Two Stage Efficiency Analysis of Indian Public and Private Sector Banks in the Context of OBS[#]

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Abstract

Efficiency is the only criteria to grow and sustain in the competitive markets. Due to technological innovations and emerging global market paradigm, any business organization is compelled to perform better than the yester-years. Banking sectors is one of the major players in the national economy and hence identifying the efficient ones and reducing the inefficient ones is a important task. Profitability is concerned, one look at the balance sheets and decide the rate of growth or decline in growth. In the banking context, one has to look in to the Off-Balance Sheet (OBS) items to study the growth pattern, rather than just depending on the balance Sheets alone. In general the OBS items appear as foot notes. Generally the efficiencies of financial institutions are decided based the standard approaches such as Ratio Analysis, a certain extend Regression Analysis.

A large number of studies based on OBS in the context of US banking sector and European Banking sectors have been done. A few research articles only available in Indian banking scenario in the context of OBS. This paper aims to bridge this gap. Last ten years good number of articles appeared based on Data Envelopment Analysis to study the efficiencies of various industrial sectors. In this paper, we have deployed the two-stage DEA to study the efficiencies of the public and private sector banks in the context of OBS.

Keywords: Data Envelopment Analysis (DEA), Frontier, Effectiveness, Off-Balance Sheet (OBS)

1. Introduction

The growth of banking sector in any geographical region is an indication of the regional growth. In a nutshell, banks are the backbone of any nation's economy. Till two decades ago, only the government was a major player and enjoying the monopoly in this segment. Due to liberalization and a change in the policy paradigm, many players entered into this sector slowly. The advancement of technology and the implementation of technology, the private players are forerunners who made a lead role and started ripping the benefits much before its counterparts, public sector banks. Hence a volume of articles appeared in studying the performance and effectiveness of banking. Most articles appeared in this arena based on CAMEL model and based on ratio analysis. The articles in this direction have used one or two parameters (or both) to measure the performance: Return On Assets (ROA) and Return On Equity (ROE). A very few articles only appeared using OBS items as one of the parameters. In this article, we used a non-parametric model, Data Envelopment Analysis (DEA) to study the performance with OBS as a parameter. Interestingly, Non-closed two-stage DEA was applied to study the efficiency of Public and Private Sector Banks in India, in the context

of OBS. In this article, the study focused on 26 Public sector banks and 19 private sector banks for the period of 3 years starting from 2015 to 2017 and hence 135 bank-years.

The remaining part of this article is presented as, section 2 on review of literature, section 3 deals with brief introduction on DEA, section 4 presents the results and discussions and section 5 is on conclusions and future directions.

2. Review of Literature

Data Envelopment Analysis is deployed to study the performance of almost in every industrial sector. In this section, reviews were on the deployment of DEA in banking sector. However, there will be reviews of papers from DEA literature too. To start with, DEA was introduced by Charnes, Cooper and Rhodes (CCR) in 1978 and later Banker, Cooper and Charnes modified the first model and it is called as BCC model. 1997 Berger and Humphrey did a review article which consists of efficiency studies of 130 financial institutions, including commercial banks (Berger, 1997).

Bhide, et al., did study on weakness of banks in the context of critical reforms and analyzed the issues and challenges (Bhide, 2002).

De studied the relationship between the ownership and efficiency and the impact of reforms on efficiency of Indian banks (De, 2004).

Another study utilized the DEA to determine the efficiency of performance of Indian Banking sector during Post-Reform and Global Financial Crisis (Kumar, 2012).

In another article, it was discussed that size of the bank and its impact on efficiency (Ray, 2004) The same authors discussed on the cost and profit efficiency of Indian banking (Ray, 2010).

Pushkala et al. did a comparative study on the impact of OBS and Liquidity (Pushkala, 2017) of both public and private sector banks in India.

Venkatesh et al., studied the profit efficiency of Foreign Banks in India in the context of OBS using DEA approach for 5 years (Venkatesh, 2016).

Other Review on efficiency analysis of Banks using DEA (Singh, 2004).

Gulati and Sunil Kumar applied two-stage NDEA to identify the intermediation and operational efficiencies in the Indian Banking scenario and observed that public sector banks are efficient than their counterparts in the intermediation efficiency whereas the private sector banks are efficient in the operational efficiency in the production process and applied the bootstrapped truncated regression to identify the influential factors towards the operational and intermediation efficiencies (Gulati, 2017).

Venkatesh et al., (2017) found that the role of OBS is the most influential factor on the performance of Public sector Banks (Venkatesh, Off-Balance Sheet items and Performance Evaluation of Prublic and Private Sector Banks in India: A DEA apporach).

