REVIEWING THE PERFORMANCE OF BANKING LISTED IN THE STOCK EXCHANGE BY APPLYING FUZZY DATA ENVELOPMENT ANALYSIS (FDEA)

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Abstract

Organizational performance has a significant effect on the activities of an organization and the methods and tools for evaluation are always one of the most important topics in the organizational and academic research. On the other DEA models can be made to meet the application needs to be done extensive research in various scientific fields. Much research has been done using this technique show considerable potential of this methodology for the evaluation and performance measurement comfortable. In this regard, this research seeks to analyze the performance and ranking of banks accepted in the stock market by applying the data envelopment analysis technique. The subject area of this research is the performance analysis and ranking of banks in the capital market, in the field of banking and investment management. The realm of research is the banks accepted in Tehran Stock Exchange and Overseas Iran. Also, the realm of time is 4 years from 2011 to 2014.
Keywords: performance evaluation, data envelopment analysis

I.   STATEMENT OF PROBLEM

In recent years, the country's banking system faces new challenges as well as the arrival of foreign banks with regard to the application to join the WTO, starting work.Private banks and increasing the activities of financial and credit institutions are considered by the banks of the country. Therefore, in order to survive and compete in a dynamic environment, they are required to improve their performance in order to identify the strengths and weaknesses of the existing situation. To improve. The dynamics, continuity and acceleration of the process of development of enterprises and, consequently, of the whole economy, depends on the full recognition of the strengths and weaknesses of the economic activities of firms in the country. Since strengths and weaknesses are comparative oncepts that are based on comparisons, ranking lists by comparison of industries and enterprises of the country provide a background that can be a useful guide for managers, policy makers and capital And the researchers' research leads to a new understanding of the business environment (Mirzaie, 2010).

Potential investors and users of financial and non-financial information seek to distinguish top and bottom companies from poor companies in order to make more appropriate decisions. Therefore, one of their fundamental questions is always which top companies

are. : WhatFeatures and how they can be identified (Mehrani et al., 2011).The results of surveys and studies on capital markets make it possible Investors and users of information are simply superior to other companies Companies, clean up, and thus make a more reasonable investment. This role is being played in the developed countries by rating agencies, but there are no such institutions in Iran, and the only common ranking of companies is the ranking of the top 100 companies of the Industrial Management Organization. Therefore, various research on the ranking of companies Using various criteria and indicators, including the criteria for extracting financial statements, can be an important step in improving the efficiency of capital markets in terms of information and encouraging companies to improve the current situation.

II.   MEASURING EFFICIENCY IN DATA ENVELOPMENT ANALYSIS (DEA)

This method is mainly known in the world as a method of performance measuring. while measuring the performance it returns the type of efficiency according to each unit. The progress and development of the above methods, DEA is currently one of the active areas of research in measuring performance and dramatically has been welcomed by researchers. In this method, instead of the term manufacturer to universalize generally as a single decision maker (DMU) is used. This method (DEA), which uses linear programming techniques, including methods of nonparametric estimation of production functions (Imami Meybodi, 1379).

In general, estimation of identical production functions or estimated frontier production function as a standard of comparison, are both needed to measure performance (SFA, DEA). (Imam Meybodi, 1379).

DEA is usually presented as proportions. Creators of this method generalized engineering definition of performance which was single factors of production to multi- factor, multi-product production (without the weight of a predetermined required) generalized (Imam Meybodi, 1379).

As previously mentioned, the efficiency index is the ratio of output to input (Y / X). for multi-input and multi-output we need to distinguish coefficients between inputs and. But there is a problem that already seemed unsolvable, considering how the coefficients for the inputs and outputs. For example, if all factors are equally important in creating output coefficients involved and whether they are the same? Certainly the role of inputs are different   to creating outputs. Therefore, we need to select proper coefficients. Some researchers use prices, costs, or ... as did the coefficients V and U. that is:

$$\text{Overall productivity } = \frac{U_1 Y_1 + Y_2 U_2 + \cdots}{V_1 X_1 + V_2 X_2 + \cdots}$$

Therefore, there was theories for applying of the above factors and thus calculation the total productivity will be limited.

