10)	7 (33)	7 (33)
	8 (30)	8 (30)	7 (27)	10 (38)	7 (29)	8 (35)	7 (33)	8 (33)	10 (38)	7 (23)	9 (30)	7 (33)	8 (33)	10 (38)	7 (23)	7 (23)	8 (33)	8 (33)	8 (33)	8 (33)	8 (27)	8 (27)	2 (10)	7 (33)	7 (33)

Source: Authors' Own Calculations

An equal number of Public Sector Banks have come into sight as moderates and laggards performers in case of Cost Efficiency, Allocative Efficiency, Technical Efficiency and Scale Efficiency. Numerous PSBs come forward as leaders in case of Pure Technical Efficiency only. The results of leaders and laggards for Private Sector Banks show that maximum numbers of Private Sector Banks are laggards according to Cost Efficiency,

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Allocative Efficiency, Technical Efficiency and Scale Efficiency, but according to Pure Technical Efficiency, most of Private Sector Banks acts as leaders. The results of leaders and laggards of Foreign Sector Banks show that a vast number of banks are operating as laggards according to Cost Efficiency and Allocative Efficiency, but in context to Technical Efficiency, Pure Technical Efficiency and Scale Efficiency, Foreign Sector Banks are leaders.

It is observed from the above results that maximum numbers of Public Sector Banks, Private Sector Banks and Foreign Sector Banks are laggards. Public Sector Banks are leaders in case of Pure Technical Efficiency score only. For all the other Cost Efficiency components they act as laggards. No doubt, Public Sector Banks have majority share of deposits, assets and branches as even at present they have 73% share in the total Indian Banking Sector (Reserve Bank of India, 2013). But, they are not able to control their cost effectively. Perhaps 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. This enhances their cost and lead to inefficiency in terms of cost. Majority of Private Sector Banks are also laggards according to Cost Efficiency, Allocative Efficiency and Technical Efficiency. According to Scale Efficiency, Private Sector Banks are to some extent moderate performers but in case of Pure Technical Efficiency large number of banks appears as leaders. Foreign Sector Banks show that maximum numbers of banks are laggards according to Cost Efficiency and Allocative Efficiency but they are leaders in terms of Technical, Pure Technical and Scale Efficiency scores as they provide speedy services to the customers. Private and Foreign Sector Banks have been attracting the best talent in the industry with lucrative salaries and perks. They have invested a good amount of resources on training and human resource management strategies to retain their workforce, which has raised their labour costs, as result they are laggards according to Cost Efficiency scores. Thus, the results highlight that there still exists room for improvement for banks in all sectors.

6. Conclusion

The results indicate that Indian Scheduled Commercial Banks have never achieved the full Cost Efficiency score of 1 in any of the years of study. The dominant reason located behind cost inefficiency is the Allocative Inefficiency which is perhaps due to high variation and unsteadiness in the input prices. Bank managers need to maintain equilibrium between inputs and outputs of banks keeping in mind the input prices. This would help them to take benefit of the favourable economic environment and sustain in

the unfavourable economic scenario. Further analysis of the efficiency suggests that technical inefficiencies are due to operating at incorrect scale. Scale inefficiency cautions that Indian Scheduled Commercial Banks are not operating on the optimum scale. They need to expand their business to correct their scale of operations. They should open new branches for expansion. Financial Inclusion should be enhanced. There is still a strong need to capture the unbanked population. Masses should be taught to develop banking habits. The results also highlight that Foreign Sector Banks are placed on the first position and the second position is taken by Private Sector Banks followed by Public Sector Banks. This depicts that Public Sector Banks are the most cost inefficient banks. 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. PSBs should follow strict credit appraisal policies and commence careful project monitoring departments to evaluate the projects while granting loans. Moreover, to recover the NPAs strong statutory mechanism should be followed. The present study provides deeper insights into the Cost Efficiency of the banking sector in India. Still, the research can further be extended by studying the various bank specific, industry specific and economy specific factors affecting efficiency of banks in terms of cost. Also, the impact of financial crisis on Cost Efficiency too can be evaluated empirically.

