AENSI Journals

Advances in Environmental Biology

ISSN-1995-0756 EISSN-1998-1066

Journal home page: http://www.aensiweb.com/AEB/

The Efficiency Evaluation of Several Insurance Companies in 2012 Using the Data Envlopement Approach

[1]Koroshnooradin Moosa and [2]Abdolkhalegh Gholami

[1]Department of Management, Yasouj Branch, Islamic Azad University, Yasouj, Iran
[2]Department of Management, Yasouj Branch, Islamic Azad University, Yasouj, Iran

ARTICLE INFO

Article history:
Received 11 October 2014
Received in revised form 21 November 2014
Accepted 25 December 2014
Available online 16 January 2015

Keywords:
Efficiency, data envelopment analysis, BCC output oriented BCC model, Anderson – Peterson

ABSTRACT

The efficiency evaluation of all Iran's insurance companies in 2012 is performed by means of data envelopment analysis. All the insurance companies in Iran comprise the statistical society of current research. With discretion of senior coordinators 10 branches are selected as statistical samples by use of the purposive sampling method. By consulting experts number of branches, total assets and number of employees are considered as input indicators and also gross income and investment returns are considered as output indicators. Efficiencies of units are calculated by means of output oriented BCC model. The results show that 6 units have efficient performances while 4 units have inefficient performances. The Anderson-Peterson technique is used for the rankings. Mihan, Tose'eh, Ma, Kar-Afarin, Kowsar and Iran insurance cooperates show the highest performances.

To Cite This Article: Koroshnooradin Moosa and Abdolkhalegh Gholami., The Efficiency Evaluation of Several Insurance Companies in 2012 Using the Data Envlopement Approach. ***Adv. Environ. Biol., 9(2),*** *214-218, 2015*

INTRODUCTION

Organizations must continually adapt methods and patterns to assess and continuously improve their performance in order to identify and determine their status and also survive and thrive in today's competitive world. Performance evaluation is a fundamental necessity in confronting and coping with changes and also for continuous improvement of activities. Nowadays, the entry of numerous companies in the private sector is caused a special condition in insurance industry in which only firms with high performance and competitiveness are able to survive. Hence it is necessary for firms to identify their strengths and weaknesses for their continuous improvement. Optimal use of available resources has always desired humans such that they have constantly tried to establish maximum exploitation of resources. The limitation of factors such as capital, labor, and energy has made executives to find a way to optimize the use of these factors. In this regard, one of the major issues is the efficiency evaluation which is very important for economic experts. Nowadays, provided services and production of numerous products have created enough sensitivity for the evaluation of the objectives, satisfaction of stakeholder and performance improvement in organizations. Performance evaluation is the process of the measurement, assessment and judgment of the performance in a specified period.

The continuous and correct performance evaluation will lead to improved organizational performance. Efficiency evaluation has been proposed as one of the most effective ways of evaluating performance recently. The results of efficiency measuement and various techniques such as modeling enable organizations to overcome the inefficiency of their subunits and increase their organizational performance. One of the most widely used methods for measuring the efficiency is data envelopment analysis [1]. The most important issue in economics is optimal allocation of limited resources. For which the economic performance of all organizations must be assessed accurately. Meanwhile, insurers are of great economic importance. Insurance companies must continually use methods and patterns to evaluate their organizational performance in order to succeed and thrive in today's competitive world. Development is one of the main goals of *20-Year Perspective Document for I.R. Iran* and one of the significant assets of which is insurance industry. By minimizing the error due to subjective judgments, scientific method can indicate the status of the insurance companies and, subsequently, can suggest appropriate measures to strengthen the position of any organization. Measuring efficiency is always one of the

Corresponding Author: Koroshnooradin Moosa, Department of Management, Yasouj Branch, Islamic Azad University, Yasouj, Iran.