In 1978, CCR model was known that it could solve the problem of coefficients, it is interesting that the coefficients obtained in this way, represents the shadow price 1. After determining the efficient frontier curve, CCR model indicates that the decision-making units where the boundaries are and how to achieve efficient frontier combination of inputs and outputs to be chosen. This is not possible except by specifying the coefficients institutions

and outputs for each unit. In fact it was a masterpiece and landmark model using linear programming method to calculate the coefficients listed.

Charnz, Cooper and Rhodes (CCR) in 1987, developed his model based on minimization of production factors and assuming constant returns to scale. In 1984, considering the assumption of variable returns to scale by Bunker, Charnz and Cooper 2 (BCC) was developed to measure the performance of DEA (Imam Meybodi, 1379).

Before the theoretical explanations about the data envelopment analysis, it is necessary to describe the input orientated and output orientated models and efficiency to scale it. Generally, models of data envelopment can be divided into " input orientated " and " output orientated " that describe below.

Input models are models with constant output, reduces the inputs whereas the output model is that with constant inputs, outputs increase (invertebrates, 1383).

Scale efficiency represents the relationship between inputs and outputs of a system changes in production, service or an enterprise. This answers to the question that if "the sources and raw materials of a plant to double its output multiplier is changed?" The three state can happen:

(A) Doubling of the inputs will cause the output double

(B) Doubling of the inputs will cause the output less than double

(C) Doubling of the inputs will cause the output greater than double

The first mode is "constant returns to scale" and the second "returns to scale down" and the third "returns to scale upward" (invertebrates, 1383).

III.   RETURNS TO SCALE IN DATA ENVELOPMENT ANALYSIS

• fixed scale efficiency

Fixed scale efficiency means that any change in inputs, the ratio of change in output to cause. In other words, the increases in inputs are not cost effective and not cause a rise in the cost. That is, in one input and one output the shape of production function is linear passing from origin and this definition reveals that there is no fixed cost of production. Again, zero input produces zero output. (Jhanshahlv, Hossein Lotfi Zadeh, 1389)

Fixed returns to scale   Decreasing returns to scale   Increasing returns to scale

Fig 1 Types of returns to scale
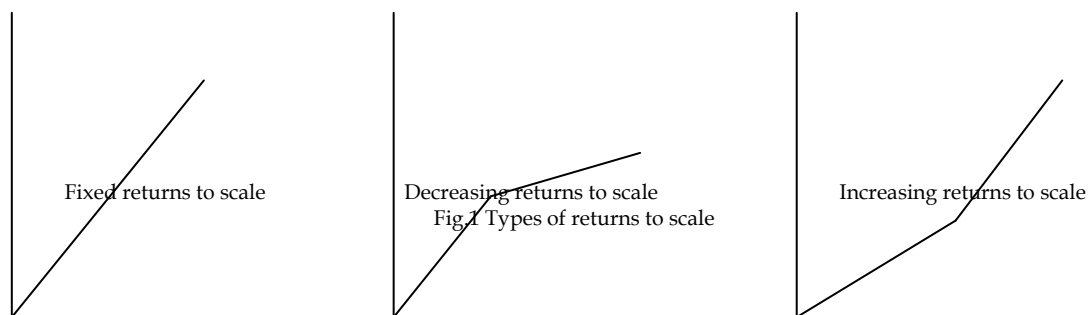
CCR model

CCR model in the nature of the input, which is known as the coverage is as follows: (Jhanshahlv, Hossein Lotfi Zadeh, 1389)

$$Min\,\theta$$

$$s.t.\sum_{j=1}^{n}\lambda_j x_{ij} \le \theta x_{io} \quad i=1,...,m$$

$$\sum_{j=1}^{n}\lambda_j y_{rj} \ge y_{ro} \quad r=1,...,s$$

$$\lambda_j \ge 0,\, j=1,....,n$$

In optimum model if $\theta* = 1$ DMU$_o$ is efficient. The above model is always possible because $\theta* = 1$ and $\lambda_o = 1$ and $\lambda_i = 1$ is a possible answer. In addition, the possible answer is that the result does not exceed the optimal value of θ. (Jhanshahlv, Hossein Lotfi Zadeh, 1389)

