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Performance evaluation and ranking of insurance companies in Tehran Stock Exchange by financial ratios using ANP and PROMETHEE

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Abstract

Given the importance of the insurance industry in the global economy and how it impacts the service sector, insurance companies need to function successfully in their goals. Knowing how to achieve the goals of organizations in today's complex and dynamic environment is important for the managers. Therefore, a model for evaluating the performance of the organization is essential. In this paper, a combination of multiple criteria decision-making approaches has been used for evaluating the performance of insurance companies in Tehran Stock Exchange. Initially, by opinions of experts and the literature study, seventeen key financial ratios related to performance evaluation of insurance companies in Tehran Stock Exchange were selected. Then, by using the analytic network process, the relative importance of each criterion (Ratios) was determined. It was found that the level of liquidity is more important to assess the performance of insurance companies in Tehran Stock Exchange. After determining the relative weights of selected financial ratios, financial data to each of the companies reviewed were collected from the financial statements of these companies and selected financial ratios for each company was calculated. Finally, by running the promethee technique, companies were ranked based on financial performance and Parsian insurance company had the highest performance.

Keywords: assessment of financial performance, financial ratios, analytic network process, Promethee technique

Introduction

Performance evaluation systems are a tool for monitoring and planning organization activities and should be specially considered. This tool is used to correcting and updating of all organization aspects and even to change organization objectives (Hanafizade et al, 2011, p.88). Determining the firm performance using a set of financial measures/ratios has been an interesting and challenging problem for many researchers and practitioners (Dursun Delen et al, 2013).

Performance assessment is viewed as an important duty of management of human resources in facilitation of organizational effectiveness. Performance evaluation and ranking results enable the firms to see their weaknesses and define their financial strategies. There are many studies that investigated the method about performance evaluation (Chalasani & Sounderpandian, 2004; Gleich et al., 2008; Maiga & Jacobs, 2004; Wynn-Williams, 2005).

Obviously, investing in the stock exchange is an important part of economy and undoubtedly, the greatest amount of capital is traded through stock exchanges around the world; and national economy is strongly influenced by the stock market performance. Also, this market is an available investment tool both for professional investors and the general public. Stock exchanges are affected by a series of macro-economic and noneconomic factors and many other variables. The multiplicity and anonymity of factors influencing on capital markets had cause to uncertainty about investment (Emadzadeh et al, 2011, p.32).

Insurance industry extends the productivities and services with providing safety and confidence. Insurance industry also causes stability and reduces the anxiety due to identification.

These companies accomplish the governmental social program as well as allocating the sources in a rational manner. Furthermore, these companies have positive effects on economics growth of the country. Therefore, the efficiency of the insurance companies is always under the question mark. Efficiency measurement in the insurance companies increases the quality of their activities and also assists them to identify and solve the problems (Kueng, 2000). The profit is not earned from insurance service alone. An insurance company uses the insurance premium acquired through the systems of agencies, broker, solicitors, etc (Kao, 2008).

Also multiple criteria decision-making (MCDM) research has developed rapidly and has become a main area of research for dealing with complex decision problems (Sun, 2010).

In this regard, present paper offers an integrated method for ranking the firms and determining the one with the highest performance rate in the insurance companies active in **Tehran Stock Exchange**. The ANP and Promethee methods provides the firms with an insight into their position in the market. Furthermore, these results could be used to follow the performance of the competing firms and to determine strategies accordingly.

Literature Review and background

Performance evaluation and ranking results enable the firms to see their weaknesses and

define their financial strategies. According to Li and Sun (2008), ranking as a practical tool ensures the survival of the firms in the sector. Sales profits and profitability on capital, which was previously used to measure financial performance, do not today suffice to evaluate the financial indicators as a whole. Therefore, firms frequently use the financial ratio analysis to better understand their market positions and to make financial decisions for the future. However, according to Tozum (2009), a traditional ratio analysis fails to measure financial performances. Instead, he recommends using multi-lateral methods.

By referring to the inventory turnover, net income ratio, earnings per share and current ratio as the standards of evaluation, Demireli (2010) ascertains the performance of the state-owned

commercial banks that extensively operate nationwide through the equal weight-TOPSIS in Turkey between the years of 2001-2007.

