International Journal of Economics and Financial Issues
Vol. 3, No. 4, 2013, pp.844-851
ISSN: 2146-4138
www.econjournals.com

Financial Performance Ranking of the Automotive Industry Firms in Turkey: Evidence from an Entropy-Weighted Technique

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ABSTRACT: This paper evaluates the financial performance of the firms in the Turkish automotive industry in the Istanbul Stock Exchange Market (ISEM) by applying the Technique for Order Preference by Similarity to Ideal Solution Methods (TOPSIS). The paper aims to measure and compare the financial performance ranking of these firms. The performances of these firms for a time-period between 2009 and 2012 are assessed and ranked by integrating the TOPSIS method and an entropy-weighted technique that is used to identify the weights of the financial ratios. According to the results, the F-M Izmit Piston firm has the highest performance rate for four years whereas the Parsan firm's performance index value is the lowest one. Such companies as Ford Auto, Anadolu Isuzu, Ege Industry, Ditas Dogan have stable results for the following four years. This technique, which can also be defined as the Enthropy-Weighted TOPSIS, is understood to be a significant multi-criteria decision-making method in terms of providing objective assessment.

Keywords: Financial Ratios; Entropy Technique; the TOPSIS
JEL Classifications: G10; M10

1. Introduction

As one of the growing sectors in the global world, the automotive sector is shaped by the developments in the market. Due to the technological changes and competitive environment, the automotive industry began in the mid-1950s in Turkey, and the industry gained momentum in the early 1960s. Since then, the Turkish automotive sector has achieved to adopt new production technologies. Thus, it has increased productivity and quality such that it has become a powerful player in the global market.

In spite of the competitive business environment, many firms are in collaboration with each other by taking into account the increases in costs and decreases in research and development durations of the automotive sector and consumer demands in the globalized world. Furthermore, this particular situation inevitably affects the financial performance of the firms in the sector. Financial performance measurement and evaluation are directly related to the success of the firms. Therefore, financial performance evaluation results always constitute to be a valuable research subject for key executives and researchers (Spronk ve Hallerbach, 1997).

Performance evaluation and ranking results enable the firms to see their weaknesses and define their financial strategies. Also, 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, automotive 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. In line with Tozum's point, this paper applies the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method.

This paper offers an integrated method for ranking the firms and determining the one with the highest performance rate in the automotive sector in Turkey. The entropy-weighted TOPSIS method 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.

There are many applications that use the TOPSIS in the literature and are proposed by various authors. Feng and Wang (2000) develop a performance evaluation model for the Taiwanese domestic airlines that also take financial ratios into consideration. The TOPSIS method is used to calculate the performance scores of the five major airlines. The final outcome shows that the performance evaluation for the airlines can be more comprehensive if the financial ratios are taken into account.

Tien-Chin and Hsu (2004) evaluate ten firms which manufacture computers and trade at the Taiwan Stock Market. They use an entropy method to determine the objective weights for each evaluation standard, and the TOPSIS method to compute the relative performance index of each project and to rank the results.

Furthermore, Mahmoodzadeh et al. (2007) refers to the fuzzy analytical hierarchy process and the TOPSIS to propose a different method for selection problem. Such criteria as net present value, rate of return, benefit cost analysis and payback period are used for evaluating and selecting the best industrial project before making an investment decision.

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. The TOPSIS method can also act in conjuction with another multi-criteria decision-making model to evaluate the performances of the firms by using financial ratios. The results of the TOPSIS model and hybrid models are comparable. 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.

This paper is organized as follows: In the methodology section, how data is sorted out is explained, and an entropy technique is elaborated on to reach the weighted value of financial ratios. Subsequently, the TOPSIS method and its steps are summarized. An application in the automotive sector is given in the third section. Lastly, in the final section, the results are presented and suggestions are made for the future studies.

2. Methodology

This research has three parts to create a multi-criteria decision making model for a financial performance evaluation problem. The first part is about calculating financial ratios of automotive firms from financial statements. After this calculation, assigning the weights of each financial ratio in the model by using the entropy technique is implemented in the following part. Finally, the TOPSIS method uses the entropy weighted value of ratios to realize its steps and to reach the rankings.

