



Performance Analysis and Rating of Insurance Companies Using DEA in Iran Capital Market

Mahboubeh Jafari^{*}, *Maryam Mousavi*

Department of Accounting, South Tehran Branch, Islamic Azad University, Tehran, Iran

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ABSTRACT

In this research, we evaluated performance analysis and ranking of insurance companies listed on the capital market of Iran using data envelopment analysis. In respect of the target the research is applied. The type of research design relying on historical data, is event following and inductive method is inference. The study is consisted of a key question and three sub-questions. This research studies the insurance companies listed on the capital market over a three-year period (2013-2015). Finally, according to the study, data was collected from 9 companies. To document the results of the statistical analysis and providing solutions, using SPSS software, Excel and GE MS we attempted to analyse the questions. At the end, the ranking resulted to the conclusion that the most efficient insurance companies of capital markets, are as follows: Alborz, Dana, Sina, Moalem, Asia, Pasargad, Parsian and Saman.

1. Introduction

For the securities market, efficiency is of great importance, because of the efficiency, the allocation of capital, which is the most important factor of production and economic development, is done correctly and the price of securities is determined fairly [12].

Various research indicates poor performance in Tehran Stock Exchange, in such a market investors and users of information try to distinguish superior companies from non-superior ones to have a good investment; As for the evaluation of companies listed on the exchange market, on the one hand, we have to measure their efficiency and on the other hand we are facing to the evaluation methods and measures of financial failures, especially in the field of organizational effectiveness [9]. Financial ratios apply a component in nominator and a component in the denominator to assess firm performance while Data Envelopment Analysis (DEA) technique has the potential to have a combination of several factors in the numerator and denominator. This method by assembly of components, allocates scores in the name of "efficiency" to each unit [3]. Assessment of the financial position of a company in decision-making process is vital and necessary, because the operations of a company largely depend on its financial position [4].

* Corresponding author. Tel.: +982122574433
E-mail address: majafari21@gmail.com

DEA is an appropriate method in this field. This model is of useful tools in assessing the performance of a number of firms with a similar production structure, in addition to calculating the company's performance, will be able to provide useful results to managers. This method determines the enterprise model as a target for inefficient companies and also suggests strategic alternatives and efficiency improvement in area of the company development [10].

The most common financial criteria and indicators for company assessment, is the analysis of financial statements and financial ratios and profit margins, etc. [12].

This study analyses the performance and ranking of insurance companies listed on the capital market of Iran using data envelopment analysis.

The main objective of the current study is analyzing the performance of insurance companies listed on the capital market of Iran using data envelopment analysis. Also, there are some secondary objectives that are listed as follows:

- a. The analysis of factors influencing the choice of the insurance companies listed on the capital market of Iran.
- b. Analysis of the performance of insurance companies listed on the capital market regarding the effective measures.
- c. Ranking of insurance companies listed on the capital market of Iran on the basis of effective measures.

However, banks and corporations requesting a loan, Central Bank, Stock Exchange, investors, and students and teachers as well as the fields of accounting and economics professors are all can be benefited from this study.

2 Theoretical Backgrounds

Investment on the one hand, attracts inefficient capitals and guides them to productive economic sectors and on the other hand, according to the orientation of investors (based on risk and return), investments are directed to industries that make more profit with less risk and it finally leads to optimal resource allocation. Given the changes that have occurred in the world today, countries, in particular, developing countries that are facing numerous threats, need to find appropriate strategies to make a better use of facilities and gifted wealth in order to solve their economic problem. In this regard, one of the main strategies is to expand the investment. It should be said, the decision regarding buyouts, is complicated; Because several variables must in this case be taken into account variables such as the rate of return on equity, earnings per share, price to earnings ratio, assets, risks and other factors. Since for deciding a set of variables are considered, you must use multi-criteria decision-making methods. Data envelopment analysis, a multi-criteria decision-making method, makes this possible. According to this method, we can determine the best options [7]. What can be inferred from current position of Iran insurance industry is that so far, this industry has not achieved its actual and key position in the economy and has not yet been able to attract economic activists. Premium of approximately 3.5 billion dollars and a penetration rate of 1.3 percent in this industry show the inefficiency and ineffectiveness ([2]. The existing tariff system with compulsory reliance are used as a means of monitoring and governance by central insurance, the gradual elimination of tariffs without design and deployment of alternative monitoring system, probably the country's insurance industry, will face difficulties [2]. Many reasons for this lack of development are suggested which the most important reasons are the state economy and reliance on oil revenues. This has led to a reliance on government