3. Data Envelopment Analysis

Data Envelopment Analysis (DEA) is one of the non-parametric methods which is deployed in most of the efficiency studies. This method was developed by Charnes, Cooper & Rhodes in 1978, and popularly known as CCR model. At a later stage BCC model was introduced. In the last decade, about 7000 articles appeared on studying efficiencies of various sectors such as Finance, Banking, Healthcare and Agriculture. DEA is one of the predominant models in studying efficiencies.

The basic CCR model is given by

$$\text{Max}_{u,v}\, z = \frac{u_1 y_{1,0} + u_2 y_{2,0} + \ldots + u_n y_{n,0}}{v_1 x_{1,0} + v_2 x_{2,0} + \ldots + v_m x_{m,0}}$$

Subject to the constraints

$$\frac{u_1 y_{1,j} + u_2 y_{2,j} + \ldots + u_n y_{n,j}}{v_1 x_{1,j} + v_2 x_{2,j} + \ldots + v_m x_{m,j}} \leq 1$$

$$u_i \geq 0\, \left(1 \leq i \leq n\right) \,\&\, v_j \geq 0,\, \left(1 \leq j \leq m\right)$$

The equivalent linear programing problem as follows:

$$\text{Max}_{u,v}\, z = u_1 y_{1,j} + u_2 y_{2,j} + \ldots + u_n y_{n,j}$$

Subject to the constraints:

$$v_1 x_{1,j} + v_2 x_{2,j} + \ldots + v_m x_{m,j} = 1$$

$$u_1 y_{1,j} + u_2 y_{2,j} + \ldots + u_n y_{n,j} \leq v_1 x_{1,j} + v_2 x_{2,j} + \ldots + v_m x_{m,j}$$

$$u_i \geq 0 \left(1 \leq i \leq n\right) \,\&\, v_j \left(1 \leq j \leq m\right)$$

The efficiency can be obtained using various returns to scale such as Constant Return Scale (CRS), Variable Returns to Scale (VRS), Decreasing Returns to the Scale (DRS), Increasing Returns to the Scale (IRS), Free Disposal Hull (FDH) and so on. These are measures which are based on the distance between the efficiency of the firm to the frontier. Another important aspect of DEA is that the orientation of either input or output: How to maximize the outputs for the predefined inputs is input orientation whereas the output orientation is the method to minimize the inputs for the predefined outputs. The combination of orientation and returns to scale lead to various efficiencies. The firms or individuals, whose efficiency will be studied is called as Decision Making Units (DMU), in DEA literature.

In this article, a two-stage network DEA was deployed to study the efficiencies of Indian Public and Private sector Banks in the context of OBS. Many researchers utilized two-stage network DEA model in their studies. Originally the two-stage network DEA was presented in Naval Research Logistics (Liang, 2008). The two-stage network DEA model is given as:

$$Max \sum_{k=1}^{m} u_k y_{k0}$$

Subject to the constraints

$$\sum_{k=1}^{m} u_k y_{k0} - \sum_{l=1}^{L} u_l z_{lj} \leq 0$$

$$\sum_{l=1}^{L} u_l z_{lj} - \sum_{i=1}^{n} v_i x_{ij} \leq 0$$

$$\sum_{i=1}^{n} v_i x_{ij} = 1$$

$$w_l \geq 0 \,\&\, v_i \geq 0, 0 \leq l \leq L \,\&\, 0 \leq i \leq n$$

$$u_k \geq 0, 0 \leq k \leq m$$

3.1 Data and Methodology

The inputs for the first stage are Deposits, Borrowings and Share Capital and the outputs are Advances, Money at Call and Short notices, Fixed Assets and Other Assets. In the second stage, the inputs are the scale-efficiency scores of the banks and OBS and the outputs are Interest Income and Other Income (which includes the non-interest Income). In the first stage CRS and VRS input orientation were applied and the scale efficiency is computed as

$$Scale\ Efficiency = \frac{efficiency\ scores\left(CRS - In\right)}{efficiency\ scores\left(VRS - in\right)}$$

and the final efficiency is obtained from the second stage is used to compute the ranks of the Private and Public sector Banks. This study is based on the secondary data available on RBI website and the period covered for the study is three years starting from 2015 to 2017 (RBI, 2017). The statistics of the input and output variables of public and private sector banks are given in the Table 1 and 2 respectively.

