Technical Efficiency Gap between Bank of Ceylon and Commercial Bank in Sri Lanka: A Data Envelopment Analysis

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Introduction

Data Envelopment Analysis (DEA) is a non-parametric technique for measuring the relative efficiency of a set of similar units, usually referred to as decision-making units (DMUs). It was initially used to assess the relative efficiency of not-for-profit organizations. However, gradually its application has been extended to cover for-profit organizations as well. Its first application in banking industry appeared with the work of Sherman and Gold (1985). The technical efficiency relates to the productivity of inputs (Sathye, 2001). A bank is said to be technically inefficient if it operates below the frontier. A measure of technical efficiency under the assumption of Constant Returns-to-Scale (CRS) is known as Overall Technical Efficiency (OTE).

In Sri Lanka, variables such as operational risk, inflation and market capitalization had a positive effect on Technical Efficiency (TE) in asset transformation of banks (Seelanatha, 2012). Fernando et al (2014) found that mean technical efficiency score of the Sri Lankan banking industry was 83 percent and the highest efficiency was recorded in the year 2011. However, none of the empirical studies in the existing literature have considered the efficiency gap between Bank of Ceylon and Commercial Bank in Sri Lanka. The Bank of Ceylon (BOC) and Commercial Bank are famous commercial banks in Sri Lanka. The

Bank of Ceylon is a government bank but Commercial Bank is a private bank in Sri Lanka. By measuring the level of technical efficiency, this study compares the technical efficiency of the both banks.

Objective

The objective of the study is to measure the technical efficiency gap between Commercial Bank and Bank of Ceylon from 2004 to 2015 by using Data Envelopment Analysis (DEA).

Methodology

Data was gathered from various annual reports of the both banks. The study used one output variable (profits of the bank before taxation) and three inputs variables (Loans and advances, liabilities, and a number of labours of the bank). The study mainly used Charnes, Cooper and Rhodes (CCR) model and Banker, Charnes, and Cooper (BCC) model of DEA. The CCR model is named after its developers Charnes, Cooper, and Rhodes (1978), and is based on the assumption of Constant Returns-to-Scale (CRS). The BCC model is named after its developers Banker, Charnes and Cooper (1984), and is based on the assumption of Variable Returns-to-Scale (VRS). The both CCR and BCC models can be divided into two categories, input-oriented and Output oriented models. The study applied only input-oriented of both CCR and BCC model given below

$$\min_{\theta\beta} \theta_k$$

Subject to

$$\sum_{j=1}^{n} \beta_j X_{ij} \leq \theta_k X_{ik} \quad (i= 1, 2,\ldots..,s) \tag{1}$$

$$\sum_{j=1}^{n} \beta_j Y_{rj} \geq Y_k \tag{2}$$

$$\beta_j \geq 0, \quad (j=1, 2,\ldots.n) \tag{3}$$

$$\sum_{j=1}^{n} \beta_j = 1, \quad \text{if VRS} \tag{4}$$

Where, X_{ik} = amount of inputs *i* used by bank k

Y_k = amount of output *Y* produced by bank *k*

θ_k = technical efficiency score for bank k
n = the number of banks (j= 1,, ……, n), where n =2
s = the number of inputs (i= 1, …., s), where s = 3

There are restrictions 1, 2, and 3 for CCR model and restrictions 1, 2, and 4 for BCC model. The CCR model provides Overall Technical Efficiency (OTE) and BCC model provides the pure technical efficiency (PTE). The OTE is decomposed by Pure Technical Efficiency (PTE) and Scale Efficiency (SE). The SE is measured by a ratio of OTE to PTE score. The PTE measure has been used as an index to capture managerial performance and SE measure provides the ability of the management to choose the optimum size of resources. All results have estimated by using Data Envelopment Analysis Program (DEAP) version 2.1 (Coelli, 1999).

Results and Discussion

The model is estimated by using cross-sectional data and the results are reported in Table 1. In Table 1 every year, the efficiency score of Commercial Bank was equal to one. This did not mean Commercial Bank had the same level of efficiency at every year. Here, the study considered two banks. In this case, a bank which is efficient among them will take an efficient score of one when estimating the model for each year. In Sri Lanka, if Commercial Bank was efficient compared to Bank of Ceylon, overall technical efficiency score of Commercial Bank was equal to one for each year. In 2009, OTE gap between Bank of Ceylon and Commercial Bank was (64.4 %) very large. In 2015, it is (8.5 %) very small. During the Global financial crisis years (2007-2009), the technical efficiency gap increased to 60.7 % as an average of three years (see Table 2).

Table 1: Results of overall TE of bank of Ceylon and commercial bank

Year	OTE score of Bank of Ceylon	OTE score of Commercial Bank	Technical Efficiency (OTE) Gap	Three years Average of OTE Gap
2004	0.641	1.000	0.359	
2005	0.560	1.000	0.440	0.399
2006	0.602	1.000	0.398	
2007	0.394	1.000	0.606	
2008	0.431	1.000	0.569	0.607
2009	0.356	1.000	0.644	
2010	0.588	1.000	0.412	
2011	0.843	1.000	0.157	0.250
2012	0.818	1.000	0.182	
2013	0.576	1.000	0.424	
2014	0.745	1.000	0.255	0.255
2015	0.915	1.000	0.085	

Source: Author's calculation

Table 2 shows decompose of overall technical efficiency (OTE) Gap between Bank of Ceylon and Commercial Bank. Here, the reader should mind Bank of Ceylon had less than or equal but no more than efficiency score (PTE and SE) to Commercial Bank.

Table 2: Decompositions of overall technical efficiency gap

Year	Pure Technical Efficiency Gap (%)	Scale Efficiency Gap (%)
2004	0	35.9
2005	34.6	14.3
2006	38.7	1.8
2007	41.5	32.6
2008	38.1	30.4
2009	39.1	41.5
2010	0	41.2
2011	0	15.7
2012	0	18.2
2013	0	42.4
2014	0	25.5
2015	0	8.5
Mean	16.0	25.7

Source: Author's Calculation

The pure technical efficiency gap between the both banks was more than 34 % between 2005 and 2009 and was no gap in other years. There is always scale efficiency gap between both banks. The SE gap was (42.4 %) very high in 2013 but it was (1.8 %) very less in 2006. Bank of Ceylon had more inefficiency in resource allocation than inefficiency in managerial performance. Because an average of SE Gap was greater than the average of PTE Gap. Commercial Bank has been performed well compared to Bank of Ceylon in terms of OTE, PTE, and SE.

Conclusion and Recommendation

The study concluded that Commercial Bank has been performed well compared to Bank of Ceylon in terms of OTE, PTE and SE. Further, Bank of Ceylon had more inefficiency on resource allocation than inefficiency on managerial performance because average SE Gap was greater than average PTE Gap between these banks. Therefore, Bank of Ceylon should focus more on resource allocation because its scale inefficiency is greater than the pure technical inefficiency.

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