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# Ranking influencing factors on relative efficiency of banking industry

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A B S T R A C T

Measuring the relative efficiency of banking industry has been one of the most interesting areas of research for the past few years. There are literally various techniques for measuring the relative performance of similar units such as banks including data envelopment analysis and stochastic frontier analysis. This paper presents an empirical investigation to measure the relative performance of some Iranian banks located in province of Alborz, Iran for two consecutive fiscal years of 2009 and 2010. The proposed study implements stochastic frontier analysis to measure the performance of these banks based on two set of criteria. In the first model, total loans devoted are considered as output and employees, total customers' investment, total fixed assets as well as no-interest deposits are considered as inputs of the model. For the second model, special banks' characteristics such as total economic value of branch, the ratio of fixed assets to total assets, educational backgrounds of employees as well as the level of automation in the system are considered as input parameters of the systems. The results indicate that most bank perform relatively well according to their efficiencies.



## 1. Introduction

Measuring the relative efficiency of banking industry has been one of the most interesting areas of research for the past few years (Yudistira, 2003). Bergendahl and Lindblom (2008), for instance, developed principles for measuring the relative efficiency of some savings banks. They study started out from the observation that such a bank could be less profit oriented than a commercial bank. The customer is an essential stakeholder to the savings bank implying a bigger emphasis on customer service provision. They implemented data envelopment analysis (DEA) (Charnes et al., 1978) as a method to study the service orientation of savings banks. They also explained how an evaluation of the performance of savings banks according to "service efficiency" varies from an evaluation based on the traditional "profit" or shareholder concept. They determined the number of Swedish savings banks being "service efficient" as well as the average degree of service efficiency in this industry.

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Bravo-Ureta and Rieger (1990) estimated technical efficiency (TE) measures based on four alternative production frontier techniques, and evaluated the sensitivity of the results to the choice of methodology. They used the Cobb-Douglas functional (Farrell, 1957) form along with data for 1982 and 1983 from 404 dairy farms located throughout six northeastern states in the US. They concluded that frontier function models were neutrally upwardly scaled versions of the OLS or average model. They also stated that various models yield markedly different efficiency levels across firms. However, the correlation between the indexes from the different methods was high, which means that the ordinal ranking of firms based on their measured level of technical efficiency appeared to be independent of the method implemented for a given year.

Halkos and Salamouris (2004) presented an application of a non-parametric analytic technique DEA in measuring the relative performance of the Greek banking sector. The study explored the efficiency of Greek banks with the implementation of a number of recommended financial efficiency ratios over the period 1997–1999. The proposed model presented an empirical reference set to compare the inefficient banks with the efficient ones. It departed from most frontier studies of bank performance, by implementing these suggested ratios as output measures and with no use of input measures. The proposed model was also compared with the conventionally implementation input–output analysis as well as to the simple ratio analysis. The results explained that DEA could be applied as either an alternative or complement to ratio analysis for the evaluation of an organization's performance. They reported that the higher the size of total assets the higher the efficiency. They also detected a wide variation in performance and demonstrated that the increase in efficiency is supported with a reduction in the number of small banks due to mergers and acquisitions.

Najafi et al. (2011) presented an integration of balanced score card (BSE) with two-stage DEA method. They used various financial and non-financial perspectives to evaluate the performance of decision making units in various BSC stages. At each stage, a two-stage DEA method was implemented to measure the relative efficiency of decision making units and the results were monitored using the cause and effect relationships. According to Khaki et al. (2012), performance evaluation is one of the most important methods to prioritize various decision making units. DEA as a non-parametric method, plays an essential role for measuring relative efficiency. BSC, on the other hand, is another method to evaluate a business plan based on non-financial perspectives. The integrated BSC-DEA takes advantage of the advantages of both methods' features. They proposed a BSC-DEA method to rank various decision making units and considered various financial criteria such as profit-margin, return on assets along with non-financial criteria such as customer satisfaction, advanced services, employee skills to compare the performance of different banks.

Karami et al. (2012) proposed a hybrid of BSC and DEA method for an empirical study of banking sector. They proposed a model for evaluating the Tose`eTa`avon bank performance, which is an example of governmental credit and financial services institutes. The study determined various important factors associated with each four components of BSC and uses analytical hierarchy process to rank the measures. In each part of BSC implementation, they applied DEA for ranking various units of bank and efficient and inefficient units were determined.