funding and reserve, public administrators no longer have concern about the risk of the funds. Of course, during the first and second development plans, good grounds for economic activity and an arena for the private sector mobility was provided, but government portfolios were all monopolized by one company. Privatization and liberalization as solutions that increase efficiency and the development of economic activities are also considered in the insurance industry and the law passed allowed private sector in 1380 to start operation and more than 16 private companies formed. But liberalization as a complement to privatization was not on the agenda. Using tariffs by Central Insurance to monitor the operation of insurance companies and third party the insurance fees administration (Civil liability of owners of vehicles) for social purposes, put Commercial insurance companies completely in tariff system [1]. So with regard to the items listed, as well as the critical importance of this indicator in insurance companies, performance analysis and ranking of insurance companies listed on the capital market using data envelopment analysis is necessary and somehow can be claimed that it is a current concern and also, due to the lack of such a study in the environment of these firms, the researcher is trying to conduct this study.

3 Literature Review

3.1 Internal Works

Mojibi [8] conducted a study entitled "Measuring the Efficiency of the Housing Foundation branches in rural housing scheme of Isfahan city". The aim of this study was to evaluate the relative efficiency of the Housing Foundation branches in rural housing scheme using DEA which was applied research and its methodology was survey descriptive. Quantitative figures of development projects of rural housing of Isfahan software and statistical centre of Iran is used to collect data. The results showed that 6 branches of Housing Foundation of 22 cities of Isfahan province were efficient in the project and the rest was inefficient. The majority of the city relative to the population as input indicators is sensitive. The results showed that to improve performance and getting along with the objectives of the fourth and fifth development plan, the province's towns require changes to the criteria which using data envelopment analysis variations needed for each city was determined to achieve efficient point.

3.1 External Works

Ekan and Kale [6] in their review on studies since 2000 on the assessment of bank performance, to maintain an overall view of the evaluated models and the performance evaluation of the input and output parameters, made a comprehensive review of the relevant literature. They showed that in 33 studies manufacturing operations approach and in 7 studies the profitability approach is used. In 27 studies CCR and in 28 studies BCC are applied. In 36 studies input – based approach and in 12 studies output – based approach was used. The average number of inputs is 3.9 and based on accepted approach the most common inputs related to employees are other operating costs, costs of rent and other equipment. Outputs are more widespread and the average number is 4.7.

4 Methodology of the Research

Forecasting methods based on dependence on mathematical and statistical methods divided into two main groups: qualitative methods based on objective, scientific research can be divided into three

basic, scientific and applied groups.

In terms of the purpose the research is applied and the method is experimental and ex post facto. This research has focused on the most effective action and less attention to their causes.

4.1 Methods and Tools for Data Collection

In order to collect theoretical data library surveys were used including study and review of the literature, theses, articles, specialized books in Persian and English, as well as the Stock Exchange website and RahAvard Novin software. To collect the data needed to calculate the variables, "RahAvard Novin" data bases were used. In cases where the data in this database is incomplete we refer to the library of the Securities and Exchange Manual Archives and management research website, development and Islamic Studies of the Securities and Exchange website (www.rdis.ir).

Information on theory and theoretical research has been collected in library with books and articles in Farsi and English. In order to answer the questions and then analyse the data Excel and GAMS software are used.

4.2 Descriptive Methods

In this study, in order to describe sample using descriptive data indices into three groups: central indices (such as the mean and median), indices of dispersion (such as variance and standard deviation) and parameters of the distribution (such as index of skewness and Kurtosis index) we describe statistic sample.

4.3 Assumptions Analysis

Normality of dependent and independent variables: Kolmogorov – Smirnov Test (K-S)

To be able to examine normal distribution of variables we use this non-parametric test. In this test, if significance level of variables is greater than 0.05 then the distribution is normal. We use this test to get permission for the use of regression and Pearson correlation coefficient and analytical tests of independent and dependent variables in order to prove normality of information.

4.4 Inductive Methods

At this point, to obtain efficacy we apply four models: output - oriented and input - oriented BCC and output - oriented and input - oriented CCR and select the most efficient one to compare performance and ranking calculation.

4.5 Data Envelopment Analysis

The model is designed primarily intended to evaluate the efficiency of decision making units (DMU) that are specified and then according to the specifications and system features we determine and select output and input for these DMU; Then by collecting data regarding the amounts of input and output of each DMU, we formulated efficiency evaluation model in accordance with one of the models of the DEA and then we obtained efficacy score after DEA model per each DMU and based on results we analysed efficacy of DMU.

