Asker, V. (2024). "The Effect of Kahramanmaras Earthquakes on Financial Performance: An Application in Companies Located in Earthquake Area", Eskişehir Osmangazi Üniversitesi İİBF Dergisi, 19(3), 713 – 725.
Doi: 10.17153/oguiibf.1420199

Başvuru: 15.01.2024 Kabul: 23.02.2024 *Araştırma Makalesi/Research Article*

The Effect of Kahramanmaras Earthquakes on Financial Performance: An Application in Companies Located in the Earthquake Area

Veysi Asker[1]

Kahramanmaraş Depremlerinin Finansal Performansa Etkisi: Deprem Bölgesinde Bulunan İşletmelerde Bir Uygulama

Öz

Bu çalışmanın amacı, 6 Şubat 2023 tarihinde Kahramanmaraş'ta meydana gelen depremlerin deprem bölgesinde yer alan ve hisseleri BIST'te işlem gören işletmelerin finansal performansı üzerindeki etkisinin Lopcow temelli Cobra yöntemiyle incelenmesidir. Çalışma kapsamında ilk olarak söz konusu işletmelere ait finansal veriler Lopcow yöntemi ile ağırlıklandırılmıştır. Daha sonra Cobra yöntemi kullanılarak ilgili işletmelerin finansal performans sıralaması gerçekleştirilmiştir. Cobra yönteminin sıralama sonuçlarına göre, ARSAN işletmesinin 2022Q1 döneminde, SANKO işletmesinin 2022Q2-2022Q4 döneminde ve ISDMR işletmesinin 2023Q1-2023Q3 döneminde göreceli olarak en iyi finansal performansa sahip olduğu görülmüştür.

Anahtar Kelimeler: Kahramanmaraş Depremleri, Finansal Performans, Lopcow Yöntemi, Cobra Yöntemi

JEL Kodları: D81, E44, G41

The Effect of Kahramanmaras Earthquakes on Financial Performance: An Application in Companies Located in the Earthquake Area

Abstract

The aim of this study is to examine the impact of the earthquakes that occurred on February 6, 2023, in Kahramanmaras on the financial performance of companies located in the earthquake area and whose stocks are traded on the BIST using Lopcow-based Cobra method. Within the scope of the study Firstly, the financial data of these companies were weighted using the Lopcow method. Subsequently, the Cobra method was employed to rank the financial performance of the relevant companies. According to the ranking results of the Cobra method, it was observed that ARSAN had the best relative financial performance in the 2022Q1 period, SANKO in the periods 2022Q2-2022Q4, and ISDMR in the periods 2023Q1-2023Q3.

Keywords: Kahramanmaras Earthquakes, Financial Performance, Lopcow Method, Cobra Method

JEL Codes: D81, E44, G41

Araştırma ve Yayın Etiği Beyanı	Bu çalışma bilimsel araştırma ve yayın etiği kurallarına uygun olarak hazırlanmıştır.
Yazarların Makaleye Olan Katkıları	Yazar 1'in makaleye katkısı %100'dür.
Çıkar Beyanı	Yazarlar açısından ya da üçüncü taraflar açısından çalışmadan kaynaklı çıkar çatışması bulunmamaktadır.

[1] Dr. Öğr. Üyesi, Dicle Üniversitesi, Sivil Havacılık Yüksekokulu, Havacılık Yönetimi Bölümü, veysi-asker@outlook.com

