THE USAGE OF MULTIPLE-CRITERIA DECISION MAKING TECHNIQUES ON PROFITABILITY AND EFFICIENCY: AN APPLICATION OF PROMETHEE

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─Abstract ─

Multiple-criteria Decision Making (MCDM) deals with decision making situations where the decision maker has different contrary objectives. It is difficult to make an optimal choice among the alternatives. A number of methods have been improved in order to solve such problems in recent years. PROMETHEE is one of the most recent MCDM methods and has successfully applied in many fields.

In this paper, the original finance data are obtained through financial statements for the year 2009, 2010 and 2011. According the availibility of data, we included 8 tourism companies. Promethee method applied to the obtained data set. We compute the eight criteria annual performances for each firm for the financial years 2009, 2010, 2011. The data were analyzed by Visual Promethee Academic. The paper evaluates the profitability and efficiency of the tourism companies.

Key Words: *Multiple-criteria Decision Making, PROMETHEE, Decision Making*

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1. INTRODUCTION

Multi-criteria decision-making (MCDM) plays an important role in many real life problems. It is not an exaggeration to argue that almost any local or federal government, industry, or business activity involves, in one way or the other, the evaluation of a set of alternatives in terms of a set of decision criteria. Very often these criteria are conflicting with each other (Triantaphyllou et all., 1998: 3). The MCDM (Multiple Criteria Decision Making) often deals with ranking of many concrete alternatives from the best to the worst ones based on multiple conflicting criteria. The PROMETHEE (Preference Ranking Organization Method for Enrichment Evaluations) is an outranking and simple ranking method for a finite set of alternative actions to be ranked and selected among criteria. The PROMETHEE family initially included the PROMETHEE I for partial ranking of the alternatives and the PROMETHEE II for complete ranking of the alternatives. PROMETHEE II is fundamental to implement the other PROMETHEE methods (Qu et all., 2012: 1).

The profitability and efficiency of the tourism sector has been one of the main subject in financial environment and also the tourism sector plays an important role in the financial services industry in all developed and developing countries. Consequently, the financial performance of tourism firms is of major importance to various stakeholders. Within this context, we want to measure profitability and efficiency of tourism firms by using PROMETHEE Method.

2. PURPOSE OF THE APPLICATION

The aim of this study is to apply PROMETHEE method to measure profitabiltiy and efficiency. The performance can be calculated based on the firms' financial statements. We randomly select 8 firms from the Borsa İstanbul Inc. We compute the eight criteria annual performances for each firm for the financial years 2009, 2010, 2011. The data were analyzed by Visual Promethee Academic.

3. DATA AND METHODOLOGY

Financial management is fundamental to companies's success, and a complex financial system is in need of companies's financial management information. It is obvious that, financial ratios can help to convert the mass of data. Our data set is compiled from Borsa İstanbul Inc. tourism companies between 2009 and 2011 period. The profitability and efficciency can be calculated based on the firms' financial statements. In this paper, the original finance data are obtained through financial statements for the year 2009, 2010 and 2011. According the availibility of data, we included 8 tourism companies. These are Altınyunus Çeşme, Marmaris Altınyunus, Martı Marmaris, Metemtur, Nettur, Petrokent, Tekart and Favori Inc. The eight criteria were selected for measuring the profitabiltiy and efficiency. These are net profit/sales, net profit/equity, net profit/assets, sales, current ratio, acid test ratio, total debt/assets and stock turnover. According to the level of importance, each criterion is given a weight. The weight increases with the importance of the criterion. We modify the weight of these financial criterias and the results as shown in Table 1.

Table 1: The weight of Financial Criterias

Criterias	**Weights**
Net profit/sales	0,15
Net profit/equity	0,15
Net profit/assets	0,15
Sales	0,10
Current ratio	0,15
Acid test ratio	0,15
Total debt/assets	0,10
Stock turnover	0,05

In order to ease the calculation of preference function, Brans & Vincke proposed six kinds of general criterions (Usual, U-shape, V-shape, level, linear and Gaussian). Gaussian function is used for modified eight criteria and 8 selected companies.

The advantage of the Promethee method is that it does not approved a linear evaluation model and it can easily be used with qualitative data. Compared to other performance evaluation models, such as data envelopment analysis (DEA), PROMETHEE is simplier to apply and it does not require the specification of inputs and outputs, which may not always be easy to identify (Kosmidou and Constantin, 2008: 89).

PROMETHEE is an easy ranking method in perception and application opposed to other methods for multi-criteria analysis. It is remarkably adapted to problems where a number of alternative actions are to be ranked (Prvulovic et all, 2011: 779).
In this study, the PROMETHEE method was selected because of its simplicity and its capacity to evaluate the profitability and efficiency of the tourism companies. It is hard to detect and compare profitability and efficiency but with the help of PROMETHEE method, we can choose the best alternative.

4. ANALYSIS AND FINDINGS

Three Years Average Ratios for Selected Companies are shown in Table 2.