References

- Abu-Alkheil, A. (2012). *Ethical Banking and Finance: A Theoretical and Empirical Framework for the Cross-Country and Inter-Bank Analysis of Efficiency, Productivity, and Financial Performance* (Doctoral Dissertation). University of Hohenheim, South Stuttgart, Germany.
- Ahmad, N. H., & Noor, M. A. N. M. (2011). *The determinants efficiency and profitability of World Islamic banks*. Paper presented at the International Conference on E-business, Management and Economics, Hong Kong. Retrieved from <http://ipedr.com/vol3/47-M10013.pdf>.
- Ariff, M., & Can, L. (2008). Cost and profit efficiency of Chinese banks: A non-parametric analysis. *China Economic Review*, 19(2), 260-273.
- Ataullah, A., & Le, H. (2006). Economic reforms and bank efficiency in developing countries: The case of the Indian banking industry. *Applied Financial Economics*, 16(9), 653-663.
- Bader, M. K. I., Mohamad, S., Ariff, M., & Hassan, T. (2008). Cost, revenue and profit efficiency of Islamic versus conventional banks: International evidence using Data Envelopment Analysis. *Islamic Economic Studies*, 15(2), 23-76.

COST EFFICIENCY OF SCHEDULED COMMERCIAL BANKS: EMPIRICAL EVIDENCE FROM INDIA

Barros, C. P., & Mascarenhas, M. J. (2005). Technical and allocative efficiency in a chain of small hotels. *International Journal of Hospitality Management*, 24(3), 415-436.

Berger, A. N., & Humphrey, D. (1997). Efficiency of Financial Institutions: International survey and directions for future research. *European Journal of Operational Research*, 98(2), 175-212.

Berger, A. N., Hunter, W. C., & Timme, S. G. (1993). The efficiency of financial institutions: A review and preview of research past, present and future. *Journal of Banking and Finance*, 17(2 and 3), 221-250.

Bhatia, A., & Mahendru, M. (2014). A comparative study of labour productivity in public, private and foreign sector banks in India. *Asia-Pacific Journal of Management Research and Innovation*, 10(3), 239-251.

Bhattacharyya, A., Lovell, C. K., & Sahay, P. (1997). The impact of liberalization on the productive efficiency of Indian commercial banks. *European Journal of Operational Research*, 98(2), 332-345.

Brack, E., and Jimborean, R. (2009). *The cost-efficiency of French banks*. (MPRA Paper No. 23471). Retrieved from <https://mpra.ub.uni-muenchen.de/id/eprint/23471>

Burki, A. A., & Niazi, G. S. K. (2006). Impact of financial reforms on efficiency of state-owned, private and foreign banks in Pakistan (CMER Working Paper No. 06-49). Retrieved from http://saber.eaber.org/sites/default/files/documents/LUMS_Burki_2006.pdf

Cetorelli, N., & Gambera, M. (2001). Banking market structure, financial dependence and growth: International evidence from industry data. *The Journal of Finance*, 56(2), 617-648.

Chansarn, S. (2008). The relative efficiency of commercial banks in Thailand: DEA Approach. *International Research Journal of Finance and Economics*, 18(3), 53-68.

Chatterjee, B., & Sinha, R. P. (2006). Cost efficiency and commercial bank lending: some empirical results. *Indian Economic Journal*, 54(1), 145-163.

Coelli, T. J. (1996). *Measurement and sources of technical efficiency in Australian coal-fired electricity generation* (WP 1/96). Australia: Centre for Efficiency and Productivity Analysis (CEPA), Department of Econometrics, University of New England.

Coelli, T. J., Rao, D. S. P., O'Donnell, C. J., & Battese, G. E. (2005). *An introduction to efficiency and productivity analysis*. Germany: Springer Science and Business Media.

Cummins, J. D., Tennyson, S., & Weiss, M. A. (1999). Consolidation and efficiency in the US life insurance industry. *Journal of Banking & Finance*, 23(2), 325-357.