1. Introduction

On February 6, 2023, earthquakes with magnitudes of 7.6 Mw (Pazarcık) and 7.4 Mw (Elbistan) occurred in Kahramanmaras, Turkey. These earthquakes are considered the largest in recent years in Turkey. They affected 11 provinces in the southeast of Turkey (Kahramanmaras, Hatay, Kilis, Adana, Adıyaman, Osmaniye, Gaziantep, Sanlıurfa, Diyarbakır, Elazığ) and the northern part of Syria (AFAD, 2023). It is estimated that these earthquakes affected 9.1 million people in Turkey and 8.8 million people in Syria (Reliefweb Situation Report, 2023). According to the Disaster and Emergency Management Authority (AFAD), 115,353 people were injured, and 50,783 people lost their lives in these earthquakes. Besides the loss of lives, these earthquakes also resulted in significant economic losses. According to the Ministry of Treasury and Finance, the financial damage in the earthquake-affected region is around 1.6 trillion TL. In addition to this, the total loss amounted to 351.4 billion TL due to expenses related to debris removal, emergency support, income loss payments, insurance payments, and all other support expenses, as well as the decrease in the national income. The cost of these earthquakes to Turkey is approximately 2 trillion TL (103.6 billion dollars). This amount is six times the financial loss experienced in the 1999 Marmara earthquake. Furthermore, it corresponds to approximately 9% of the expected national income in the year 2023 (hmb.gov.tr, 2023).

The economic impact of earthquakes can vary in the short, medium, and long term. Short-term negative effects on the economy arise from the immediate human and material losses, as well as disruptions in transportation and communication. Additionally, the decline in production and sales activities in the earthquake-affected region, coupled with financial difficulties for companies in that area, represents the medium and long-term adverse effects of earthquakes on the economy. Initially, earthquakes negatively impact the financial performance of companies in the region, and in subsequent periods, they continue to have adverse effects on the national economy (Atabay and Kamilçelebi Öztürk, 2023, p. 1194)

The aim of this study is to examine the impact of the earthquakes in Kahramanmaras on the financial performance of companies operating in the region and listed on the Borsa Istanbul (BIST) using Multi Criteria Decision Making (MCDM) methods. Additionally, the study involves comparing the financial performance of these companies before and after the earthquakes. In this context, the financial performance of 8 companies for the period of 2022Q1-2023Q3 has been analyzed using the Lopcow-based Cobra method. In the subsequent sections of the study, Section 2 discusses relevant literature on the topic. Section 3 provides information about the data and methods used in the research. Section 4 examines the findings obtained from the analysis. The final section evaluates the results of the analysis and presents recommendations.

2. Literature

The Cobra method, a relatively new approach in the literature, was first developed by Krstic et al. (2022). In their study, conducted with the aim of evaluating the applicability of Industry 4.0 technology in the reverse logistics sector and determining the validity of the method, Krstic et al. (2022) weighted the criteria of Industry 4.0 technology using the Best-Worst Method (BWM) and then ranked the alternatives of this technology using the Cobra method. The research found that Internet of Things, cloud computing, and mobile market applications were the most applicable Industry 4.0 technologies in the reverse logistics sector. Additionally, the ranking results obtained were found to be similar to the ranking results obtained with other multi-criteria decision-making methods. Popovic et al. (2022), in their study aimed at

determining the most applicable strategies in the e-commerce sector, first weighted the criteria for e-commerce strategies using the MEREC method. Subsequently, they ranked the decision alternatives related to these strategies using the Cobra method. According to the research results, the adoption of social e-commerce was identified as the most successful strategy. In another study, Krstic et al. (2023), aimed to determine the most manageable risk groups in the operational process of the circular supply chain in the agricultural sector. They initially weighted the manageable risk criteria of the circular supply chain in the agricultural sector using the BWM method, and then ranked these manageable risk groups internally using the Cobra method. According to the research findings, risks related to product characteristics, logistics risks, and management risks were identified as the most manageable risks.