In their research, Yalcin et al. (2012) suggest a new financial performance evaluation approach to rank the firms of each sector in the manufacturing industry of Turkey. Furthermore, they attempt to show the ranking of the firms which are obtained through the comparison of the TOPSIS and VIKOR methods. Ertugrul and Karakasoglu (2009) evaluate cement firms by using some of the traditional accounting-based financial ratios under the fuzzy multi-criteria decision making model.

Khajavi et al (2005) examined the application of data envelopment analysis in determining a portfolio of most efficient companies of Tehran Stock Exchange. An input-oriented CCR model with covering form was used in this study. The results showed that among 90 studied companies, 29 companies equal to 32 percent of the total number are efficient and the others are inefficient (Khajavi et al, 2005, pp.75-89).

Bulgurcu (2013) by using the Enthropy-Weighted TOPSIS technique, survived financial performance ranking of the Automotive Industry Firms in Turkey.

Dursun Delen et al **(2013)** in a research titled "measuring firm performance using financial ratios" based on sensitivity analysis found that Earnings Before Tax to-Equity Ratio and Net Profit Margin are the two most important variables.

Shahroudi et al (2012) in their research, used traditional DEA model and two-stage DEA model to measure the efficiency of Iranian private insurance companies during 2007-2009. The results indicated that the traditional DEA model is not suitable for such kind of network systems.

The results indicated that the investment weakness is the main reason of insurance companies' deficiencies during the studied period.

Harford and Uysal (2014) show that being rated indeed relaxes financing constraints and has a real effect on investments.

Alissa et al (2013) demonstrate that firms are concerned about their credit rating levels and adjust their corporate policies accordingly in order to attain or maintain specific rating targets.

Methodology

In this study, was used Multi Criteria decision making methods. In the first step with review the literature and interviews with experts in the insurance industry, key performance metrics of insurance companies and retirement active in Tehran Stock Exchange were extracted. model of analytic network process has been used to determine weight of any one of the Criteria. The correlation matrix of the criteria designed and will be distributed among 12 experts in the insurance industry, and with the consensus of expert opinions, pairwise comparisons questionnaire based on the analytic network process designed and completed by the experts. Then using analytic network process (ANP), the weights of criteria will be extract. It should be noted that to analyze data and calculate ranks, Super Decisions software has been used. Here, the first phase of the study will be completed. Then, in order to prioritize the insurance industry companies PROMETHEE method will be used. Data needed to run the way will be extracted for each of the companies surveyed from the actual data. Values for each of the criteria for the 2011, 2012 and 2013 were calculated and will be computed the average of this values for each criterion for each year. Now the data will be entered into the software visual promethee. By run the software, companies will be ranked and recommendations will be presented.

Data analysis

In this study, the first step that is to select performance measures for pension insurance companies Tehran Stock Exchange, were investigate using previous studies. And with extract all the criteria employed in this study and interviews with experts in insurance and retirement industry, 17 criteria into 5 clusters were selected which are as follows:

- The first cluster, the criteria of liquidity: quick ratio, current ratio, liquidity ratio, and the ratio of current assets;
- The second cluster, the leveraged criteria, debt ratio, the ratio of debt to equity and the ratio of equity;
- The third cluster, the criteria of profitability, return on assets, return on investment, return of working capital, and compound interest;
- The fourth cluster, the exchange criteria: level of liquidity, the number transaction days, the book value;
- The fifth cluster, the market criteria: P / E, P / BV, DPS.

With the finalization of the performance evaluation criteria to the insurance companies and pension Tehran Stock Exchange, turn to weigh the importance of each criterion was determined. To determine the weight, analytic network process techniques were used. This technique is presented in the following stages:

a) Research problem network

ANP network has been drawn based on relations recognized between criteria that has been experts opinion. relations between criteria have been shown in ANP model in figure (1) as internal relations or feedback and also, external relations with other clusters through arrows.