Cummins, J. D., Weiss, M. A., Xie, X., & Zi, H. (2010). Economies of scope in financial services:

A DEA efficiency analysis of the US insurance industry. *Journal of Banking and Finance*, 34(7), 1525-1539.

Das, A., Nag, A., & Ray, S. C. (2005). Liberalisation, ownership and efficiency in Indian banking: A non-parametric analysis. *Economic and Political Weekly*, 40(12), 1190-1197.

Egesa, K. (2010). *Financial Sector Liberalization and Productivity Change in Ugandas Commercial Banking Sector*. The African Economic Research Consortium, Nairobi, Kenya. Retrieved from <http://dspace.africaportal.org/jspui/bitstream/123456789/32145/1/RP202.pdf?1>

Favero, C. A., & Papi, L. (1995). Technical efficiency and scale efficiency in the Italian banking sector: A non-parametric approach, *Applied Economics*, 27(4), 385-96.

Girardone, C., Molyneux, P., & Gardener, E. P. (2004). Analysing the determinants of bank efficiency: The case of Italian banks. *Applied Economics*, 36(3), 215-227.

Gulati, R. (2011). *Efficiency in Indian commercial banks: A post-deregulation experience*, (Doctoral Dissertation). Guru Nanak Dev University, Amritsar, India.

Gulati, R., & Kumar, S. (2011). Impact of non-traditional activities on the efficiency of Indian banks: an empirical investigation. *Macroeconomics and Finance in Emerging Market Economies (An international journal of Routledge, Taylor & Francis Group)*, 4(1), p125-166.

Ioannis, A. G., Sophocles, B. N., & Manthos, D. D. (2008). The efficiency of the Greek banking system and its determinants. *Economic Bulletin*, 30, 7-27.

Isik, I., & Hassan, M. K. (2002). Technical, scale and allocative efficiencies of Turkish banking industry. *Journal of Banking and Finance*, 26(4), 719-766.

Jagannathan, R. (2014, December 30). Re: 3 Modi matters for PSU banks: Less capital, more autonomy, productive staff. [Web log comment]. Retrieved from <http://www.firstpost.com/business/3-modi-mantras-psu-banks-less-capital-autonomy-productive-staff-2022131.html>

Kalluru, S. R., & Bhat, S. K. (2009). Determinants of cost efficiency of commercial banks in India. *IUP Journal of Bank Management*, 8(2), 32-50.

Karimzadeh, M. (2012). Efficiency analysis by using data envelopment analysis model: Evidence from Indian banks. *International Journal of Latest Trends in Finance and Economic Sciences*, 2(3), 228-237.

Kaur, P., & Kaur, G. (2010). Impact of mergers on the cost efficiency of Indian commercial banks. *Eurasian Journal of Business and Economics*, 3(5), 27-50.

Ketkar, K. W., & Ketkar, S. L. (2008). *Performance and profitability of Indian banks in the post*

COST EFFICIENCY OF SCHEDULED COMMERCIAL BANKS: EMPIRICAL EVIDENCE FROM INDIA

liberalization period. Paper presented at The 2008 World Conference on National Accounts and Economic Performance Measures for Nations, Washington DC. Retrieved from <http://indexmeasures.com/dc2008/papers/ketkar17940.pdf>

Kumar, S. (2013). Banking reforms and the evolution of cost efficiency in Indian public sector banks. *Economic Change and Restructuring*, 46(2), 143-182.

Kumar, S., & Gulati, R. (2008). An examination of technical, pure technical, and scale efficiencies in Indian public sector banks using data envelopment analysis. *Eurasian Journal of Business and Economics*, 1(2), 33-69.

Kumar, S., & Gulati, R. (2010). *Dynamics of cost efficiency in Indian public sector banks: A post-deregulation experience*. Paper presented at the 12th Annual Conference on Money and Finance in the Indian Economy, Mumbai. Retrieved from http://202.54.18.156/conf/money1/mfc-12/Dynamics%20of%20cost%20efficiency_sunil%20kumar.pdf

Levin, R. (1997). Financial development and economic growth: Views and agenda. *Journal of Economic Literature*, 35(2), 688-726.