2.1. Data Analysis

Competitiveness and practical knowledge play an important role for the firms in enhancing the development of the sector. Also, financial reports have beneficial operation and profit information in this regard. Thus, the ratios from financial reports can be seen as a widely accepted tool for evaluation and calculation in terms of helping the firms to see their financial future (Akguc, 2010). According to Walton (2000), the ratio value of the same two financial data from the financial statements facilitates the comparison. Therefore, Table 1 shows that ten financial ratios are chosen as the evaluation standards in this study.

Ten important financial ratios are calculated in excel format through the formulas indicated in Table 1 and by using the financial charts of the ten automotive firms registered in the ISEM for the years of 2009, 2010, 2011 ve 2012.

2.2. The Entropy Technique for Weight Value of Financial Ratios

The entropy technique was introduced as a new concept of information theory. Entropy means the average amount of information (Ding and Shi, 2005). In this research, the entropy technique is applied to determine the criteria weights which are used for TOPSIS method. Therefore, this creates an entropy-weighted TOPSIS method.

Table 1. Ten Financial Ratios Used in the Study

Ratio Name	Formula
Current Ratio	Current Assets/Current Liabilities
Acid Test Ratio	(Current Assets-Inventories) / Current Liabilities
Total Debt Ratio	(Total Assets - Shareholder's Equity) / Total Assets
Debt Equity Ratio	Total Debt / Shareholder's Equity
Current Assets Turnover	Net Sales / Current Assets
Fixed Assets Turnover	Net Sales/ Fixed Assets
Net Profit Margin	Net Revenue / Net Sales
Return on Equity	Net Income / Shareholder's Equity
Working Capital Turnover	Net Revenue/ (Current Assets- Short Term Liabilities)
Return on Assets	Net Profit / Total Assets

The entropy method is highly reliable and can easily be adjusted to information measurement (Zou et al., 2005). The calculation steps are as follows: Suppose a decision matrix D with m alternatives and n criteria:

Step 1. It is essential to standardize indices using the equations of relative optimum membership degree. For the benefit indices, the attribute value of the jth index in the ith can be transformed by this formula:

$$r_{ij} = x_{ij} / \max_j x_{ij} \qquad (i = 1,...m;\ j = 1,...,n)$$

To the cost indices, the attribute value of the jth index in the ith can be transformed by this formula:

$$r_{ij} = \min_j x_{ij} / x_{ij} \quad \min_j x_{ij} \neq 0 \qquad (i = 1,...m;\ j = 1,...,n)$$

Step 2. After the standardization of indices, the standardized index matrix D is created as D'=[r_{ij}] m×n.

Step 3. In the matrix D, feature weight p_{ij} is of the i_{th} alternatives to the j_{th} factor:

$$p_{ij} = r_{ij} / \sum_{i=1}^{m} r_{ij} \qquad (1 \leq i \leq m, 1 \leq j \leq n)$$

Step 4. The output entropy e_j of the j_{th} factor becomes

$$e_j = -k \sum_{i=1}^{m} p_{ij} In\, p_{ij} \qquad (k = 1/\ln m; 1 \leq j \leq n)$$

Step 5. Variation coefficient of the jth factor: g_j can be defined by the following equation:

$$d_j = 1 - e_j \qquad (1 \leq j \leq n)$$

Note that the larger g_j is the higher the weight should be.

Step 6. Calculate the weight of entropy α_j:

$$w_j = g_j / \sum_{j=1}^{m} g_j \qquad (1 \leq j \leq n)$$

2.3. The Technique for Order Preference by Similarity to Ideal Solution Method

As an approved variation of the Multi-Criteria Analysis methods, the TOPSIS method was developed by Hwang and Yoon in 1981. This method is based on the rank of alternatives to obtain the best alternative selection, which is the closest to the ideal solution. In other words, such an alternative has the most distant solution from the anti-ideal solution. The TOPSIS method takes into consideration the distance from both sides. The process of the TOPSIS begins to make an original data matrix by using the criteria value for each alternative. The TOPSIS transforms this original matrix into a normalized matrix and it has five steps after these applications over matrix to determine the ranking of the firms.