Numerous studies in the literature have explored the impact of earthquakes on the financial structure of companies. For example: Yıldırım and Alola (2020), investigated the shock effect of earthquakes on stock returns of companies in Turkey between 2000Q2-2017Q4 using econometric methods. The analysis concluded that earthquakes did not have statistically significant short-term effects on the stock returns of these companies. Joseph (2022) examined the impact of the 2010 earthquake in Haiti on economic growth and recovery using econometric models. The analysis found that the earthquake caused significant short-term declines in the Haitian economy. Hamurcu (2022), studied the effect of the 2020 earthquake in Izmir on the stock prices of insurance companies, finding that the earthquake had a negative impact on the stock prices of these companies for up to 60 days. Kırkağaç and Karpuz (2023), investigated the impact of the earthquakes in Kahramanmaras on companies in the banking and insurance sectors using the event study method and T-Test. The research revealed significant decreases in stock returns for the affected banks and insurance companies. Şen (2023), examined the financial measures implemented after the Kahramanmaras earthquakes to understand their impact on the Turkish economy. The study estimated that the costs of the earthquakes would be around 70 billion dollars. Göktaş (2023), studied the impact of the Kahramanmaras earthquakes on regional tourism, listing damaged historical and cultural sites and suggesting measures for their recovery. The research found that many cultural and historical sites, as well as travel agencies and accommodation companies, were affected by the earthquakes. Tetik and Albulut (2023), evaluated the financial and economic effects of the 2023 earthquakes in Kahramanmaras on export-oriented companies. The study highlighted financial difficulties faced by export companies in the earthquake-affected region. Atabay and Kamilçelebi (2023), compared the financial performance of companies listed on BIST before and after the Marmara (1999) and Van (2011) earthquakes, noting variations in the financial performance of manufacturing and wholesale/retail trade sector companies. Tetik and Öner (2023), examined the economic losses resulting from the earthquakes in Kahramanmaras on Small and Medium-sized Enterprises (SMEs), suggesting that government support packages should be increased to help these companies survive financially. Say and Doğan (2023), analyzed the impact of the Kahramanmaras earthquakes on stock prices of companies in BIST 30 using the event study method, finding abnormal returns within the first two days after the earthquakes. Gürsoy et al. (2023), used Fourier Volatility Spillover Test to explore the impact of the Kahramanmaras earthquakes on the financial performance of sectors such as food and beverage, banking, technology, and textiles. The analysis revealed different effects on these sectors. Kanat and Tetik (2023), examined the impact of the Kahramanmaras earthquakes on Borsa Istanbul (BIST) using the event study method. The analysis concluded that the rises and losses in BIST between 06.02.2023 and 17.02.2023 did not result in abnormal gains or losses.

These studies collectively provide a comprehensive overview of the diverse ways earthquakes can affect companies, financial markets, and various sectors, shedding light on both short-term and long-term implications. However, any study has been found in the literature comparing the financial performance of companies located in the earthquake area before and after the Kahramanmaras earthquakes. In this regard, it is thought that this study will fill this gap in the literature.

3. Data and Methodology

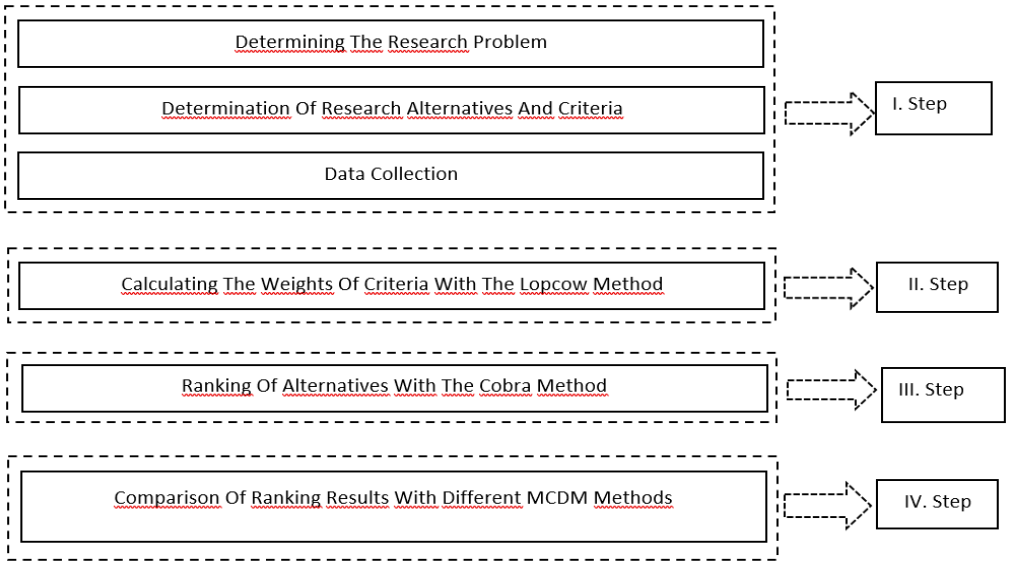
In this study, the financial performance of 8 companies (ARSAN, BLCYT, BOSSA, HATEK, ISDMR, RUBNS, SANKO, SASA) located in the earthquake-affected region and whose stocks are traded on Borsa Istanbul (BIST) has been examined using the Lopcow-based Cobra method, focusing on 10 criteria, before (2022Q1-2022Q4) and after (2023Q1-2023Q3) the Kahramanmaras-centered earthquakes. The majority of the companies included in the study operate in the textile sector (ARSAN, BLCYT, BOSSA, HATEK, RUBNS), some in the chemical-pharmaceutical-petroleum-rubber-plastic products sector (SASA), some in the wholesale trade sector (SANKO), and others in the primary metal industry sector (ISDMR). Quarterly data has been utilized to present changes in financial performance in more detail. Financial data for the respective companies have been obtained from their annual reports. The financial performance criteria included in the study are presented in Table 1.