4.6 Population and Statistical Sample

The target population includes all insurance companies listed on the capital market of Iran during the years 2013 to 2015 and analysis of interest in relation to the population was studied and tested.

5 Results and Findings

5.1 Input and Output of Research

Inputs and outputs of the companies in the period 2013 to 2015 were evaluated as follows: In the next sections we present the data of each variable separately in the annual average format:

Table 1: Inputs and Outputs in 2013

Number	maximum score	minimum score	average	Variable
9				-Outputs
	7300	12	628.98	-Earnings per share
	190.34	28.41	96.79	- The efficiency of a year
	126.41	12.47	85.69	- three-year returns
	145.96	21.79	84.15	- return on five-year
				- Inputs
	33.717.787	10.895	19.093.045	-Property
	469.74	32.47	45.79	- The ratio of price to earnings
	0.501	0.102	0.174	- coefficient of Sigma
2.589	0.008	0.632	- beta coefficient	

Table 2: Inputs and Outputs in 2014

Number	maximum score	minimum score	average	Variable
9				-Outputs
	8510	7	578.42	-Earnings per share
	135.34	21.47	51.82	- The efficiency of a year
	187.63	14.97	56.21	- three-year returns
	154.71	21.79	74.63	- return on five-year
				- Inputs
	30.746.175	15.203	20.125.069	-Property
	502.74	35.47	74.47	- The ratio of price to earnings
	0.494	0.118	0.109	- coefficient of Sigma
2.157	0.002	0.547	- beta coefficient	

Table 3: Inputs and Outputs in 2015

Number	maximum score	minimum score	average	Variable
9				-Outputs
	9600	15	487.96	-Earnings per share
	146.48	26.41	89.95	- The efficiency of a year
	169.43	23.41	87.74	- three-year returns
	163.74	47.61	77.15	- return on five-year
				- Inputs
	31.746.967	15.203	21.698.634	-Property
	578.86	-47.36	46.58	- The ratio of price to earnings
	0.786	0.126	0.126	- coefficient of Sigma
1.478	0.002	0.489	- beta coefficient	

5.2 Data Normality Test

Kolmogorov – Smirnov Test (K-S) was used to examine the normality of variables. In fact this test is applied to examine the normality of a quantitative variable data distribution which in this research SPSS software helped us to do this. In order to examine normality of special variable we did as follows:

H0: the distribution of the selected variable is normal.

H1: the distribution of the selected variable is not normal.

Given the output of SPSS software one can understand normal distribution of the selected variable. So if the "significant level" is more than 0.05, H0 is accepted and the claim of normality of variables is confirmed.

The table below results of variables' normality test for each year shown separately:

Table 4: The normal Tests in the Study Period

2015		2014		2013		Variable
Statistical significance	Level of significance	Statistical significance	Level of significance	Statistical significance	Level of significance	
0.205	0.200	0.231	0.200	0.236	0.200	X1
0.165	0.200	0.205	0.200	0.027	0.200	X2
0.222	0.200	0.213	0.200	0.251	0.078	X3
0.201	0.188	0.217	0.200	0.278	0.200	X4
0.202	0.200	0.198	0.200	0.234	0.127	Y1
0.212	0.200	0.205	0.200	0.202	0.200	Y2
0.220	0.200	0.263	0.200	0.264	0.083	Y3
0.226	0.200	0.231	0.182	0.235	0.178	Y4

As can be seen in all the variables, significance level is more than 0.05, so variables of this study are normally distributed.

5.3 Data Envelopment Analysis

In this study, a review of literature on evaluating various companies, indicators used DEA model and rigid model were selected. Then the definite and rigid models of data envelopment analysis were put in the environment of programming software and then solved and the results are presented in table:

In this section in four available models, the company's performance has been calculated and optimized efficacy related to input – oriented BCC model, as selected and their weights are presented in the last table:

The company's performance using four study models:

Table 5: Units' performance using 4 models

reliability	T	Freedom degree	Significance level	Deviation from mean	95% error level	
					Lower limit	Upper limit
	13,678	289	0.000	0.69740	0.5970	0.7978

In the table above using Gomez software and mean of each variable data in different years, efficacy of units is calculated. In order to choose the most efficient model among the models proposed we evaluated each method.

A) Input – oriented BCC model

The highest efficiency in this model is 1 and the lowest is 0.99, and calculated mean of this method is 0.996.