Table 1.   Variables of the study

SCAP	Share Capital	MCAL	Money at Call & Short Notice	DEPO	Deposits
INVEST	Investment	ADV	Advances	BORR	Borrowings
FA	Fixed Assets	OA	Other Assets	OBS	Off-Balance Sheet Items
OINC	Other Income	INTINC	Interest Income	-	-

Table 2.   Summary Statistics of input-output variables public sector banks

Variables	Mean	Std. Dev.	Median	Skewness	Kurtosis
SCAP	7384.881	5950.109	6486.547	1.345215	1.977322
MCAL	55121.91	92510.25	9748.254	2.380088	5.892791
INVEST	879231	1137258	594633.8	4.232754	19.41983
ADV	2131476	2706034	1398605	3.695754	14.37053
FA	33586.01	51273.45	16783.74	5.956308	42.57485
OA	163766.1	249904.5	90116.45	4.208249	18.39139
DEPO	2917563	3379830	2009645	3.483452	13.26491
BORR	276548.4	547412.1	106059.6	4.345614	19.45894
INTINC	262394.1	301510.5	184916.5	3.685598	14.27296
OINC	34768.45	54575.91	19248.54	4.258837	19.18064
OBS	1459655	2065491	655614.2	2.848167	8.879379

Table 3.   Summary Statistics of input-output variables private sector banks

Variables	Mean	Std. Dev.	Median	Skewness	Kurtosis
SCAP	4311.431	6300.027	2459.295	3.516616	13.50887
MCAL	24907.52	55805.84	2499.733	3.499694	14.43576
INVEST	385382	534471	155570.7	1.881199	2.306513
ADV	953776.3	1389304	397408	1.914966	2.339954
FA	10846.82	16340.41	4686.746	2.587297	6.784174
OA	93304.5	154520.2	31043.01	2.116006	3.337
DEPO	1086664	1516332	502835.6	1.971565	2.790359
BORR	233419.9	422448.3	23239.54	2.228791	4.314399
INTINC	123063.4	171181.3	54196.54	1.896604	2.329493
OINC	25755.96	43295.92	5618.499	2.133809	3.794034
OBS	1762304	2940973	158069.3	1.651865	1.386165

The correlation among the input and output variables of public and private sector banks are presented in Figure 1 and 2 respectively. From the correlation analysis on public sector banks, OBS is highly interacting in the positive direction with Interest Income, Other Income, Deposits, Borrowings, Other Assets, Advances, Fixed Assets and Money at Call and Share Capital are in the decreasing order of correlation coefficients. Also, it is observed that Share Capital and Money at Call & Short notice plays a minimal role in determining the efficiencies of DMUs. Moreover, Interest Income and Deposits have attained the perfect correlation of 1 and Advances and deposits are also perfectly correlated with each other in both the DMUs. In case of private sector banks, OBS is highly interacting with Advances, Interest Income, Other Income, Other Assets, Borrowings, Fixed Assets, and Money at Call & Short notice and Share Capital. Among the input and output variables, Share Capital has very minimal interaction in both cases.