Advances in Environmental Biology, 9(2) January 2015, Pages: 214-218

main issues management. The defense body of an economic unit is strengthened by perceptive plans through which creating an appropriate attempt to determine the existing strengths and weaknesses is tried as well as plans of defects removals. However assessment of insurance companies as public services is a complex matter due to the variety of their services, therefore it needs more attentive approaches. Insurance companies, by optimizing the use of existing facilities, are also trying to offer desirable services in terms of quality and quantity. One of the main aspects of performance evaluation is measuring efficiency which describes the ratio of a system's outputs to its inputs. However, the number of a system's outputs and inputs has increased and consequently conventional methods of efficiency evaluation cannot be adopted anymore. Data envelopment analysis with desired characteristics, extensive outputs and its ability to analyze inefficient firms in more than three decades is highly taken into consideration recently as a useful method. Hence, considering the importance of efficiency in advancement of society and also its position among other sciences, its detailed study seems inevitable, especially in a mathematical point of view such as as DEA. Because in circumstances of change it allows the change of direction and speed of a organization as well as increasing its speed in some particular area while decreasing the speed in other areas in order for the organization to be able to react appropriately to future threats and to exploit the upcoming opportunities. In fact, the organization will be able to improve its weaknesses and by taking maximum advantage of its abilities and strengths overcome the difficulties within developments. Insurance plays an important role in the national economy which heavily influences the behavior economic sectors. Today, with fundamental changes in the global economy, insurance companies are also experiencing major changes. Among which is the increase in number of insurance agencies and the presence of the private sector in these field of economic activities which has grown almost several times over the past few years. The insurance industry is one of the phenomena that are particularly important in domestic and foreign trade and credibility. Thus the assessment of the efficiency of insurance companies in addition to informing the beneficiaries can enhance competition, improve industry dynamics and result in sustainable and balanced development of society. Competition between organizations and the era information are among the characteristics of present time in which each organization takes all the necessary measures to outshine their rivals and maintain a competitive advantage and also intends to create a new way for its development. Therefore performance evaluation has become a necessity for every organization. By considering the importance of efficiency in advancement of society, its detailed mathematical study seems inevitable. Thus the calculation of efficiency, assessment and ranking of all branches departments or public services and industry subset projects is necessary in order for companies to evaluate their performance relative to other companies and continuously improve in their own areas by identifying their strengths and weaknesses. Efficiency and performance evaluation must be carried out on a yearly basis based on scientific principles. Current study is carried out for this purpose in 2012. The objectives of this study is to measure the technical efficiency of insurance companies in 2 cases of BCC output based and the identification of efficient and inefficient ranking efficient units using the technique of Anderson - Peterson output based.

2. Research Questions:

- How much is the efficiency of insurances companies using th output based BCC model?
- What is the ranking of efficient units with the use of output based Anderson – Peterson?

3. Research methodology:

Considering the purpose of the study it is an applied research. The research methodology is descriptive and mathematical due to the nature of the subject and the data are collected in the field. Since the study aims to evaluate performance in 2012, it is a retrospective research. The statistical sample consists of all insurance companies working in the country (24 companies); also in this study the census is used instead of sampling. Both library and field methods are used for the collection of data. Library is used for theoretical literature and other required data are collected in the field. Related books and papers are used in library method to acquire the data while in the field method documentation supplied by the Statistical Yearbook of 2012 is used. (www.gentinsur.ir)

The statistical method of this research is data envelopment analysis which is a non-parametric method in which the efficiency is measured for the Decision Making Units by means of mathematical programming. A desirable mathematical form is used in parametric methods, while a clear understanding about the different units is achieved in the DEA. In contrast with parametric methods that focus only on the parameters in DEA emphasis is given to the characteristics of all observations. Parametric methods should be specified in equation forms (regression equation, production function, and etc.) in which independent and dependent variables are related to each other whereas the DEA do not need any assumption or particular mathematical form. The obtained efficiency from DEA is the relative effectiveness of frontier created by a convex combination of efficient units. Therefore each DMU that is placed above the frontier is efficient otherwise it is inefficient. In order to change an inefficient unit to an efficient one certain changes must take place. It is worth noting that after the implementation of the DEA a set is provided called as a reference set. The collection indicates that inefficient, should be compared with which one of the efficient units in order to reach the efficiency frontier. If organizational units