Step 1. Normalization of alternative values: Normalization aims at maintaining comparable scales (Hwang and Yoon, 1981). There are several ways of normalizing the values of the alternatives. This paper will use vector normalization, which utilizes the ratio of the original value (xij) and the square root of the sum of the original criterion values. This procedure is usually utilized in the TOPSIS (Yurdakul and Ic, 2003). The formula is as follows:

$$\text{pij}=\frac{\text{Xij}}{\sum_{i=1}^{m}\text{Xij}}$$ where i is the i_{th} firm , j the j_{th} evaluation criterion r_{ij} the criterion value after vector normalization for the i_{th} automotive firm and j_{th} evaluation criterion, xij the original value of criterion for the i_{th} automotive firm and j_{th} evaluation criterion and m the number of automotive firms.

Step 2. Determination of ideal (A^+) and negative ideal (A^-) solution:

$$A^+ = \left\{\left(\max_i r_{ij} \mid j \in J\right), \left(\min_i r_{ij} \mid j \in J'\right) \mid i = 1,2,\ldots..m\right\} = \left\{A_1^+, A_2^+ \ldots, A_j^+, \ldots, A_k^+\right\}$$

$$A^- = \left\{\left(\min_i r_{ij} \mid j \in J\right), \left(\max_i r_{ij} \mid j \in J'\right) \mid i = 1,2,\ldots..m\right\} = \left\{A_1^-, A_2^- \ldots, A_j^-, \ldots, A_k^-\right\}$$

$J = \{j = 1,2,\ldots,k \mid k$ belongs to benefit criteria $\}$ benefit criterion implies a larger indicator value and a higher performance score. $J' = \{j = 1,2,\ldots,k \mid k$ belongs to cost criteria $\}$ cost criterion implies a smaller indicator value and a higher performance score.

Step 3. Calculation of the separation measure: The separation of each airline from the ideal one (S_i^+) and the worst one (S_i^-) is then respectively given by

$$S_i^+ = \sqrt{\sum_{j=1}^{k}(r_{ij} - A_J^+)^2} \qquad S_i^- = \sqrt{\sum_{j=1}^{k}(r_{ij} - A_J^-)^2} \qquad i = 1,2,\ldots..m$$

Step 4. Calculation of the relative closeness to the ideal solution (C*) :

$$C_i^* = \frac{S_i^-}{S_i^+ + S_i^-} \qquad 0 < C_i^* < 1$$

Step 5. Ranking the preference order according to the descending order of C_i^* .

3. Application

In this paper, the financial data of ten automotive firms listed in the ISEM for the years between 2009 and 2012 are used. First of all, ten financial ratios as criteria are calculated from their balance and revenue sheet for each firms by using a ratio analysis method. Secondly, decision matrices (10 x 10) are formed separately for the years of 2009, 2010, 2011 and 2012 by using calculated ten financial ratios such as Current Ratio, Acid Test Ratio, Total Debt Ratio, Debt Equity Ratio, Current Assets Turnover, Fixed Assets Turnover, Net Profit Margin, Return on Equity, Working Capital Turnover and Return on Assets (C1, C2,… as the same order) and ten decision points (firms). Thirdly, the entropy-based weights are calculated for each of the ten criteria for each year and linguistic variables are not used, which serves to the purpose of this paper to obtain an objective and reliable weight calculation. The total of weights must be one. The original data matrix in table 2 is the framework of all calculation for this research.

Table 2. Original Data Matrix (for 2009)

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Anadolu Isuzu	1,9183	0,778	0,4044	0,6789	1,3022	3,2401	-0,0737	-0,115	2,7202	-0,0685
Bosch Fren Sys.	0,5595	0,4388	0,9236	12,088	3,1163	3,0996	-0,0398	-0,8096	-3,9581	-0,0619
Ditas Dogan	1,7433	1,1609	0,3811	0,6157	1,4365	1,8413	-0,1369	-0,1785	3,3691	-0,1105
Ege Industry	2,2743	1,5783	0,446	0,8051	1,1462	1,909	-0,0091	-0,0118	2,0456	-0,0065
F-M Izmit Pistn.	10,464	9,7045	0,0683	0,0734	1,3073	3,2338	0,09705	0,09698	1,4454	0,09035
Ford Auto.	1,9381	1,5888	0,4137	0,7057	3,4525	4,6481	0,05982	0,20213	7,1328	0,1185
Karsan Auto.	0,6357	0,2668	0,63	1,703	2,6638	1,4592	-0,1953	-0,4977	-4,6482	-0,1841
Otokar	1,2114	0,7366	0,7119	2,4715	1,1856	2,851	0,06728	0,19558	6,7949	0,05634
Parsan	2,6457	1,4372	0,1549	0,1833	1,3322	0,2691	-0,366	-0,097	2,1417	-0,0819
Tofas Auto.	1,1299	0,9642	0,6743	2,0706	2,5664	2,142	0,07067	0,25337	22,321	0,08251