B) Output – oriented BCC model

The highest efficiency in this model is 1 and the lowest is 0.98, and calculated mean of this method is 0.986.

C) Input – oriented CCR model

The highest efficiency in this model is 1 and the lowest is 0.97, and calculated mean of this method is 0.99.

D) Output – oriented CCR model

The highest efficiency in this model is 1 and the lowest is 0.96, and calculated mean of this method is 0.986.

According to the obtained values related to insurance companies and the research population, input-oriented BCC model is the best model and we conduct all the research performance calculations using this model.

5.4 Sensitivity Analysis of Variables

In this section we analyse the sensitivity of each of the variables in each stage by removing each variable we calculated performance and compared them. In this section we analysed the sensitivity of variables.

A sensitivity analysis in this section represents the sensitivity of whole performance relative to existence and non-existence of a variable which means of we remove a variable from under study variables how much performance varies.

Table 6: the results of the sensitivity analysis of variables

Efficiency			Deleted variable	
2015	2014	2013		
1.00	0.96	1.00	Earnings per share	Outputs
1.00	0.96	1.00	One-year returns	
1.00	0.93	1.00	Three-year returns	
1.00	0.94	1.00	Five- year return	
0.98	0.93	1.00	Price to revenue ratio	Inputs
0.99	0.95	1.00	Beta Coefficient	
1.00	0.93	1.00	Sigma Coefficient	
0.97	0.95	0.98	Property	

For this method, each of the variables in turn eliminated and examined performance with the other variables finally, for each of these scenarios calculated the average performance achieved during years of research and compared to basic value (see Table 6). The mean values of companies' performance in different years are as follows:

1. Outputs Elimination

- A) Removing the output of earnings per share: Average performance of 0.986
- B) Removing the output of return rate of five-year period: average efficacy of 0.98
- C) Removing the output of return rate of one year: an average efficacy of 0.986
- D) Removing the output of return rate of a three-year period: average efficacy of 0.976

According to the values obtained in this way we can conclude that the sensitivity of the output variables is as follows:

The first variable: Earnings per share and return on one-year

The second variable: rate of return for five years

The third variable: rate of return for three years

2. Inputs Elimination

- A) Removing input of price-to-earnings ratio: average efficacy 0.97
- B) Removing input of Assets: Average efficacy of 0.966
- C) Removing input of the beta coefficient: Average efficacy of 0.976
- D) Removing input of sigma coefficient: Average efficacy of 0.976

According to the values obtained in this way we can conclude that the sensitivity of the input variables is as follows:

The first variable: assets

The second variable: the price to earnings ratio

The third variable: beta coefficient and sigma coefficient

The rating method in this section is in such a way that the variable that will be removed from the outputs and increases efficiency is selected as the most sensitive output and the variable that will be removed from the inputs and has the least efficiency is selected as the most sensitive input.

6 Discussion and Conclusions

In this study we tried to identify, evaluate and compare the performance and ranking of insurance companies listed on the capital market of Iran using data envelopment analysis. The aim of this study was to evaluate the efficacy and performance and then to rank using data envelopment analysis. In this research, due to the nature we didn't seek for independent and dependent variables.

In this section, we investigate and respond to questions.

This study's first question is about the survey and determination of the most efficient insurer among insurance companies listed on the capital market.

According to the central question of this study, which is based on the most reliable insurance company along with other companies, we can say that the most efficient insurance companies are Alborz, Dana, Mellat, Sina and Moalem.

The second research question is based on sensitivity analysis of variables that after the tests required in this regard, the order of these variables is as follows:

Outputs

The first variable: Earnings per share and return on one-year

The second variable: rate of return for five years

The third variable: rate of return for three years

Inputs

The first variable: assets

The second variable: the price to earnings ratio

The third variable: beta and sigma coefficients

Due to the sensitivity analysis performed in the insurance companies listed in the capital market, we suggest that investors, shareholders and the Central Insurance pay more attention to the structure of assets, earnings per share and return on one year and Tehran Stock Exchange present rules and regulations from in order to integration of financial statements presentation based on same variables in Iran's capital market.

Given the purpose of the study suggested earlier, it is suggested Stock Exchange provide the same factors to record financial information and based on integrated IT systems, with electronic receipt of financial information online and plan to implement information integration which is very costly.

It is suggested that before relying on financial statements, appropriate methods will be used for evaluating the integrity of their accounting information. Obviously, some of unsustainable trends in financial statements and in the form of a time series process can be a sign of lack of integrity of the information.

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