Table 1: Performance Criteria, Codes, and Reference Information Used in the Study

Performance Criteria	Code	Type	References
Liquid Assets / Short-term Liabilities	C1	Max	(Satır, Kısakürek, & Yaşar, 2020); (Oral & Şenen, 2023); (Gök Kısa & Perçin, 2020); (Karadeniz & İskenderoğlu, 2022); (Kehribar, Karademir, & Evci, 2021); (Kurt & Kablan, 2022); (Pala, 2021); (Yıldırım & Kılıç, 2021); (Köse & Akıllı, 2021); (Özdemir & Parmaksız, 2022)
Liquid Assets - Stocks / Short-term Liabilities	C2	Max	(Açıkgöz, 2021); (Karadeniz & İskenderoğlu, 2022); (Oral & Şenen, 2023); (Şahin & Sarı, 2019); (Yıldırım & Kılıç, 2021); (Köse & Akıllı, 2021)
Total Debt / Total Assets	C3	Min	(Oral & Şenen, 2023); (Akbulut & Hepşen, 2021); (Ertaş & Yetim, 2022); (Gök Kısa & Perçin, 2020); (Karadeniz & İskenderoğlu, 2022);(Söylemez, 2020); (Yıldırım & Kılıç, 2021); (Köse & Akıllı, 2021)
Total Debt / Equity	C4	Min	(Akbulut & Hepşen, 2021); (Ersoy, 2020), (Gök Kısa & Perçin, 2020); (Yıldırım & Kılıç, 2021)
Net Sales / Receivables	C5	Max	(Ersoy, 2020); (Gök Kısa & Perçin, 2020); (Karadeniz & İskenderoğlu, 2022); (Karamahmutoğlu, 2022); (Kehribar, Karademir, & Evci, 2021); (Yıldırım & Kılıç, 2021)
Cost of Goods Sold / Average Inventory	C6	Max	(Ertaş & Yetim, 2022); (Gök Kısa & Perçin, 2020); (Karadeniz & İskenderoğlu, 2022), (Karamahmutoğlu, 2022); (Kehribar, Karademir, & Evci, 2021); (Yıldırım & Kılıç, 2021)
Net Sales / Total Assets	C7	Max	(Ersoy, 2020); (Ertaş & Yetim, 2022), (Karadeniz & İskenderoğlu, 2022); (Karamahmutoğlu, 2022); (Kehribar, Karademir, & Evci, 2021); (Kurt & Kablan, 2022); (Pala, 2021): (Şahin & Sarı, 2019); (Yıldırım & Kılıç, 2021); (Özdemir & Parmaksız, 2022)
Net Profit / Net Sales	C8	Max	(Karadeniz & İskenderoğlu, 2022); (Kurt & Kablan, 2022); (Oral & Şenen, 2023); (Pala, 2021); (Söylemez, 2020): (Şahin & Sarı, 2019); (Yıldırım & Kılıç, 2021)
EBIT / Net Sales	C9	Max	(Karamahmutoğlu, 2022); (Kurt & Kablan, 2022); (Söylemez, 2020)
Net Profit / Equity	C10	Max	(Oral & Şenen, 2023); (Açıkgöz, 2021); (Alnıpak & Kale, 2021); (Baydaş & Eren, 2021); (Karadeniz & İskenderoğlu, 2022); (Kurt & Kablan, 2022); (Söylemez, 2020): (Şahin & Sarı, 2019), (Yıldırım & Kılıç, 2021); (Özdemir & Parmaksız, 2022)

