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Technical Efficiency and Super-Efficiency of Commercial Banks in Albania

Assoc. Prof. Dr. Alma Spaho, Prof. Dr. Thoma Mitre, Dr. Valentina Shehu

University of Tirana, Albania
e-mail: alma.spaho@unitir.edu.al

Abstract

Banks are the dominant financial institutions in Albania and their health is critical to the general economy. Moreover, the growth of the economy is closely related to the well-being of the banking sector. In this study, the technical efficiency and the super-efficiency level of all commercial banks in Albania during year 2014 is analyzed using Data Envelopment Analysis (DEA) by adopting the intermediation approach. The data used in the analysis are the 2014 data of financial statements. The results indicated that 12 out of 16 banks were efficient. The findings of this research can be used by banks managers and other financial authorities in Albania.

Introduction

DEA is a non-parametric technique used in the analysis of efficiency of homogeneous units called decision making units (DMUs). There are two types of measures in DEA, radial and non-radial, which can evaluate the efficiency of DMUs. Radial models assume proportional change of inputs or outputs and usually discard the existence of slacks in the efficiency scores. For the first time the radial DEA model was proposed by Charnes et al. (1978) (CCR model) and later extended by Banker et al. (1984) (BCC model). Non-radical models consider the slacks of each input or output and the variations of inputs and outputs are not proportional, in other worlds the inputs/ outputs are allowed to decrease/ increase at different rates. A non-radial model by the name of slacks-based-measure (SBM) was developed by Tone in 2001. SBM model directly works with input excess and output shortfall slacks, and integrates them into an efficiency measure.

The difference between a super-efficiency (SE) model and standard efficiency model is that in super models the DMU evaluated is eliminated from the reference set. The first super-efficiency model has been developed by Andersen & Petersen (1993) to provide strict ranking to DMUs in the sample. Under the assumption of variable-return-to-scale (VRS), the SE model may be infeasible for some efficient DMUs. Based on the SBM model, Tone (2002) proposed a super-SBM model that could resolve the infeasibility problem.

There are a number of studies examining banks technical efficiency and super-efficiency. Rosman et al. (2014) using intermediation approach, found that the Islamic banks in both Middle Eastern and Asian countries on average can be characterized as technically efficient during the period 2007-2010. Zimkova (2014) used BCC, SBM and Super SBM input oriented model with VRS to estimate the efficiency of banks and to rank the efficient units. The results showed that more than half of banks were BCC and SBM efficient. A slight difference was found in the use of BCC and SBM models in banking institutions ranking.

Methodology

DEA models

Consider there are *n* DMUs, each DMU*j*, (*j* = 1, 2, …, *n*) uses *m* inputs in respective amounts x_{ij} (*i* = 1, …, *m*) and generates *s* outputs in respective amounts y_{rj} (*r* = 1, …, *s*). The input-oriented **BCC** model with VRS for DMU_p (*p* = 1, 2, …, *n*) is,

min θ_p

subject to

$$\begin{cases} \sum_{j=1}^{n} \lambda_j x_{ij} \le \theta x_{ip} & i = 1,2,...,m \\ \sum_{j=1}^{n} \lambda_j y_{rj} \ge y_{rp} & r = 1,2,...,s \\ \sum_{j=1}^{n} \lambda_j = 1 \end{cases} \quad (1)$$

and $\lambda_j \ge 0$, *j*=1, 2, …, *n*; θ_p unrestricted in sign where θ_p indicates the efficiency score of DMU_p, and λ_j are the dual variables.

The DMUp is considered BCC-eficient if and only if $\theta_p(\min)=1$,and inefficient if $\theta_p(\min)< 1$.

The input oriented **SBM** model with VRS of Tone (2001) can be formulated as:

$$\min \quad \rho_p = 1 - \frac{1}{m}\sum_{i=1}^{m} \frac{s_i^-}{x_{ip}}$$

subject to

$$\begin{cases} \sum_{j=1}^{n} \lambda_j x_{ij} + s_i^- = x_{ip} & i = 1,2,...,m \\ \sum_{j=1}^{n} \lambda_j y_{rj} - s_r^+ = y_{rp} & r = 1,2,...,s \\ \sum_{j=1}^{n} \lambda_j = 1 \end{cases} \quad (2)$$

and $\lambda_j \ge 0$, *j* = 1, 2, …, *n*; $s_i^- \ge 0$, *i* =1,2,…, *m*; $s_r^+ \ge 0$, *r* = 1, 2, …, *s*; ρ_p unrestricted in sign where s_i^- and s_r^+ indicate the input excesses and output shortfall slacks, respectively. The DMUp is considered SBM efficient only if $\rho_p(\min) = 1$ and $s_i^- = s_r^+ = 0$. If $\rho_p(\min) < 1$, the unit is inefficient.