Using this original data matrix, the maximum and minimum criteria values are taken from the original matrix and used to calculate the standardization matrix. The table 3 and 4 show the results of these calculations.

Table 3. Maximum and Minimum Criteria Column Value (for 2009)

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
MAX	10,464	9,7045	0,9236	12,088	3,4525	4,6481	0,09705	0,2534	22,3213	0,1185
MIN	0,5595	0,2668	0,0683	0,0734	1,1462	0,2691	-0,366	-0,8096	-4,6482	-0,1841

Table 4. Standardization Index Matrix (for 2009)

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Anadolu Isuzu	0,1833	0,0802	0,4378	0,0562	0,3772	0,6971	0,2014	0,142	0,1219	0,3719
Bosch Fren Sys.	0,0535	0,0452	1	1	0,9026	0,6669	0,1087	1	0,8515	0,336
Ditas Dogan	0,1666	0,1196	0,4126	0,0509	0,4161	0,3961	0,3739	0,2204	0,1509	0,5999
Ege Industry	0,2173	0,1626	0,4829	0,0666	0,332	0,4107	0,025	0,0146	0,0916	0,0356
F-M Izmit Pistn.	1	1	0,074	0,0061	0,3787	0,6957	1	0,3828	0,0648	0,7625
Ford Auto.	0,1852	0,1637	0,448	0,0584	1	1	0,6163	0,7977	0,3195	1
Karsan Auto.	0,0607	0,0275	0,6822	0,1409	0,7716	0,3139	0,5335	0,6147	1	1
Otokar	0,1158	0,0759	0,7708	0,2045	0,3434	0,6134	0,6932	0,7719	0,3044	0,4755
Parsan	0,2528	0,1481	0,1678	0,0152	0,3859	0,0579	1	0,1198	0,0959	0,4451
Tofas Auto.	0,108	0,0994	0,7301	0,1713	0,7433	0,4608	0,7282	1	1	0,6963

The output entropy Ej is calculated by using the m and k values inside step 4's formula in Table 5. m=10 and k=0,434 are found.

Table 5. The output entropy Ej of the jth factor (for 2009)

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Ej=	1,0501	0,8663	1,1385	0,7197	1,1787	1,1691	0,9304	0,8569	0,8801	1,0128

By using the degree of divergence from Table 6, the entropy-weighed value of ratios can be easily calculated (Table 7).

Table 6 .The degree of divergence (d_j) of intrinsic information (for 2009)

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
dj	0,0501	0,1337	0,1385	0,2803	0,1787	0,1691	0,0696	0,1431	0,1199	0,0128

Table 7. The entropy weight value of ratios

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Weight	0,0387	0,1032	0,1069	0,2164	0,1379	0,1305	0,0537	0,1104	0,0925	0,0099

Finally, by using the entropy-weight-based TOPSIS method, the ranking of the firms is procured according to their general performances. The ratios for 2009 in Table 1 are used for creating the original decision matrix, which is displayed in Table 2. After the original matrix is created, the normalization of these values is calculated by using the formula in the first step of the TOPSIS method as Table 8 shows.