Advances in Environmental Biology, 9(2) January 2015, Pages: 214-218

have only one input and one output, the resultant efficiency is of the form output to input. In contrast if an organizational unit has various inputs and outputs, it is difficult and even impossible to find common weights for various inputs and outputs. This is a situation in which DEA must be used. Consider the following system which is a set of different organizational units (various DMUs):
Each organization has N decision making units (DMU_j) with m inputs (X_{ij}) and s outputs (Y_{rj}), hence:

$$\begin{cases} j = 1,2,3,\dots,n; & number\ of\ DMU \\ i = 1,2,3,\dots,m; & number\ of\ inputs \\ r = 1,2,3,\dots,s; & number\ of\ outputs \end{cases}$$

We have:

$$\text{J (efficiency of unit)} = \frac{\text{Total weighted outputs}}{\text{Total weighted inputs}} = \frac{U_1 Y_{1j} + U_2 Y + \cdots + U_s Y_{s2j}}{V_1 X_{1j} + V_2 X_{2j} + \cdots + V_m X_{mj}}$$

$$= \frac{\sum_{r=1}^{s} U_r Y_{rj}}{\sum_{i=1}^{m} V_i X_{ij}}$$

In the above formula, U_r is the weight of *rth* output, and V_i is the weight of *ith* input. A linear programming model must be constructed for using the DEA technique in which the relative efficiency of each DMU can be compared with others. Hence the number of developed linear programming models must be equal to the number of DMUs. Solving each of which yields the relative efficiency (*Ej*) of DMU. The general linear programming model of DEA is of the following form.

$$Max\ Z_0 = \frac{\sum_{i=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_i x_{i0}}$$

$$St:$$

$$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1$$

While $u_r, v_i \geq 0$

$(j = 0,1,2,\dots,n)$ *for each unit.*

4. Research Findings:

In this section, first the efficiency of companies is determined by means of output based BCC model, then using Anderson-Peterson technique, the efficient units are ranked and finally the reference sets are introduced.

4.1. Evaluation of efficacy of units with the output based BCC approach

Table 4.1 shows the inputs and outputs of decision making units:

Table 4.1:

Outputs		Inputs			DMU
Services Branch	The volume of deposits	Number of branches	Total Assets	Return on investment	
204	64831702	204	64831702	15	A.
77	16927018	77	16927018	20	B.
52	9158893	52	9158893	11	C.
35	3668461	35	3668461	14	D.
36	5418399	36	5418399	24	E.
29	7796459	29	7796459	18	F.
55	4836895	55	4836895	18	G.
22	1611094	22	1611094	20	H.
31	3048252	31	3048252	17	I.
40	1754901	40	1754901	21	J.

A: Iran insurance B: Asia Insurance C: Dana Insurance
D: Moalem Insurance E: Tose'eh Insurance F: Karafarin Insurance
G: Pasargad Insurance H: Ma Insurance I: Kowsar Insurance
J: Mihan Insurance

According to the Inputs and outputs data for the insurance company in Table 4.1 and in order to evaluate the efficiency of these units using the multiple form output based BCC model, 10 models are formed. The first unit's model is given in the following:

Min $Z_A = 204\ V_1 + 64831702\ V_2 + 4573\ V_3 + W;$

Multiple form of output based BCC model:

St:

1. $2989168\ U_1+ 15\ U_2 =1;$
2. $-2989168\ U_1- 15\ U_2 +204\ V_1+ 64831702\ V_2+ 4573\ V_3+W \geq 0;$
3. $-864610\ U_{1-2}-20\ U_2+ 77\ V_1+ 16927018\ V_2+ 2452\ V_3+W \geq 0;$
4. $-608767\ U_{1-2}-11U_2+52\ V_1+ 9158893\ V_2+ 1622\ V_3+W \geq 0;$
5. $-218326\ U_{1-2}-14\ U_2+ 35\ V_1+ 3668461\ V_2+ 581\ V_3+W \geq 0;$
6. $-113850\ U_{1-2}-24\ U_2+ 36\ V_1+ 5418399\ V_2+ 619\ V_3+W \geq 0;$
7. $-371798\ U_{1-2}-18\ U_2+29\ V_1+ 7796459\ V_2+ 665\ V_3+W \geq 0;$
8. $-306026\ U_{1-2}-18\ U_2+ 55\ V_1+ 4836895\ V_2+ 533\ V_3+W \geq 0;$
9. $-162016\ U_{1-2}-20\ U_2+ 22\ V_1+ 1611094\ V_2+ 206+\ V_3+W \geq 0;$
10. $-311724\ U_{1-2}-17\ U_2+ 31\ V_1+ 3048252\ V_2+ 313\ V_3+W \geq 0;$
11. $-94357\ U_{1-2}-21\ U_2+ 40\ V_1+ 1754901\ V_2+ 205\ V_3+W \geq 0;$

$V_1 \geq 0;\ V_2 \geq 0;\ V_3 \geq 0;\ U_1 \geq 0;\ U_2 \geq 0;\ U_3 \geq 0;\ W \geq 0;$

The rest of efficiency evaluation models are given in appendix. Table 4.2 shows the results of efficiency evaluation of insurance companies. As it can be seen, six units have efficiencies equal to 1, and four units have efficiencies less than 1. That is, the efficiencies of Iran, Tose'eh, Karafarin, Ma, Kowsar, and Mihan insurance companies are equal to 1 while for the rest it is less than 1.

Table 4.2: Efficiency evaluations of units using output oriented BCC model.

DMU	Z
A	1
B	0.977
C	0.833
D	0.686
E	1
F	1
G	0.895
H	1
I	1
J	1

4.2. Ranking of efficient units:

In DEA, the efficient units cannot be ranked using classical DEA models and instead the Anderson - Peterson method is used in which the efficiency can be greater than 1. Only units with output oriented BCC efficiencies equal to 1 are considered in Anderson-Peterson method (previous step) and therefore the boundary can be omitted from multiple model or the corresponding boundary variable is eliminated from DEA and program is re-run:

Following model is used for ranking of efficient units after determination of efficient units in output oriented BCC model:

Studying efficient unit A-

St:

1. $2989168\ U_1+ 15\ U_2 =1;$
2. $-2989168\ U_1- 15\ U_2 +204\ V_1+ 64831702\ V_2+ 4573\ V_3+W \geq 0;$
3. $-113850\ U_{1-2}-24\ U_2+ 36\ V_1+ 5418399\ V_2+ 619\ V_3+W \geq 0;$
4. $-371798\ U_{1-2}-18\ U_2+29\ V_1+ 7796459\ V_2+ 665\ V_3+W \geq 0;$
5. $-162016\ U_{1-2}-20\ U_2+ 22\ V_1+ 1611094\ V_2+ 206+\ V_3+W \geq 0;$
6. $-311724\ U_{1-2}-17\ U_2+ 31\ V_1+ 3048252\ V_2+ 313\ V_3+W \geq 0;$
7. $-94357\ U_{1-2}-21\ U_2+ 40\ V_1+ 1754901\ V_2+ 205\ V_3+W \geq 0;$

$V_1 \geq 0.00001$; $V_2 \geq 0.00001$; $V3 \geq 0.00001$; $u1 \geq 0.00001$; $u2 \geq 0.00001$;

The ranking of efficient units in output oriented BCC model using the Anderson-Peterson technique is presented in table 4.3:

Table 4.3: Rankings of efficient units in output oriented BCC model.