3.2 The Two-Stage DEA

In the first stage DEA, the inputs are Deposits, Borrowings and Share Capital and the outputs are Money at Call & Short notice, Fixed Assets, Other Assets. We deployed CRS input and VRS input oriented approach to obtain the scale efficiencies of DMUs. In the second stage, the efficiency scores of DMUs obtained in the first stage and OBS are the inputs and the outputs are Interest Income and Other Interest Income to obtain
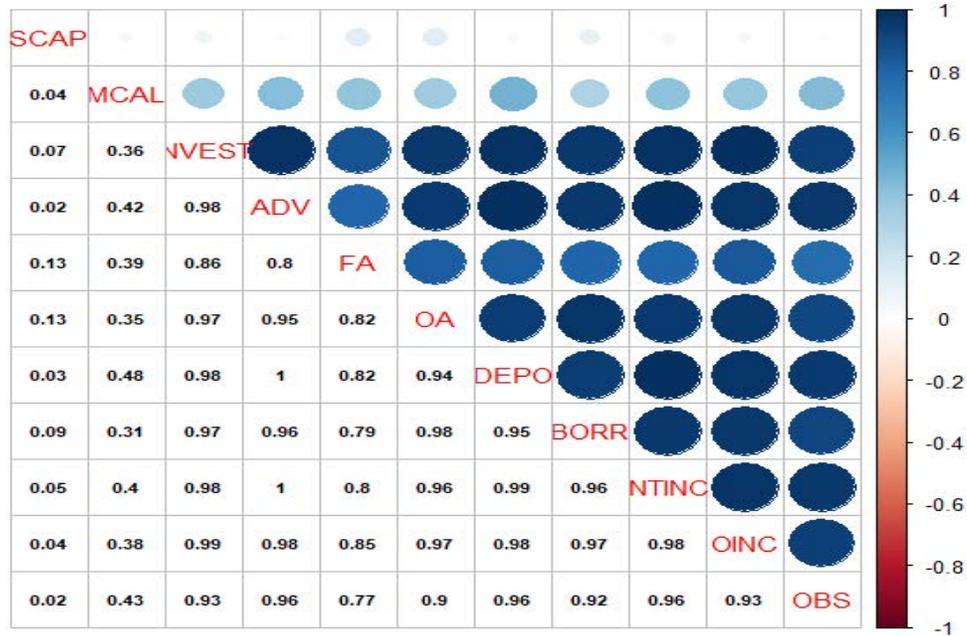
Figure 1. Correlation among the variables public sector banks
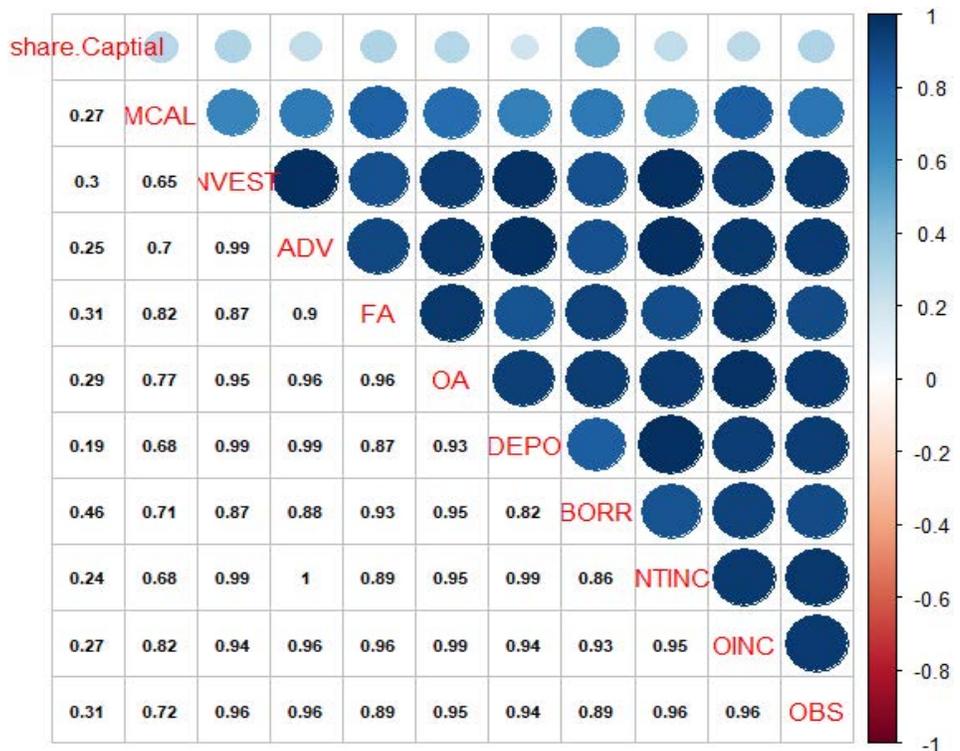

Figure 2. Correlation among the variables – private sector banks.

the scale efficiencies of the DMUs. These inputs and outputs are chosen based on the correlation analysis, even though there is no consistency of choosing the inputs and outputs for any study. There are very few articles appeared for the selection of input and output variables, but there is contradiction among the proven

results (Farzipoor Saen, 2005). Another article states that in order to identify the inputs and outputs, start with one input and one output, obtain the efficiency scores and subsequently consider second input/output, find the correlation coefficient. Based on this result, add one by one (Luis Daniel Otero, 2012). Share Capital is the only variable not considered in all the above studies, but it is reasonable to consider Share Capital as vital variable in this study because it is the primary most sources of funds to do banking business.

4. Results and Discussions

The first stage CRIO, VRIO and Scale efficiencies of private and Public sector banks are presented in Table 3 and 4 respectively. Frontiers are depicted in Figure 3 and 4 (one input variable and the corresponding scale efficiency). In the first stage, it is found that Jammu & Kashmir Bank is the most inefficient in the year 2015 and the remaining two years it has become efficient one. It is evident that only 6 banks among the considered 19 private banks are fully efficient during the study period.

The efficient private Banks are HDFC, ICICI, Kotak Mahindra Bank, Dhanalakshmi Bank, Tamil Nadu Mercantile Bank and Yes Bank. In case of public sector banks, only five banks are found fully efficient and they are State Bank of Travancore, State Bank of Patiala, State Bank of Mysore, Indian Bank and IDBI.