Table 8. Normalized Matrix (for 2009)

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Anadolu Isuzu	0,1647	0,0668	0,0347	0,0583	0,1118	0,2782	-0,0063	-0,0099	0,2336	-0,0059
Bosch Fren Sys.	0,0480	0,0377	0,0793	1,0380	0,2676	0,2662	-0,0034	-0,0695	-0,3399	-0,0053
Ditas Dogan	0,1497	0,0997	0,0327	0,0529	0,1234	0,1581	-0,0118	-0,0153	0,2893	-0,0095
Ege Industry	0,1953	0,1355	0,0383	0,0691	0,0984	0,1639	-0,0008	-0,0010	0,1757	-0,0006
F-M Izmit Pistn.	0,8986	0,8333	0,0059	0,0063	0,1123	0,2777	0,0083	0,0083	0,1241	0,0078
Ford Auto.	0,1664	0,1364	0,0355	0,0606	0,2965	0,3991	0,0051	0,0174	0,6125	0,0102
Karsan Auto.	0,0546	0,0229	0,0541	0,1462	0,2287	0,1253	-0,0168	-0,0427	-0,3991	-0,0158
Otokar	0,1040	0,0633	0,0611	0,2122	0,1018	0,2448	0,0058	0,0168	0,5835	0,0048
Parsan	0,2272	0,1234	0,0133	0,0157	0,1144	0,0231	-0,0314	-0,0083	0,1839	-0,0070
Tofas Auto.	0,0970	0,0828	0,0579	0,1778	0,2204	0,1839	0,0061	0,0218	1,9168	0,0071

Then, the weighted normalized matrix is formed by multiplying each value with their entropy weights. Table 9 represents this matrix. Calculated weights by using an entropy technique for 2009 are as follows from Table 7:

W_{2009}= {0,0387, 0,1032, 0,1069, 0,2164, 0,1379, 0,1305, 0,0537, 0,1104, 0,092, 0,0099}

Table 9. Entropy-Weighted Normalized Matrix (for 2009)

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Anadolu Isuzu	0,0165	0,0067	0,0035	0,0058	0,0112	0,0278	-0,0006	-0,0010	0,0234	-0,0006
Bosch Fren Sys.	0,0048	0,0038	0,0079	0,1038	0,0268	0,0266	-0,0003	-0,0070	-0,0340	-0,0005
Ditas Dogan	0,0150	0,0100	0,0033	0,0053	0,0123	0,0158	-0,0012	-0,0015	0,0289	-0,0009
Ege Industry	0,0195	0,0136	0,0038	0,0069	0,0098	0,0164	-0,0001	-0,0001	0,0176	-0,0001
F-M Izmit Pistn.	0,0899	0,0833	0,0006	0,0006	0,0112	0,0278	0,0008	0,0008	0,0124	0,0008
Ford Auto.	0,0166	0,0136	0,0036	0,0061	0,0296	0,0399	0,0005	0,0017	0,0613	0,0010
Karsan Auto.	0,0055	0,0023	0,0054	0,0146	0,0229	0,0125	-0,0017	-0,0043	-0,0399	-0,0016
Otokar	0,0104	0,0063	0,0061	0,0212	0,0102	0,0245	0,0006	0,0017	0,0583	0,0005
Parsan	0,0227	0,0123	0,0013	0,0016	0,0114	0,0023	-0,0031	-0,0008	0,0184	-0,0007
Tofas Auto.	0,0097	0,0083	0,0058	0,0178	0,0220	0,0184	0,0006	0,0022	0,1917	0,0007

The distances between the valuation subjects and ideal and negative ideal solution are determined by taking the maximum and minimum values for each criterion from the entropy-weighted normalization matrix table.

S^+ = (0,25401, 0,132531, 0,25303, 0,25193, 0,25257, 0,23977, 0,26028, 0,21539, 0,264023, 0,20503)

S^- = (0,03195, 0,229786, 0,0245, 0,02573, 0,09008, 0,0635, 0,04564, 0,056104, 0,023069, 0,085099)

The same process is carried out for the years of 2010, 2011 and 2012 in order to obtain all the steps of the TOPSIS method similar to the process in 2009. Finally, the relative closeness calculation to the ideal solution of automotive firms is determined by using the formula in the fourth step of this method. The financial performance evaluation of ten automotive firms is done according to this calculation. The rankings of the firms are reached according to the performance index values (Table 10).

If the performance index value is higher, it means that it is closer to the distance from ideal solution and it is further from the negative ideal solution. Therefore, it is the ideal ranking. From Table 10, the F-M Izmit Piston firm has the highest performance rate for a four-year period. In this research, the performance index value of the Parsan firm is the lowest one. Ford Auto, Anadolu Isuzu, Ege Industry, Ditas Dogan have consistent results for the following four years.