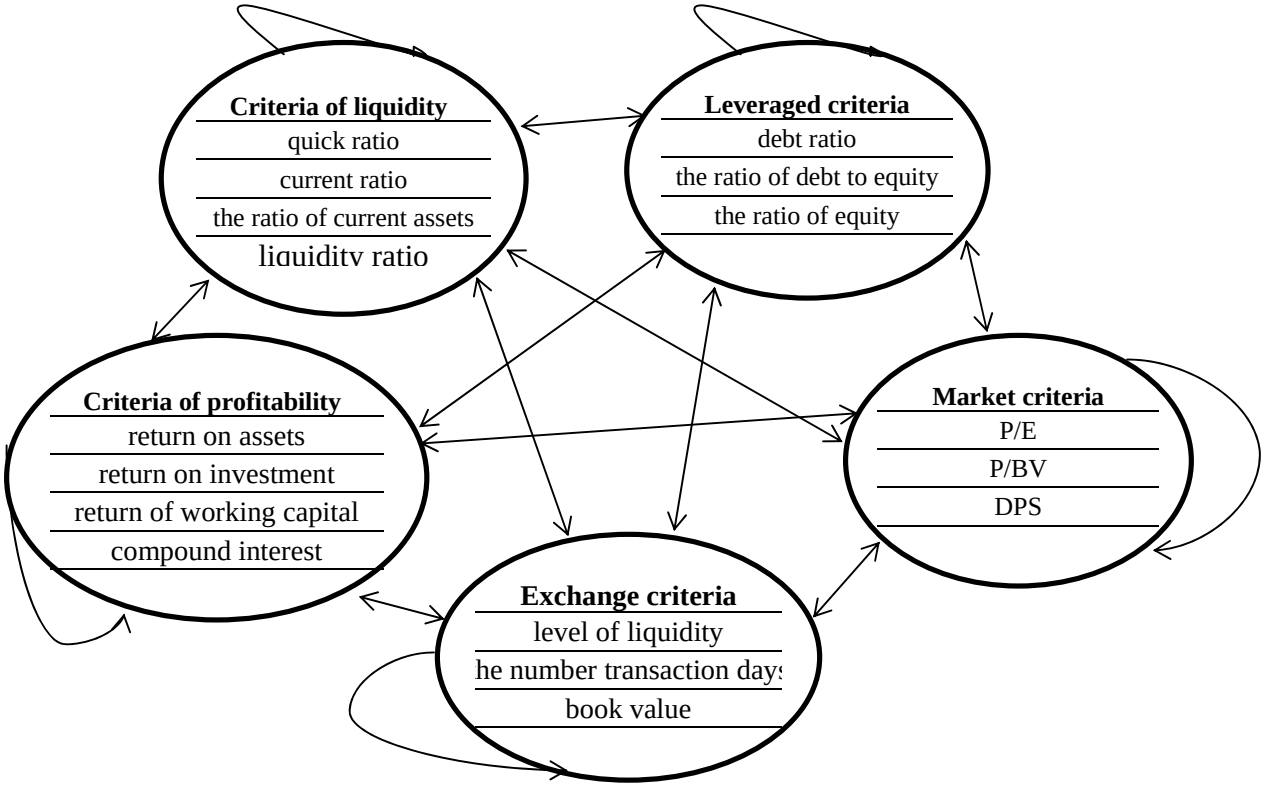

Figure 1. ANP model of the problem

b) Obtained priorities for sub-criteria inside clusters

The following table is getting from obtained ranks for sub-criteria inside clusters of problem model of research.

In view of table 1, according to obtained weights in this part the most important criteria can be investigated between all criteria and also, they can be observed among elements inside any cluster and priority of criteria can be also specified based on existing weight in column "Total Weight" and in column of "Local weights", obtained priorities are observable for any criterion in the "Total Rank" column.

Thus, using the analytic network process and determined the relative importance of each criterion (Ratios) were found to be level of liquidity is more important to assess the performance of insurance companies in Tehran Stock Exchange.

- **Rating of insurance companies using Promethee method**

After determining the weight and importance of each criterion using the analytic network process, evaluating insurance companies turn to be examined. At this stage in order to prioritize companies Promethee method used. Data required for Promethee method is extracted of the input data extracted from the financial statements and audit reports of insurance companies in Tehran Stock Exchange.

Promethee method steps as follows:

- The first step is forming a decision matrix.

The main source to calculate the quantitative assessment criteria according to their companies, is financial data for each company based on each criterion. After determining the status of each company based on the criteria in each of the three years (2011, 2012 & 2013), for each of the matrix elements, sum of each criterion were averaged and entered into software. The starting

point is forming decision matrix that the method presented in this study using the software Visual Promethee done. In addition, the weight of each criterion that is calculated in the previous step using the analytic network process, will be entered into the Visual Promethee software. The horizontal axis is based on the criteria and vertical axis is according to the options evaluated (the insurance company).