Multiple CCR model (Jhanshahlv, Hossein Lotfi Zadeh, 1389)

$$Max\sum_{r=1}^{s}u_r y_{r\circ}$$

$$s.t.\sum_{i=1}^{m}V_i x_{i\circ} = 1$$

$$\sum_{r=1}^{s}u_r y_{rj} - \sum_{i=1}^{m}v_i x_{ij} \le 0 \qquad j=1,...,n$$

$$u_r \ge 0 \quad,\quad v_i \ge 0, r=1,...,s, i=1,...,m$$

ur and vi respectively are dual variables corresponding to the constraint r-th output and i-th input on the cover of CCR. (Jhanshahlv, Hossein Lotfi Zadeh, 1389). ur and vi are the weight r-th output and i-th input respectively and yro and xio are the amount of r-th output and i-th input for a unit under investigation. Also Yrj and xij is showing the amount of r-th output and i-th input for a unit j-th. S is the number of outputs, m the number of inputs and n is the number of units.
  • Efficiency scale variable
  BCC cover model

$$Min\,\theta$$

$$s.t.\sum_{j=1}^{n}\lambda_j x_j \le \theta x_o$$

$$\sum_{j=1}^{n}\lambda_j y_j \ge y_o$$

$$\sum_{j=1}^{n}\lambda_j = 1$$

$$\lambda_j \ge 0,\, j=1,....,n$$

This model is seen as a cover CCR model that constraint $\sum_{j=1}^{n}\lambda_j = 1$ is added. (Jhanshahlv, Hossein Lotfi Zadeh, 1389).

BCC multiple models

To write the multiple BCC model in its entrance nature we have (Jhanshahlv, Hossein Lotfi Zadeh, 1389)

$$Min\, \theta$$

$$s.t. - \sum_{j=1}^{n} \lambda_j x_j + \theta x_o \quad \geq \quad 0$$

$$\sum_{j=1}^{n} \lambda_j y_j \quad \geq y_o$$

$$\sum_{j=1}^{n} \lambda_j \quad = \quad 1$$

$$\lambda_j \geq 0, j = 1,....,n$$

So the dual would be (Jhanshahlv, Hossein Lotfi Zadeh, 1389):

$$\max U' y_0 + u_0$$

$$s.t. V^t X_o \quad = \quad 1$$

$$U^t Y_j - V^t X_o + u_o \quad \leq \quad 0, j = 1,...,n$$

$$U \geq 0, V \geq 0$$

IV.   METHODOLOGY

The aim of the present study, is the type of applied research. Applied research is the research findings can be put to practical use (Seyf., 1375). Applied research aims to develop practical knowledge in a particular field. In other words, applied research is directed toward the practical application of knowledge (Sarmad al., 1383). Also on the basis of data collection, this descriptive research since leads to further understanding of the situation and assist the decision making process is causal-comparative. Because the probability of its occurrence is investigated. Groups that are different variables, are compared to determine their effect on the dependent variable (Sarmad al., 1383).

V.   THE INTRODUCTION OF INPUTS AND OUTPUTS

Capital adequacy: The ratio of capital adequacy is one of the ratios of the health performance measurement and financial stability of the financial institution and the banks. Banks must have sufficient capital to cover the risks arising from their activities and ensure that losses incurred by depositors are not transferred. Therefore, you should have the minimum amount of money to cover your operational risks. This ratio is the result of the division of the base capital into the sum of the assets allocated to the risk factors in percentages that must be disclosed in the financial statements of the banks.

Return on assets:It relates the ratio of operating profit to all resources that are under the management of the bank. This ratio is the best ratio for management assessment and evaluates the net income generated by the use of all bank assets. (Same source).

Asset quality index:Because the banks themselves should decide on the allocation of funds deposited with them. This decision shapes the level of risk of credit and the risk of default and their demands, so by following a benchmark such as assessing the quality of bank assets

that include loans and securities, this can be achieved after the objectives of the bank's assessment. .