Like the scale efficiency computed in the first stage, the scale efficiency along with the ranks of public and private sector banks are computed under the second stage too. It is revealed that, no bank is fully efficient but most of the banks are efficient with respect to Variable Returns to Scale and input oriented approach. Three categories of efficiencies of private and public sector banks are given in Table 5 and 6 respectively.

It is learnt from the Table 4 that, Lakshmi Vilas Bank has been continuously attained the perfect efficiency of 1 in 2016 and 2017. Seven private sector banks attained efficiency score of 1 in 2017 which indicates that the private sector banks are trying hard to attain the utmost efficiency.

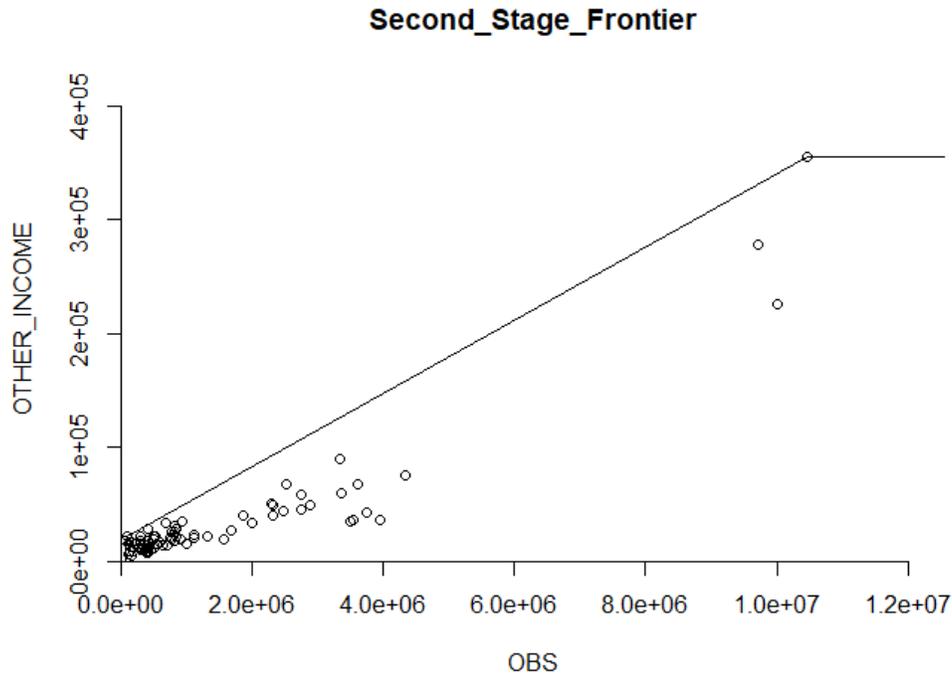**Table 3.**   Three efficiency scores 3 years – private sector banks

Year	2015			2016			2017		
Bank	CRIO EFF	VRIO EFF	Scale EFF	CRIO EFF	VRIO EFF	Scale EFF	CRIO EFF	VRIO EFF	Scale EFF
Axis Bank Ltd.	1.000	1.000	1.000	0.960	0.970	0.990	0.976	0.978	0.998
Catholic Syrian Bank Ltd.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
City Union Bank Ltd.	1.000	1.000	1.000	0.974	0.976	0.998	1.000	1.000	1.000
DCB Bank Ltd.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Federal Bank Ltd	1.000	1.000	1.000	0.957	0.960	0.997	0.966	0.969	0.997
HDFC Bank Ltd.	1.000	1.000	1.000	0.979	1.000	0.979	1.000	1.000	1.000
ICICI Bank Ltd.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
IDFC Bank Ltd.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Jammu & Kashmir Bank Ltd.	0.979	0.981	0.997	1.000	1.000	1.000	1.000	1.000	1.000
Karnataka Bank Ltd.	1.000	1.000	1.000	0.955	0.965	0.990	1.000	1.000	1.000
Karur Vysya Bank Ltd.	0.995	1.000	0.995	0.947	0.970	0.976	0.979	1.000	0.979
Kotak Mahindra Bank Ltd.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lakshmi Vilas Bank Ltd.	1.000	1.000	1.000	0.997	0.997	0.999	0.957	0.959	0.997
Nainital Bank Ltd.	1.000	1.000	1.000	0.852	1.000	0.852	1.000	1.000	1.000
RBL Bank Ltd.	1.000	1.000	1.000	0.941	0.947	0.994	0.945	0.957	0.987
South Indian Bank Ltd.	1.000	1.000	1.000	0.960	0.965	0.994	1.000	1.000	1.000
Tamil Nadu Mercantile Bank Ltd.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
The Dhanalakshmi Bank Ltd.	1.000	1.000	1.000	0.960	1.000	0.960	1.000	1.000	1.000
Yes Bank Ltd.	1.000	1.000	1.000	0.963	0.964	1.000	1.000	1.000	1.000