For an efficient DMUp, the VRS input-oriented **SE-BCC** model (3) is the same as model (1) above with the only change that the DMU under evaluation is not included in the analysis; that is, *j* = 1, 2, …, *n* , *j* ≠ *p*.

The super-efficiency model of Tone (2002), the **SE-SBM** model can be formulated as:

$$\min \quad \rho_p = 1 + \frac{1}{m}\sum_{i=1}^{m} \frac{s_i^-}{x_{ip}}$$

subject to

$$\begin{cases} x_{ip} - \sum_{j=1,\neq p}^{n} \lambda_j x_{ij} + s_i^- \ge 0 & i = 1,2,...,m \\ \sum_{j=1,\neq p}^{n} \lambda_j y_{rj} - y_{rp} - s_r^+ = 0 & r = 1,2,...,s \\ \sum_{j=1,\neq p}^{n} \lambda_j = 1 \end{cases} \quad (4)$$

and $\lambda_j \ge 0$, *j*=1, 2, …, *n* (*j*≠*p*); $s_i^- \ge 0$, *i*=1, 2,…,*m*; $s_r^+ \ge 0$, *r* = 1, 2, …, *s*; ρ_p unrestricted in sign

The data

This study includes all commercial banks operating in Albania during year 2014. The data are taken from the financial statements of each bank. Three inputs and two outputs are selected based on the study of Rosman et al. (2014). Input variables were: total deposits, personnel expenses and fixed assets; whereas output variables: total loans and investments.

Results and discussion

The results of BCC and SBM models indicate a slight difference in the technical efficiency scores of banks. The inefficient banks rank change more between the two models. The results of the analysis showed that 12 out of 16 banks were technically efficient by applying input-oriented BCC and SBM models under VRS.

Bank	BCC score	SBM score	SE-BCC score	SE-SBM score
RF	1.000	1.000	1.180	1.060
NCB	1.000	1.000	Infeasible	Infeasible
United	1.000	1.000	1.134	1.066
IntesaSan Paolo	1.000	1.000	1.016	1.007
Tirana	1.000	1.000	1.136	1.056
NBG	1.000	1.000	1.351	1.215
Alpha	1.000	1.000	1.082	1.028
Veneto	0.999	0.886	0.999	0.886
ProCredit	0.867	0.529	0.867	0.529
ICB	0.978	0.878	0.978	0.878
Credit Agricole	1.000	1.000	1.055	1.018
Credit Bank	1.000	1.000	8.328	3.896
Credins	1.000	1.000	1.876	1.674
Societe Generale	0.911	0.843	0.911	0.843
Union	1.000	1.000	1.293	1.104
FiBank	1.000	1.000	1.476	1.223

The results of SE models indicate an infeasible solution for NCB bank and the highest score for Credit Bank.

Two interpretations of a SE score are: the higher its value, the higher is the super-efficiency of the respective bank; and it can be used to find outlier in the dataset under study (Zimkova, 2014).

Based on the super-efficiency scores and interpreting the higher scores as the higher efficiency, according to the results of SE-BCC and SE-SBM models the most efficient banks were NCB and Credit bank, and the least efficient banks were ProCredit and Societe.

Pearson correlation coefficients indicate a high significant and positive correlation (r=0.93, p<0.01) between BCC and SBM efficiency scores, and also a high significant positive correlation between SE-BCC and SE-SBM efficiency scores (r = 0.98, p<0.01). The correlation coefficients between BCC and SBM efficiency scores, and the SE-BCC and SE-SBM efficiency scores efficiency score were not high, not significant, but positive. Spearman correlation coefficients indicate that the four efficiency scores were monotonically related (p < 0.01), even if their relationship is not linear. This results are consistent with the findings of Zimkova (2014).

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