	Equity	Sales Asset	Turnover Index Asset	Quality Index	Asset Return	Risk	Utility	Own equity ratio	Capital adequacy
Equity	1								
Sales Asset	0.34475	1							
Turnover Index Asset	0.25945	-0.622313	1						
Quality Index	0.13902	-0.148839	0.300759	1					
Asset Return	0.61825	0.661577	0.064881	0.077657	1				
risk	0.32401	-0.286116	0.640469	0.188763	0.191089	1			
utility	0.25705	0.054304	0.091374	0.055807	0.148953	0.271855	1		
Own equity ratio	-0.11233	-0.57769	0.076088	-0.00135	-0.82111	-0.04129	-0.00512	1	
Capital adequacy	-0.26184	-0.156372	-0.0767	-0.01722	-0.15335	-0.05054	-0.34976	0.048773	1

VI.   RESULTS

In this research, 56 decision units were investigated according to 5 inputs and 2 outputs. The type used in this research is based on the CRS model and the input-axis approach. The efficiency value is given according to the model defined in Table 1. In addition to the amount of performance, its type can be seen in this table

1.1 Bank name	1.2 Efficiency
1.3 eghtesad novon 2011-2014	1.4 0.915
	1.5 0.849
	1.6 0.751
	1.7 0.56

1.8 Ansar 2011-2014	1.9 1
	1.10 1
	1.11 0.833
	1.12 0.788
1.13 Parsian 2011-2014	1.14 0.7
	1.15 1
	1.16 0.738
	1.17 0.243
1.18 Pasargad 2011-2014	1.19 0.957
	1.20 1
	1.21 0.964
	1.22 0.635
1.23 Tejarat 2011-2014	1.24 0.691
	1.25 0.59
	1.26 0.363
	1.27 0.339
1.28 Dey 2011-2014	1.29 1
	1.30 1
	1.31 0.963
	1.32 1
1.33 Saman 2011-2014	1.34 0.713
	1.35 0.685
	1.36 0.668
	1.37 0.507
1.38 Sarmayeh 2011-2014	1.39 0.532
	1.40 1
	1.41 0.854
	1.42 0.415
1.43 Sina 2011-2014	1.44 0.817
	1.45 0.878
	1.46 1
	1.47 0.571
1.48 Saderat 2011-2014	1.49 0.558
	1.50 0.5

	1.51 0.271
	1.52 0.219
1.53 Karafarin 2011-2014	1.54 1
	1.55 1
	1.56 0.807
	1.57 0.787
1.58 Mellat 2011-2014	1.59 0.494
	1.60 0.915
	1.61 1
	1.62 0.878

VII.   CONCLUSION

The main purpose of this study is to investigate the performance and ranking of banks accepted in the stock exchange by using the technique (DEA). Existing data has been processed using Excel software and the technique is used to test the hypothesis (DEA). Research on the performance and ranking of banks accepted in the Tehran Stock Exchange is generally based on examples of financial statements of banks. According to numerous studies on measuring performance and ranking of banks in other countries, as well as the importance of more to the variables in banks and the limited number of research done in the country in this regard, the researcher has In this research, we investigate the performance and rankings of accepted banks in the stock market using the technique (DEA) and answer the above questions. The results of the technique (DEA) in the research sample are as follows:

Capital adequacy indices have the most impact on the performance of banks accepted in the capital market. Also, indicators of quality assurance and asset structure, management quality measurement indicators, profitability indicators, and liquidity indicators are most effective in assessing the performance of accepted banks in the capital market.   Given that the research model was BCC input-axis model, the output values were constant, and the inputs were calculated. As can be seen, in units of efficiency, the values achieved and the target in the inputs are equal, meaning that the units have been able to achieve the amount of purpose that they have considered in the calculation of the financial indicators of performance measurement. Conversely, inefficient units have not been able to achieve the desired goals and optimal points in the studied variable. Finally, according to the efficiency chart of the units, the nation's banks, Sinai, Capital, Dias, Pasargad have the highest efficiency.

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