Table 4.   Three efficiency scores for 3 years - public sector banks

YEAR	2015			2016			2017		
Banks	**CRIO EFF**	**VRIO EFF**	**Scale EFF**	**CRIO EFF**	**VRIO EFF**	**Scale EFF**	**CRIO EFF**	**VRIO EFF**	**Scale EFF**
Allahabad Bank	0.971	0.975	1	0.971	0.97	0.997	0.96	0.97	0.995
Andhra Bank	0.998	0.998	1	0.993	1	0.997	0.96	0.96	0.998
Bank of Baroda	0.867	1	0.87	0.866	1	0.866	0.84	1	0.840
Bank of India	0.952	1	0.95	0.909	0.93	0.978	0.89	0.98	0.914
Bank of Maharashtra	0.994	0.995	1	0.972	0.97	0.997	0.9	0.91	0.998
Canara Bank	0.962	1	0.96	0.937	1	0.937	0.92	0.95	0.970
Central Bank of India	0.99	0.99	1	1	1	1	0.91	1	0.909
Corporation Bank	1	1	1	0.985	0.99	0.999	1	1	1.000
Dena Bank	0.972	0.98	0.99	0.96	0.96	1	1	1	1.000
IDBI Bank Limited	1	1	1	1	1	1	1	1	1.000
Indian Bank	1	1	1	1	1	1	1	1	1.000
Indian Overseas Bank	0.944	0.95	0.99	0.959	0.97	0.994	0.93	0.93	1.000
Oriental Bank of Commerce	1	1	1	0.987	0.99	0.994	0.99	1	0.988
Punjab And Sind Bank	0.98	1	0.98	0.982	1	0.982	0.99	1	0.986
Punjab National Bank	0.96	0.986	0.97	0.927	0.94	0.986	0.92	1	0.921
Syndicate Bank	0.955	0.969	0.99	0.941	0.95	0.987	0.95	0.98	0.974
UCO Bank	0.939	0.946	0.99	1	1	1	1	1	1.000
Union Bank of India	0.979	0.99	0.99	0.969	0.99	0.983	0.94	0.95	0.995
United Bank of India	1	1	1	1	1	1	1	1	1.000
Vijaya Bank	0.953	0.956	1	0.96	0.97	0.991	0.97	0.97	0.996
State Bank of Bikaner & Jaipur	1	1	1	0.983	1	0.983	1	1	1.000
State Bank of Hyderabad	1	1	1	1	1	1	1	1	1.000
State Bank of India	0.995	1	1	1	1	1	1	1	1.000
State Bank of Mysore	1	1	1	1	1	1	1	1	1.000
State Bank of Patiala	1	1	1	1	1	1	1	1	1.000
State Bank of Travancore	1	1	1	1	1	1	1	1	1.000
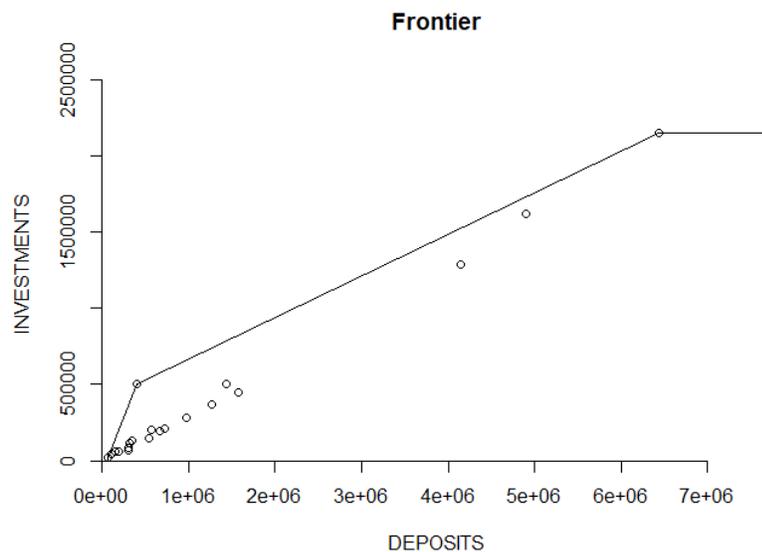
Figure 3.   First Stage Frontier.