Decision-making unit	efficiency	Rank
Mihan	1.08	1
Tose'eh	0.97	2
Ma	0.92	3
Karafarin	0.76	4
Kousar	0.65	5
[Iran	0.43	6

4.3. The reference units of DMUs:

Shadow prices represent another perspective for inefficient units in DEA. For example, in the above table, the output oriented BCC efficiency of Moalem Insurance Company is 0.686 which is less than one indicating that

Advances in Environmental Biology, 9(2) January 2015, Pages: 214-218

it is an inefficient unit. Inefficient units need to improve their efficiency and effectiveness by benchmarking the so-called reference units. References of inefficient units are identified based on non-zero shadow price resulting from solving its corresponding efficient model (except the shadow price of the first constraint). Software output indicates that Iran, Tose'eh and Ma insurance companies have non-zero shadow price (0.77, .58, and 0.17) thus these three units are reference units of Moalem Insurance Company. The most important part of DEA is finding the best virtual unit by combining all the real units. If the virtual unit is better than the unit under assessment, meaning that either it has more outputs than the real unit for the same number of inputs or for the same amount of outputs it consumes fewer inputs, then the unit in question is inefficient. The virtual unit corresponding to inefficient unit is formed by the composition of its reference units. Non-zero shadow prices represent the ratio of composition of reference units. Thus, the output of which is greater than the output of the second unit. So the inputs of virtual unit are fewer (equal) than of the Moalem Insuance Company. It is obvious that with greater inputs Moalem Insurance produces fewer outputs than the virtual unit which indicates the reason of its inefficiency. In other words, one can find a unit (virtual unit) which with fewer inputs produces greater outputs.

The reference units of inefficient units of las section are introduced in table 4.4.

Table 4.4: The table of reference units to inefficient unit.

DMU	Reference Unites					
	Iran	Tose'eh	Karafarin	Ma	Kousar	Mihan
Asia	☑	☑		☑		
Dana	☑		☑	☑		
Moalem	☑	☑		☑		
Pasargad	☑			☑		☑

5. Conclusions:

The purpose of this study was to evaluate the relative efficiency of Insurance companies in 2012 with Data Envelopment Analysis (DEA). The statistical society of the research was consisted of all the insurance companies. With discretion of senior coordinators 10 branches were selected as statistical samples. After consultation with experts 11 indicators of efficiency were identified to be extracted. These indicators were then placed on a check list. Experts were asked to rate the importance of these indicators from 1 to 5. Finally, 5 indicators with higher importance than 3.5 were extracted for this study. Then the necessary information about the input parameters (the number of branches, total assets and number of employees) and output (gross profit and return on investment) were collected though the use of documentations. Then the efficiencies of units were calculated by output oriented BCC model. Anderson-Peterson technique was used to determine the rankings of units. Finally the reference units were introduced.

REFERENCES

[1] Saleh-Zadeh, *et al.*, 2009. Innovation in organizations: concepts, types and processes. Economics and Management, 42.

[2] Taqi Progeny and Najaf Pvrkrdy, 2005. The application of data envelopment analysis (DEA) to determine the most effective portfolio companies listed in Tehran Stock Exchange. Humanities and social sciences, Shiraz University, 22(2): 89-75.

[3] Ekrami and Ski Guide, 2010. Application of DEA model to evaluate the performance of companies; A Case Study of Commercial Bank Supervision. Economic Essays, 4(7): 54-11.

[4] Rostomiants and Tabasi, 2011. Performance Management (with a view to assessing the performance of executive agencies). Ahran: Frmnsh.

[5] Ghasemi, A., 2010. The relationship between technical efficiency evaluation and ranking of commercial banks using DEA. Research and Economic Policy, 47: 95-65.

[6] Rahnamay Rudposht, Mahmudabad, 2012. Decision support system designed to evaluate the performance of a commercial bank branches. Tehran: Institute for Monetary and Banking.