

The Global Financial Crisis and the Technical Efficiency of Commercial Banks in Sri Lanka: A Data Envelopment Analysis

S.S.Uthayakumar¹ and T.Selvamalai²

Introduction

Data envelopment analysis (DEA) introduced by Charnes et al. (1978) based on Farrell (1957), 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 organisations; but gradually its application was extended to cover for-profit organisations as well. Its first application in banking industry appeared with the work of Sherman and Gold (1985). DEA provides the technical efficiency score of a bank or any institution.

Technical efficiency of a firm is a comparative measure of how well it actually processes inputs to achieve outputs, as compared to its maximum potential for doing so, as represented by its production possibility frontier (Barros and Mascarenhas, 2005). 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). Technical efficiency of banks is determined by internal and external factors. A financial crisis is an important external factor. A financial crisis is a situation in which some financial institutions or assets suddenly lose a large part of their value. It is a testament to the shortcomings of international capital markets and their vulnerability to sudden reversals of market confidence. It can be classified into five categories, macroeconomic policy-induced crisis, financial panic, bubble collapse, moral hazard crisis, and disorderly workout. There was a financial crisis in 2007 and 2008 in the world. It affected the efficiency of financial institutions directly or indirectly. In this view, the study focuses on the impact that financial crisis 2008 had on the efficiency of commercial banks in Sri Lanka.

Objective and Methodology

The objective of the study is to find the impact of the financial crisis of 2007/2008 on the efficiency of commercial banks in Sri Lanka using DEA. The study selected only four commercial banks (People's Bank, Bank of Ceylon, Commercial Bank of Ceylon, and Hatton National Bank) and only studied six years between 2005 and

¹ Senior Lecturer, Department of Economics, University of Jaffna, Sri Lanka. ssuthayan@yahoo.com

² Lecturer (on Contract), Department of Economics and Management, Vavuniya Campus, University of Jaffna, Sri Lanka. selvam3088@gmail.com

2010. For the DEA, 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). All data were gathered from the annual reports of the banks.

In basic DEA, there are two types of model, CCR and BCC. The CCR model is named after developers Charnes, Cooper, and Rhodes (1978), and is based on the assumption of constant returns-to-scale (CRS). The BCC model is named after developers Banker, Charnes and Cooper (1984), and is based on the assumption of variable returns-to-scale (VRS). The CCR and BCC models can be divided into two categories, input-oriented and output-oriented models. The study considered both CCR and BCC models, applying only input-oriented CCR and BCC.

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

Subject to

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

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

$$\beta_j \geq 0, \quad (j=1, 2, \dots, n) \quad (3)$$

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

Where X_{ik} = amount of inputs i used by DMU k

Y_k = amount of output Y produced by DMU k

θ_k = technical efficiency score for DMU k

n = the number of DMUs $(j= 1, 2, \dots, n)$

s = the number of inputs $(i= 1, 2, \dots, s)$

The CCR model's restrictions are 1, 2, and 3 and the BCC model's restrictions are 1, 2 and 4. The CCR model provides overall technical efficiency (OTE) score which decomposed by pure technical efficiency (PTE) and scale efficiency (SE). The BCC model provides the PTE score. The SE is measured by a ratio of OTE score (from CCR model) to PTE score (from BCC model). The PTE measure has been used as an index to capture managerial performance and measure of SE provides the ability of the management to choose the optimum size of resources.

All results have estimated by using DEAP version 2.1 (Coelli T.J, 1999) software. The study considered the year 2005 and 2006 as pre-crisis years, 2007 and 2008 as crisis years and 2009 and 2010 as a post-crisis years.

Results and Discussion

Table 1 shows the results of the average overall technical efficiency (OTE) score of selected commercial banks of Sri Lanka between 2005 and 2010. During the crisis, an average overall technical efficiency score of selected commercial banks of Sri Lanka was less than the during pre and post crisis. The mean of OTE score was 0.658 during the crisis period but it was greater than 0.734 during the pre- and post-crisis periods (see Table 1).

Table 1: Results of overall technical efficiency of selected commercial banks of Sri Lanka between 2005 and 2010

Year		Overall Technical Efficiency (OTE)	
Pre-crisis	2005	0.737	0.751
	2006	0.765	
Crisis	2007	0.658	0.658
	2008	0.658	
Post- crisis	2009	0.711	0.735
	2010	0.759	

Source: Author calculation

Table 2: Decompositions of Overall Technical Efficiency

Year		Pure Technical Efficiency (PTE)		Scale Efficiency (SE)	
Pre-crisis	2005	0.913	0.866	0.811	0.877
	2006	0.819		0.943	
Crisis	2007	0.809	0.816	0.738	0.761
	2008	0.824		0.785	
Post-crisis	2009	0.799	0.852	0.863	0.857
	2010	0.905		0.851	

Source: Author calculation

Table 2 shows the decomposition of overall technical efficiency. The pure technical efficiency (PTE) and scale efficiency (SE) was less during the crisis period compared to pre and post-crisis periods. The PTE score was 0.816 during the crisis but it was greater than 0.85 during pre- and post-crisis periods. The SE score was 0.761 during the crisis but was greater than 0.856 during pre- and post-crisis

periods. The global financial crisis affected SE more than PTE because the decrease in SE score is greater than the decrease in PTE during the crisis period.

Conclusion and Recommendation

During the crisis, the average overall technical efficiency score of selected commercial banks of Sri Lanka fell below pre and post crisis values. The global financial crisis affected scale efficiency more than pure technical. Therefore, policy makers should focus more on how to increase scale efficiency than on how to increase the pure technical efficiency of banks during periods of crisis or depression in an economy.

Keywords: Commercial Banks, Data Envelopment Analysis (DEA), Financial Crisis, Technical Efficiency

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