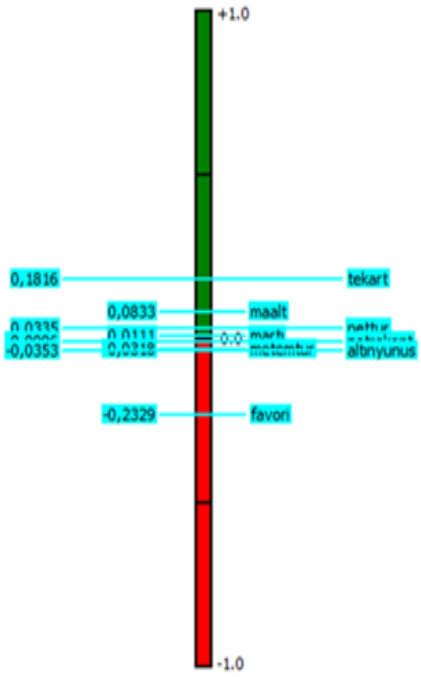
Table 2: Companies and financial criterias's average for the period 2009-2011

	Net profit/sales	Net profit/equity	Net profit/assets	Sales	Current ratio	Acid test ratio	Total debt/assets	Stock turnover
altınyunus	0	0	0	14501099	0,461944	0,4108	0,204906	46,55409
maalt	0,162424	0,05351	0,047309	13772232	3,539921	3,406995	0,141692	59,9989
martı	0,025569	0,012134	0,004829	59034679	0,851067	0,561986	1,232137	2,269528
metemtur	0	2,778948	0	2445074	1,111544	0,95843	9,635693	1,112911
nettur	1,555498	0,20989	0,162166	40855109	2,060602	1,50447	0,321433	2,054686
petrokent	0,110075	0,149653	0,072199	25523026	0,573674	0,511663	1,321975	17,75946
tekart	0,123123	0,008538	0,00806	10053267	5,536969	5,495883	0,122313	92,17176
favori	0,339732	1,302949	0,02212	8218908	0,241442	0,179451	-5,81506	5,710213

PROMETHEE II has been used with success to solve many problems. This method is based on a comparison pair per pair of possible decisions along each criterion. Possible decisions are evaluated according to different criteria, which have to be maximised or minimized (Taillandier and Stinckwich, 2011: 1) and PROMETHEE II ranks alternatives according to their net flows. Promethee II shows which alternative must be preferred. The PROMETHEE method is based on the calculation of positive flow and negative flow for each alternative according to the given weight for each criterion. The positive outranking flow expresses how much each alternative is outranking all the others. The higher the

positive flow, the better the alternative. The negative outranking flow expresses how much each alternative is outranked by all the others. The smaller the negative flow the better the alternative. The PROMETHEE II complete ranking is based on a calculation of net outranking flow value that represents the balance between the positive and negative outranking flows. The higher the net flow, the better the alternative (Bogdanovic et.all., 2012: 84). Promethee II Complete Ranking results are shown in Figure 1.

Figure 1: Promethee II Complete Ranking



Based on the above ranking, we conclude that Tekart (0,1816) was ranked the first and the others are respectively Maalt (0,0833), Nettur (0,0335) , Martı (0,0111), Petrokent (-0,0096), Metemtur (-0,0318), Altınyunus (-0,0353) and Favori (-0,23). Promethee Flows results are shown in Table 3.

Table 3: PROMETHEE flows

Action	Phi	Phi+	Phi-
Tekart	0,1816	0,2812	0,0995
Maalt	0,0833	0,1840	0,1007
Nettur	0,0335	0,1331	0,0996
Martı	0,0111	0,1181	0,1070
Petrokent	-0,0096	0,1178	0,1273
Metemtur	-0,0318	0,1477	0,1796
Altınyunus	-0,0353	0,1054	0,1407
Favori	-0,2329	0,0374	0,2702

PROMETHEE I uses positive and negative flow values to find the partial ranking. Favori is determined as the worst alternative according to the PROMETHEE I partial ranking. Tekart, Maalt, Nettur, Martı, Petrokent, Metemtur, Altınyunus are preferred to Favori. Maalt is preferred to Nettur, Martı, Petrokent and Altınyunus. It is obvious that PROMETHEE I did not provide information about the best alternative.

The best alternative is identified by PROMETHEE II complete ranking (Fig. 1). Net flow values given in the first column of Table 3 are used in this process. Tekart is selected as the best alternative based on the information provided by PROMETHEE II, and the others are respectively Maalt, Nettur, Martı, Petrokeny, Metemtur, Altınyunus and Favori.

5. CONCLUSION

In this paper, we have used Promethee method to evaluate the profitibality and efficiency of the Turkish tourism sector over a three year period. Our data set is compiled from Borsa İstanbul Inc. Tourism companies between 2009 and 2011 period. According the availibility of data, we included 8 tourism companies. In our analysis, we used eight criterias. The eight criteria were selected for measuring the profitabiltiy and efficiency. These are net profit/sales, net profit/equity, net profit/assets, sales, current ratio, acid test ratio, total debt/assets

and stock turnover. Then we modify the weight of these financial criterias. Finally promethee method was applied the data set. Tekart is selected as the best alternative based on the information provided by PROMETHEE II, and the others are respectively Maalt, Nettur, Martı, Petrokent, Metemtur, Altınyunus and Favori. Our application is identified to relative time period and model's hypothesis that we choosed. Different results may be achieved by using different time period and model.

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