## 2. The proposed study

The proposed study uses a mathematical model to measure the performance of selected Bank Melli Iran on province of Alborz, Iran. The study uses the following formula to calculate the minimum number of sample size,

$$n = \frac{N \times z_{\alpha/2}^2 \times p \times q}{\varepsilon^2 \times (N-1) + z_{\alpha/2}^2 \times p \times q}, \quad (1)$$

where $N$ is the population size, $p = 1 - q$ represents the yes/no categories, $z_{\alpha/2}$ is CDF of normal distribution and finally $\varepsilon$ is the error term. Since we have $p = 0.5, z_{\alpha/2} = 1.96$ and $N$=114, the number of sample size is calculated as $n$=79. The proposed study has used 77 brnaches to measure the relative efficiencies of these branches. The study uses Stochastic Frontier Analysis (SFA) (Coelli, 1995) to measure the efficiency of diffeent branches based on Frontier 4.1 software package.

$$\begin{aligned} logC_{it} = \beta_0 + \beta_1 logq_{it} + \sum_{j=1}^{4} \beta_{j.}\, logP_{jit} + \frac{1}{2}\beta_{qq}(logq_{it})^2 + \frac{1}{2}\sum_{j=1}^{4}\sum_{k=1}^{4} jk\, logP_{jit} logP_{kit} \\ + \sum_{j=1}^{4} \beta_{qi}\, logq_{it} logP_{jit} + \beta_s logs_{it} + \beta_{qs} logq_{it} logs_{it} + \sum_{j=1}^{4} \beta_{js}\, logP_{jit} logs_{it} \\ + \frac{1}{2}\beta_{ss}(logs_{it})^2 + \vartheta_{it} + u_{it}\,. \qquad\qquad j \geq k \end{aligned} \quad (1)$$

In Eq. (1), $C_{it}$ represent total banks' expenditure of each bank. In the first model, total loans devoted are considered as output and employees, total customers' investment, total fixed assets as well as no-interest deposits are considered as inputs of the model. For the second model, special banks' characteristics such as total economic value of branch, the ratio of fixed assets to total assets, educational backgrounds of employees as well as the level of automation in the system are considered as input parameters of the systems.

## 3. The results

In this section, we present details of the implementation of Eq. (1) for measuring the relative efficiency of 79 firms. Table 1 demonstrates the summary of the outputs generated based on the first model.

**Table 1**
The summary of the output generated for the first model

| Efficiency | 2009 | 2010 | Mean |
|---|---|---|---|
| Mean | 77.4% | 74.17% | 74.65% |
| Min | 55.8% | 50.0% | 52.9% |
| Max | 98.2% | 98% | 98.1% |

Based on the results of the implementation of the first model, the mean relative efficiency of all banks have been reduced from 77.4% to 74.17%. The reduction is also edident on min and max of the relativel efficiencies as well. Overal, banking industry in province of Alborz were relativiely efficient with the mean of 74.65%. In addition, Table 2 shows the summary of the implementation of the second model.

**Table 1**
The summary of the output generated for the second model

| Efficiency | 2009 | 2010 | Mean |
|---|---|---|---|
| Mean | 66.97% | 61.41% | 64.19% |
| Min | 24.5% | 10.4% | 17.45% |
| Max | 97.4% | 98% | 97.7% |

The results of the second model are similar to the results of the first model in one sene since both models demonstrate reduction on mean of efficiency. However, the second model provides lower values for efficiency of all firms since the mean was 64.19%, which is approximately 10% lower than the first model. Note that the second model meaures more technical aspects of firms and the educational backgrounds as well as the level of automation had positive impacts on firms' efficiencies while the ratio of fix assets on total assets maintained negative impact on the relative efficiency of banks.

## 4. Conclusion

In this paper, we have presented an empirical investigation to measure the relative performance of some Iranian banks located in province of Alborz, Iran. The proposed study has implemented stochastic frontier analysis to measure the performance of these banks. The method considered different technical and fundamental figures as input/output of the proposed model. There were two types of input/output methods and the results of our investigation have helped us conclude that most banks were working within 75% of their full performances.

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