Second_Stage_Frontier

Figure 4.　Second Stage Frontier

Table 5.　Efficiency scores 2nd stage - private banks

Year	2015			2016			2017		
Bank	**CRIO EFF**	**VRIO EFF**	**Scale EFF**	**CRIO EFF**	**VRIO EFF**	**Scale EFF**	**CRIO EFF**	**VRIO EFF**	**Scale EFF**
Axis Bank	0.815	0.877	0.930	0.888	0.910	0.976	0.981	0.983	0.998
Catholic Syrian Bank	1.000	1.000	1.000	0.965	0.971	0.994	1.000	1.000	1.000
City Union Bank	0.475	0.816	0.582	0.525	0.834	0.629	0.570	0.849	0.671
Dcb Bank Ltd.	0.472	0.757	0.623	0.662	0.782	0.846	0.660	0.797	0.828
Dhanlaxmi Bank	0.889	0.915	0.971	0.912	0.950	0.961	1.000	1.000	1.000
Federal Bank	0.941	0.962	0.978	0.870	0.964	0.903	1.000	1.000	1.000
HDFC Bank	0.708	0.918	0.771	0.949	0.970	0.978	1.000	1.000	1.000
ICICI Bank	0.837	0.939	0.891	0.287	0.733	0.391	0.377	0.753	0.500
Indusind Bank	0.562	0.764	0.736	0.563	0.776	0.725	0.525	0.790	0.664
Ing Vysya Bank	0.295	0.746	0.396	0.848	0.928	0.913	1.000	1.000	1.000
Jammu & Kashmir Bank Ltd.	0.812	0.912	0.890	0.838	0.941	0.890	1.000	1.000	1.000
Karnataka Bank Ltd.	0.727	0.893	0.814	0.845	0.933	0.906	0.873	0.963	0.907
Karur Vysya Bank	0.743	0.891	0.834	0.640	0.785	0.815	0.907	0.940	0.965
Kotak Mahindra Bank Ltd.	1.000	1.000	1.000	0.630	0.816	0.772	0.893	0.932	0.959
Lakshmi Vilas Bank	0.664	0.811	0.819	1.000	1.000	1.000	1.000	1.000	1.000
Nainital Bank	1.000	1.000	1.000	0.373	0.752	0.496	0.483	0.787	0.614
RBL	0.353	0.766	0.461	0.715	0.885	0.807	0.990	1.000	0.990
South Indian Bank	0.573	0.838	0.683	0.446	0.798	0.559	0.500	0.804	0.622
Tamil Nadu Mercantile Bank Ltd.	0.436	0.793	0.550	0.886	0.907	0.978	0.742	0.788	0.943
Yes Bank Ltd.	0.362	0.766	0.473	0.461	0.776	0.595	0.579	0.794	0.730

Table 6. Efficiency scores 2nd stage - public sector banks

Year	2015			2016			2017		
Bank	CRIO EFF	VRIO EFF	Scale EFF	CRIO EFF	VRIO EFF	Scale EFF	CRIO EFF	VRIO EFF	Scale EFF
Allahabad Bank	0.643	0.911	0.706	0.500	0.898	0.556	0.447	0.904	0.495
Andhra Bank	0.725	0.906	0.800	0.862	0.955	0.903	0.588	0.923	0.637
Bank of Baroda	0.855	0.982	0.871	0.927	1.000	0.927	0.830	1.000	0.830
Bank of India	0.611	0.884	0.691	0.620	0.924	0.671	0.577	0.941	0.613
Bank of Maharashtra	0.723	0.921	0.785	0.766	0.947	0.809	0.773	1.000	0.773
Canara Bank	0.781	0.888	0.879	0.764	0.902	0.847	0.519	0.916	0.567
Central Bank of India	0.943	0.961	0.982	0.997	1.000	0.997	0.960	1.000	0.960
Corporation Bank	0.665	0.888	0.749	0.737	0.911	0.809	0.772	0.912	0.847
Dena Bank	0.545	0.928	0.587	0.544	0.939	0.579	0.515	0.902	0.571
IDBI Bank Limited	0.565	0.856	0.660	0.627	0.864	0.726	0.649	0.867	0.749
Indian Bank	0.809	0.936	0.864	0.957	0.974	0.983	0.990	0.991	0.999
Indian Overseas Bank	0.913	0.962	0.949	0.932	0.966	0.965	0.921	1.000	0.921
Oriental Bank of Commerce	0.933	0.964	0.968	1.000	1.000	1.000	1.000	1.000	1.000
Punjab and Sind Bank	0.681	0.972	0.701	0.685	0.969	0.707	0.734	0.994	0.739
Punjab National Bank	0.830	0.903	0.919	0.731	0.914	0.800	0.745	0.930	0.801
Syndicate Bank	0.638	0.919	0.694	0.898	0.965	0.931	0.854	0.958	0.892
UCO Bank	0.780	0.956	0.816	0.797	0.915	0.871	0.774	0.913	0.847
Union Bank of India	0.474	0.859	0.552	0.433	0.867	0.499	0.666	0.903	0.737
United Bank of India	1.000	1.000	1.000	0.848	0.975	0.870	1.000	1.000	1.000
Vijaya Bank	1.000	1.000	1.000	0.911	0.982	0.928	0.974	1.000	0.974
State Bank of Bikaner & Jaipur	0.436	0.901	0.484	0.452	0.915	0.494	0.556	0.905	0.614
State Bank of Hyderabad	0.581	0.897	0.648	0.571	0.895	0.639	0.648	0.901	0.719
State Bank of India	0.905	0.977	0.926	1.000	1.000	1.000	1.000	1.000	1.000
State Bank of Mysore	0.355	0.902	0.394	0.370	0.903	0.410	0.390	0.903	0.432
State Bank of Patiala	0.621	0.916	0.679	0.609	0.910	0.669	0.685	0.937	0.731
State Bank of Travancore	0.559	0.911	0.614	0.494	0.902	0.547	0.699	0.945	0.740