Table 1. Ranks related to criteria

Clusters	Criteria	Cluster weight	Local weight	Local rate	Total weight	Total rate
criteria of liquidity	quick ratio	0.245	0.285	1	0.07	7
	current ratio		0.245	2	0.06	9
	the ratio of current assets		0.225	4	0.055	12
	liquidity ratio		0.245	2	0.06	9
leveraged criteria	debt ratio	0.146	0.55	1	0.08	5
	the ratio of debt to equity		0.06	3	0.01	16
	the ratio of equity		0.39	2	0.056	11
criteria of profitability	return on assets	0.194	0.41	1	0.08	5
	return on investment		0.36	2	0.07	7
	return of working capital		0.12	3	0.024	14
	compound interest		0.11	4	0.02	15
exchange criteria	level of liquidity	0.285	0.35	1	0.1	1
	the number transaction days		0.33	2	0.095	2
	book value		0.32	3	0.09	3
market criteria	P/E	0.13	0.65	1	0.085	4
	P/BV		0.07	3	0.01	16
	DPS		0.28	2	0.035	13

Table (2)- Decision matrix (formed by evaluating insurance companies)

	quick ratio	current ratio	liquidity ratio	the ratio of current assets	debt ratio	the ratio of debt to equity	the ratio of equity	return on assets	return on investment	return of working capital	compound interest	level of liquidity	the number transaction days	book value	p/e	p/bv	Dps
ANP Weights	0.07	0.06	0.055	0.06	0.08	0.01	0.056	0.08	0.07	0.024	0.02	0.1	0.095	0.09	0.085	0.01	0.035
Asia	0.77	0.78	0.11	0.67	0.89	9.86	10.67	1.07	11.49	-5.53	0.77	259	10.50	1,636.35	10.94	1.67	34.00
Alborz	0.86	0.86	0.23	0.59	0.73	3.51	26.51	3.06	14.66	-33.93	1.07	144.5	17.00	2,215.80	9.79	1.93	315.00
Parsian	0.98	0.98	0.09	0.75	0.80	4.10	19.66	4.72	24.13	238.78	0.92	63.5	18.50	1,799.27	4.74	1.37	410.00
Dana	0.87	0.87	0.08	0.76	0.93	22.84	7.16	0.66	18.54	-5.54	0.60	290	11.00	1,589.20	11.43	3.30	33.00
Mellat	0.93	0.93	0.15	0.59	0.68	2.14	31.88	4.84	15.19	-116.30	0.55	214	8.50	1,334.01	5.29	0.95	185.00

- Calculate the preference function

Finally, by running the promethee technique, companies were ranked based on financial performance and Parsian insurance company had the highest performance. Comparison using a pre-

defined preference function With the Range (+1, 0) is measured. For a preference function P, options a, b and j are criterion.

Equation (1) $$P_j(a,b) = P_J[d_j(a,b)]$$

Where:

$d_j(a,b) = f_j(a) - f_j(b)$ represents the difference between the two options based on the j-th criterion. Whatever amount of π (a, b) is more, a option is preferable. Preference function for each criterion is often will be determined through the nature of the criterion and decision-maker approaches.

- Calculate the total Preference function:

Final ranking or priority of the two options is obtained by adding the priority for all criteria. In fact, the overall priority π (a, b) for each a option to b option alculated. π (a, b) is calculated thus:

Equation: $$\pi(a,b) = \sum_{j=1}^{k} w_j p_j(a,b), \quad (\sum_{j=1}^{k} w_j = 1)$$

Where:

Wj equal to the weight of the j-th criterion and the weights assigned by decision makers and then will be normalizd ($\sum w_j = 1$). As mentioned before, the criteria for evaluating the performance of the insurance industry by employing the techniques of analytic network process, were weighted.

If the number of options (n) is greater than two, the final ranking obtained by the sum of the values of pairwise comparisons. For each option a ∈A and consider other options x ∈A flow of ratings can be calculated as the following: The positive current of ratings or output current:

Equation (3) $$\emptyset^+(a) = \frac{1}{n-1}\sum_{x\in A}\pi(a,x)$$

This flow shows how a option priority over other options. This process is actually power of a option. The biggest $\emptyset^+(a)$ means the best option. See this rating into table 3.