McKevitt, D. & Lawton, A. (1994). *Public Sector Management: Theory, Critique and Practice*. London: Sage Publications Ltd.,.

Niazi, G. (2003). *Measuring cost efficiency and productivity change of commercial banks in Pakistan, 1991-2000* (Doctoral Dissertation). Quaid-I-Azam University, Islamabad, Pakistan.

Pančurová, D., & Lyócsa, S. (2013). Determinants of commercial banks' efficiency: Evidence from 11 CEE countries. *Finance aUver*, 63(2), 152-179.

Raina, D., & Sharma, S. K. (2013). Determinants of cost efficiency of commercial banks in India: DEA Evidence. *IUP Journal of Bank Management*, 12(2), 17-30.

Rajan, R.G., & Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. *Journal of Finance*, 50(5), 1421-1460.

Ram Mohan, T. T., & Ray, S. C. (2004). Comparing performance of public and private sector banks: A revenue maximisation efficiency approach. *Economic and Political Weekly*, 39(12), 1271-1276.

Resende, M. (2000). Regulatory regimes and efficiency in US local telephony. *Oxford Economic Papers*. 52(3), 447-470.

Reserve Bank of India (2004-05). *Report on trend and progress of banking in India*, Mumbai: Jayant Printers.

Reserve Bank of India (2005-06). *Report on trend and progress of banking in India*, Mumbai:

Jayant Printers.

Reserve Bank of India (2006-07). *Report on trend and progress of banking in India*, Mumbai: Jayant Printers.

Reserve Bank of India (2008-09). *Report on trend and progress of banking in India*, Mumbai: Jayant Printers.

Reserve Bank of India (2011-12). *Report on trend and progress of banking in India*, Mumbai: Jayant Printers.

Reserve Bank of India (2012-13). *Report on trend and progress of banking in India*, Mumbai: Jayant Printers.

Reserve Bank of India (2013). *Banking Structure in India Looking Ahead by Looking Back*. Retrieved from https://www.rbi.org.in/scripts/BS_SpeechesView.aspx?Id=828

Sahoo, B. K., Sengupta, J., & Mandal, A. (2007). Productive performance evaluation of the banking sector in India using data envelopment analysis. *International Journal of Operations Research*, 4 (2), 63-79.

Saxonhouse, G. R. (1976). Estimated parameters as dependent variables. *American Economic Review*, 66(1), 178-84.

Staub, R. B., Souza, G. D. S., & Tabak, B. M. (2010). Evolution of bank efficiency in Brazil: A DEA approach. *European Journal of Operational Research*, 202(1), 204-213.

Uddin, S. S., & Suzuki, Y. (2011). Financial reform, ownership and performance in banking industry: The case of Bangladesh. *International Journal of Business and Management*, 6(7), 28-39.

Valverde, S. C., Humphrey, D. B., & Fernández, F. R. (2003). Bank deregulation is better than mergers. *Journal of International Financial Markets, Institutions and Money*, 13(5), 429-449.

Varadi, V. K., Mavaluri, P. K., & Boppana, N. (2006). *Measurement of efficiency of banks in India* (MPRA Paper No. 17350). Retrieved from http://mpra.ub.uni-muenchen.de/17350/MPRA_Paper_No.17350

Weill, L. (2004). Measuring cost efficiency in European banking: A comparison of frontier techniques. *Journal of Productivity Analysis*, 21(2), 133-152.

Yue, P. (1992). Data envelopment analysis and commercial bank performance: A primer with applications to Missouri banks. *Federal Reserve Bank of St. Louis Review*, 74, 31-45.

Zeitun, R., & Benjelloun, H. (2013). The efficiency of banks and the financial crisis in a developing economy: the case of Jordan. *Journal of Finance, Accounting and Management*, 4(1), 1-20.