Table 7. Ranks - private banks

Banks	Rank CRS	Rank VRS	Rank SE
Axis Bank	4	8	3
Catholic Syrian Bank Ltd.	1	1	1
City Union Bank Ltd.	17	14	17
DCB Bank Limited	15	18	13
Dhanlaxmi Bank	3	4	2
Federal Bank	2	2	4
HDFC Bank	6	3	7
ICICI Bank	19	17	20
Indusind Bank	16	20	15
Ing Vysya Bank	11	10	12

Jammu & Kashmir Bank Ltd.	7	5	6
Karnataka Bank Ltd.	9	7	9
Karur Vysya Bank	10	12	10
Kotak Mahindra Bank Ltd.	8	9	8
Lakshmi Vilas Bank	5	6	5
Nainital Bank	14	13	16
RBL	13	11	14
South Indian Bank	18	16	18
Tamilnad Mercantile Bank Ltd.	12	15	11
Yes Bank Ltd.	20	19	19

Table 8.   Ranks - public sector banks

Bank	Rank C	Rank V	Rank S	Bank	Rank C	Rank V	Rank S
Allahabad Bank	23	20	23	Punjab and Sind Bank	15	7	16
Andhra Bank	13	13	14	Punjab National Bank	11	18	10
Bank of Baroda	8	2	8	State Bank of Bikaner & Jaipur	25	19	25
Bank of India	19	17	20	State Bank of Hyderabad	20	24	19
Bank of Maharashtra	12	10	13	State Bank of India	2	3	3
Canara Bank	16	23	15	State Bank of Mysore	26	22	26
Central Bank of India	3	6	2	State Bank of Patiala	17	15	18
Corporation Bank	14	21	12	State Bank of Travancore	21	16	21
Dena Bank	22	14	24	Syndicate Bank	9	11	11
IDBI Bank Limited	18	26	17	UCO Bank	10	12	9
Indian Bank	7	9	6	Union Bank of India	24	25	22
Indian Overseas Bank	6	8	7	United Bank of India	5	4	5
Oriental Bank of Commerce	1	5	1	Vijaya Bank	4	1	4

Oriental Bank of Commerce and State Bank of India are the efficiency scores of 1 in 2016 and secured 2017. Indian Bank and Vijaya Bank have secured near perfect efficiency scores during the three years of study. However the private sector banks are better than their counter-parts, public sector banks, even though the correlation coefficient of OBS is .9 and above with all other variables except Share Capital. The Ranks have been computed based on the average efficiency scores are summarized in Table 7 and 8.

efficiency scores. SBI, Oriental Bank of Commerce and Vijaya Bank are top performers in maintaining their topper ranks. All the associates of SBI are the poor performers and ranked poorly in the context of all types of efficiency. Few Public sector banks attained the efficiency of 1 and 0.9. Other public sector banks performed miserably in all spheres of efficiency scores. The private sector banks outsmart in all classified efficiencies than in the public sector banks in the last three years. It is suggested in the study that, consolidation among public sector banks is inevitable to attain efficiencies in the long run.

5. Conclusion

Irrespective of the type of efficiency scores, Catholic Syrian Bank topped among all the private banks in India. Federal Bank and Dhanlaxmi Bank maintained the second and third positions in all types of

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