Figure 1 presents the application steps of the Lopcow-based Cobra methods used in the scope of the study in a flowchart. In the first step, financial criteria related to the research problem were determined, and data related to these criteria were collected. In the second step, the weights of the criteria were calculated using the Lopcow method. In the third step, the financial performances of companies operating in the earthquake-affected region were calculated separately for each year using the Cobra method. In the final step, the ranking results obtained were compared with other MCDM (Codas, Edas, Mairca, Marcos) methods to check the validity and reliability of the proposed model.

Figure 1: Flow Chart of the Application Model



3.1. Lopcow Method

The Lopcow (Logarithmic Percentage Change-driven Objective Weighting) method, developed by Ecer and Pamucar (2022), is a relatively new objective criteria weighting method. The Lopcow method provides suitable solutions for both cost and benefit-oriented criteria without any restrictions on the criteria. The most significant difference of the Lopcow method from other objective weighting methods is that it considers the percentage of standard deviations of the mean square values of the series. This eliminates the gap (difference) caused by the size of the series. Another feature of the Lopcow method is that it is not affected by negative values in the data (Ecer et al., 2023). The implementation steps of the method are provided below (Ecer and Pamucar, 2022):

Step 1: To identify and solve the decision problem, the initial decision matrix consisting of "m" alternatives and "n" criteria is organized as shown in Equation 1.

$$IDM = \begin{bmatrix} y_{11} & y_{12} & \cdots & y_{1n} \\ y_{21} & y_{22} & \cdots & y_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ y_{m1} & y_{m2} & \ldots & y_{mn} \end{bmatrix} \quad (1)$$

Step 2: The evaluation criteria in the initial decision matrix are normalized based on whether they are cost or benefit-oriented using linear normalization techniques, respectively through Equations (2) and (3).

$$r_{ij} = \frac{x_{max} - x_{ij}}{x_{max} - x_{min}} \qquad if\ j \in C \tag{2}$$

$$r_{ij} = \frac{x_{ij} - x_{min}}{x_{max} - x_{min}} \qquad if\ j \in B \tag{3}$$

Step 3: In this step, the percentage value (PV) for each evaluation criterion is calculated using Equation 4. To eliminate the gap (difference) caused by the size of the data for each criterion, the percentage of standard deviations of each criterion's mean square value is calculated.

$$PV_{ij} = \left| \ln \left\{ \frac{\sqrt{\frac{\sqrt{\sum_{i=1}^{m} r_{ij}^2}}{m}}}{\sigma} \right\} * 100 \right| \tag{4}$$

Step 4: In the final step, the importance weight for each criterion is calculated using Equation 5.

$$W_j = \frac{PV_{ij}}{\sum_{i=1}^{n} PV_{ij}} \tag{5}$$

3.2. Cobra Method

The Cobra (COmprehensive Distance Based RAnking) method was introduced into the literature by (Krstic et al., 2022). Since the Cobra method is a new method, it has been used in very few studies. (Popoviç et al., 2022); (Krstic et al., 2023). The application steps of the Cobra method are listed below. (Krstic et al., 2022):

Step 1: The decision matrix created by combining the evaluation criteria and decision alternatives is arranged as shown in Equation 1.