Table (3)- The output current prioritization of companies using Visual Promethee software

Company	Rank	Phi+
Parsian	1	0,5878
Alborz	2	0,4740
Mellat	3	0,4364
Dana	4	0,2725
Asia	5	0,1710

Table (4)- The input current prioritization of companies using Visual Promethee software

Company	Rank	Phi-
Parsian	1	0,2257
Alborz	2	0,3313
Mellat	3	0,3404
Dana	4	0,4619
Asia	5	0,5824

According to the results of ranking Promethee I, Parsian Insurance Company achieved the highest output current and Asia Insurance Company gain lowest output current. The preference of other options on the a option that call input current, is the result of the following calculation:

The negative ratings or input current:

Equation (4) $$\emptyset^{-}(a) = \frac{1}{n-1}\sum_{x\in A}\pi(x,a)$$

This current shows other options how priority to a option. This current, in fact, is a weakness of a option. Smallest $\emptyset^{-}(a)$ represents the best option. The ratings in the table (4) is shown.

According to the results of ranking Pramty I, and based on the intput current, Parsian Insurance Company obtained the lowest input current and Asia Insurance Company achieved the highest input current. Thus, by having and study separate two curent $\emptyset^{+}(a)$ and $\emptyset^{-}(a)$ can be made a partial rank (rank I PROMETHEE); that the rankings are usually not the same. But in the research ahead, ranking Promethee I, on the basis of each of these two curent, the result is the same rating.

- Calculation of net current rating (PROMETHEE II)

Decision makers always wanted to complete Ranking, as it will be easier decision. Calculation of net current rating makes it possible. For a complete ranking of options, net current ratings for each option must be defined (Ranked PROMETHEE II).

Equation (5) $$\emptyset(a) = \emptyset^{+}(a) - \emptyset^{-}(a)$$

This current is result of the balance between positive and negative current ranks.The higher net current, indicating the preferred option. This version of the method is called PROMETHEE II. The complete rankings will be calculated by PROMETHEE II (Marasovic and Babic 2011). Thus full ranking would be:

Equation (6) $$\begin{cases} aP^{\|}b & \text{if} \quad \emptyset(a) > \emptyset(b) \\ aI^{\|}b & \text{if} \quad \emptyset(a) = \emptyset(b) \end{cases}$$

In this case, all options will be comparable and no option is incomparably. As you can see, all these options can be compared to each other and amount of their net current determine the superiority over another. Priority of the companies based on the net current were determined and the results in Table 5 are shown.

Table 5. Prioritize companies using Visual PROMETHEE software based on current net

Company	Rank	Phi-	Phi+	Phi
Parsian	1	0,2257	0,5878	0,3621
Alborz	2	0,3313	0,4740	0,1427
Mellat	3	0,3404	0,4364	0,0960
Dana	4	0,4619	0,2725	-0,1895
Asia	5	0,5824	0,1710	-0,4114

Conclusion and Recommendations

In this study, a multi-criteria decision making method is used to evaluate financial performance of five companies in the insurance sector and active in the Tehran Stock Exchange by regard to the criteria of financial ratios. To evaluation criteria were studied in this research and weighting them by opinions of experts, analytic network process is used. The companies are ranked by comparing the value of companies is determined in several years. Comparison between the results of the ranking, provides a way to identify insurance companies with stable financial performance for the managers, stockholders, investors and business environment. Rao (2000) argues that financial performance is measured to be re-classified, and if the business strategy and companies operational plans, increases profitability, It be considered. The result of this study, Rao's

view of the fact that Promethee approach helps companies to revise their financial knowledge and analyze the financial situation of most successful companies, strengthen. In addition, stronger and bigger company, not necessarily the best results. Promethee results proves that a very high competition there is between companies by smaller scale and larger. In addition, smaller companies often achieve better results than larger companies. Based on the results of the analytic network process, level of liquidity, the number of transactions days and book value achieved the highest weight and ranked in the first place to third. In relation to the five clusters of ANP Models, respectively exchange, liquidity, profitability, leverage and market achieved the highest to lowest weights. In relation to the rating of the company, based on the Promethee I and II, the rankings were similar, the companies Parsian Alborz, Mellat, Dana and Asia in terms of net current, inputs and outputs have achieved highest to lowest priority.

According to importance of companies ranking, therefore, the following topics are offered as suggestions for future research:

• Given that the study Promethee methods for ranking insurance companies have been used, it is recommended to use other methods such as TOPSIS and Electre be used for ranking. Then results obtained can be compared with the results of this method.

• Use of Promethee techniques to rank companies in other industries active in Tehran Stock Exchange.

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