Table 10. Performance indexes of the ten listing firms for 2009-2010-2011-2012

	2009		2010		2011		2012	
	c_i *	Ranking	c_i *	Ranking	c_i *	Ranking	c_i *	Ranking
Anadolu Isuzu	0,11174	7	0,20057	5	0,28602	6	0,31352	3
Bosch Fren Sys.	0,63421	1	0,19781	6	0,41342	3	0,24617	6
Ditas Dogan	0,08828	9	0,18799	7	0,27915	7	0,27005	4
Ege Industry	0,09267	8	0,17058	8	0,27402	8	0,23267	7
F-M Izmit Pistn.	**0,2629**	**3**	**0,7792**	**1**	**0,5235**	**1**	**0,6199**	**1**
Ford Auto.	0,20938	4	0,37701	2	0,34335	4	0,38466	2
Karsan Auto.	0,14919	6	0,23426	3	0,26126	9	0,21005	9
Otokar	0,20665	5	0,14791	10	0,42282	2	0,26533	5
Parsan	**0,0804**	**10**	**0,1632**	**9**	**0,2313**	**10**	**0,1502**	**10**
Tofas Auto.	0,29332	2	0,20454	4	0,28367	5	0,22188	8

The ranking results are presented in Table 10. This result orders the financially succesful firms in 2009 as follows: Bosch Fren Systems, F-M Izmit Piston and Tofas Turkish Automotive. Parsan Machinery Industry has the lowest financial performance for the same year. F-M Izmit Piston, Ford Automotive and Karsan Automotive are the most financially successful firms for the year of 2010. However, Parsan Automotive Industry and Otokar show the worst performance in 2010. For the years of 2011 and 2012, the results point to the same firms as the best and the worst financial performers. The best firm is the F-M Izmit Piston whereas Parsan has the worst result. At the end of this evaluation, it is possible to state that the F-M Izmit Piston firm has taken the first place with the unfailing performance for a four-year period of time and Ford Automotive; Ege Industry firms show constant outcomes. The other firms exhibit unsteady trends.

4. Conclusion

In this study, a multi-criteria decision-making method is utilized to evaluate the financial performances of the ten firms operating in the automotive sector and trading at the ISEM by taking the criteria of financial ratios into account. The proposed method, which is called the entropy-weighted TOPSIS technique, is used in converting these criteria to a single indicative value of the firms' financial performance. If this research method had used equally weighted criteria, it would have never received the objective results. Therefore, using an entropy method has proven to be useful and reliable in terms of eliminating the risk of subjectivity.

The ranking of the firms in the same sector is determined to compare the value of the firms for each year. The comparison between the ranking results provides managers, stake holders, investors and business environment with the way to identify the automotive firms with stable financial performances. Rao (2000) argues that financial performance measurements are the measures to be resorted to to see if the existing business strategy and applications of the firm operations increase profitability. The outcome of this study reinforces Rao's point in terms of exposing the fact the TOPSIS technique helps the firms to revise their financial knowledge and analyze the most successful firm's financial situation.

Furthermore, the more powerful and bigger firms have not necessarily had the highest results. The TOPSIS results prove that there is an immense competition between the bigger- and smaller-scale firms. Moreover, the smaller ones occasionally achieve better results than bigger firms do.

Another important consequence of this study is that the positions of the automotive firms in the market are mainly stable except for a few numbers of companies. The F-M Izmit Piston film is found out to be the most successful firm according to the results. Its position in the market is favorable when compared to the other automotive firms. Therefore, it would be recommended to its rivals to closely follow this firm in terms of the automotive sector. Located among the firms with an unstable market position within the indicated time period, Parsan is the least successful one with its failing financial performance from 2009 till 2012. This manifests that Parsan falls behind in following its rivals. This study foregrounded the objectivity and accountability of the TOPSIS method in terms of financial performance measurement by integrating it with an entropy-weight technique.

In the future, it would be advisable to use a greater number of criteria which are involved in the marketing process. Likewise, it could be considered that different weight calculation methods with a greater number of criteria values and results of weights based on the TOPSIS technique can stand a better comparison among others. As an ultimate suggestion, hybrid methods can be developed and addressed to strengthen the power of evaluation of financial performances.

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