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 intermediate 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 bank 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-radial models consider the slacks of each input or output and the variations of inputs and outputs are not proportional, in other words 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 meta-regression analysis, 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 SBM, 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 CC 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 DMUj (j = 1, 2, ..., n) uses m inputs in respective amounts xij (i = 1, ..., m) and generates s outputs in respective amounts yij (r = 1, 2, ..., s). The input-oriented BCC model with VRS for DMUj (p = 1, 2, ..., n) is, min θ

subject to

\[ \sum_{j=1}^{n} \lambda_j x_{ij} \leq x_{im}, \quad i = 1,2,...,m \]

\[ \sum_{i=1}^{m} \gamma_i \lambda_j \geq y_{ij}, \quad r = 1,2,...,s \]

\[ \sum_{j=1}^{n} \lambda_j = 1 \]

and \( \lambda_j \geq 0, j = 1,2, ..., n; \gamma_i \) unrestricted in sign where \( \theta \) indicates the efficiency score of DMUj and \( \lambda_j \) are the dual variables. The DMU is considered BCC-efficient if and only if \( \theta_{j} \geq 1 \) and efficient if \( \theta_{j} < 1 \). The input oriented SBM model with VRS (2001) can be formulated as:

\[ \min \ \rho \ = 1 - \frac{1}{m} \sum_{j=1}^{n} \theta_j \]

subject to

\[ \sum_{j=1}^{n} \lambda_j x_{ij} = x_{im}, \quad i = 1,2,...,m \]

\[ \sum_{i=1}^{m} \gamma_i \lambda_j = y_{ij}, \quad r = 1,2,...,s \]

\[ \sum_{j=1}^{n} \lambda_j = 1 \]

and \( \gamma_i \geq 0, \lambda_j \geq 0, j = 1,2, ..., n; s \) unrestricted in sign where \( s \) and \( \gamma_i \) indicate the input excess and output shortfall slacks, respectively. The DMU is considered SBM efficient only if \( \rho \geq 1 \) and \( \rho = 1 \), the unit is inefficient. For an efficient DMU, 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, \( j = 1,2,...,n; j \neq p \).

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

\[ \min \ \rho \ = 1 - \frac{1}{m} \sum_{j=1}^{n} \theta_j \]

subject to

\[ \sum_{j=1}^{n} \lambda_j x_{ij} - x_{im} \leq 0, \quad i = 1,2,...,m \]

\[ \sum_{i=1}^{m} \gamma_i \lambda_j - y_{ij} \leq 0, \quad r = 1,2,...,s \]

\[ \rho \geq 0, j = 1,2,...,n; \rho (fp) \] 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 1 out of 16 banks were technically efficient by applying input-oriented BCC and SBM models under VRS.

References