Step 2: Each evaluation criterion in the decision matrix is normalized through Equation (6).

$$\alpha_{ij} = \frac{\alpha_{ij}}{max_i a_{ij}} \tag{6}$$

Step 3: Each evaluation criterion in the decision matrix is weighted via Equation (7). The (w_j) value in the formula is the importance weight value for each criterion obtained by the Lopcow method.

$$\Delta_{\boldsymbol{w}} = [\omega_{\boldsymbol{j}} \times \alpha_{ij}]_{n \times m} \tag{7}$$

Step 4: In this step, the values for Positive Ideal Solution (PIS_j), Negative Ideal Solution (NIS_j) and Average Solution (AS_j) for each criterion are calculated through Equation (8-12).

$$PIS_j = max_i\,(\omega_j \times \alpha_{ij}),\ \ \forall_j = 1, \ldots\ldots m \ \ za\ j\ \ni\ J^B \tag{8}$$

$$PIS_j = min_i\,(\omega_j \times \alpha_{ij}),\ \ \forall_j = 1, \ldots\ldots m \ \ za\ j\ \ni\ J^C \tag{9}$$

$$NIS_j = min_i\,(\omega_j \times \alpha_{ij}),\ \ \forall_j = 1, \ldots\ldots m \ \ za\ j\ \ni\ J^B \tag{10}$$

$$NIS_j = max_i\,(\omega_{\boldsymbol{j}} \times \alpha_{ij}),\ \ \forall_j = 1, \ldots\ldots m \ \ za\ j\ \ni\ J^C \tag{11}$$

$$AS_j = \frac{\sum_{i=1}^{n} (\omega_{\boldsymbol{j}} \times \alpha_{ij})}{n}\ \ \forall_j = 1, \ldots\ldots m \ \ za\ j\ \ni\ J^B, J^C \tag{12}$$

"J^c" is the set of cost and "J^b" is the set of benefit criteria**.**

Step 5: In this step of the method, For each alternative define positive ideal solution ($d(PIS_j)$), negative ideal solution ($d(NIS_j)$) besides negative ($d(AS_j)_i^-$) and positive ($d(AS_j)_i^+$) distance from the average solution values are calculated by using Equation (13).

$$d(S_j) = dE(S_j) + \partial \times dE(S_j) \times dT(S_j) \quad \forall_j = 1, \ldots\ldots m, \tag{13}$$

The value (S_j) indicates the values belonging to $(NIS_j, PIS_j, AS_j)'$ and (∂) is calculated through the formula in Equation (14)

$$\partial = max_i\, dE(S_j) - min_i\, dE(S_j), \tag{14}$$

The Euclidean distances is calculated for the positive ideal solution representing the $dE(S_j)$ function using Equation (15)

$$dE(PIS_j)_i = \sqrt{\sum_{j=1}^{m}(PIS_j - \omega_j \times \alpha_{ij})^2} \qquad \forall_i = 1, \ldots\ldots, n, \ \forall_j = 1, \ldots\ldots, m, \tag{15}$$

The Taxicab distances is calculated for the positive ideal solution representing the $dE(S_j)$ function using Equation (16)

$$dT(PIS_j)_i = \sum_{j=1}^{m}|PIS_j - \omega_j \times \alpha_{ij}| \qquad \forall_i = 1, \ldots\ldots, n, \ \forall_j = 1, \ldots\ldots, m, \tag{16}$$

For the negative ideal solution, the Euclidean distances is calculated using Equation (17)

$$dE(NIS_j)_i = \sqrt{\sum_{j=1}^{m}(NIS_j - \omega_j \times \alpha_{ij})^2} \qquad \forall_i = 1, \ldots\ldots, n, \ \forall_j = 1, \ldots\ldots, m, \tag{17}$$

For the negative ideal solution, the Taxicab distance is calculated using Equation (18).

$$dT(NIS_j)_i = \sum_{j=1}^{m}|NIS_j - \omega_j \times \alpha_{ij}| \qquad \forall_i = 1, \ldots\ldots, n, \ \forall_j = 1, \ldots\ldots, m, \tag{18}$$

Euclidian and Taxicab distances are calculated for the positive distance from the average solution using Equation (19-21), respectively.

$$dE(AS_j)_i^+ = \sqrt{\sum_{j=1}^{m}\tau^+(AS_j - \omega_j \times \alpha_{ij})^2} \ \forall_i = 1, \ldots\ldots, n, \ \forall_j = 1, \ldots\ldots, m, \tag{19}$$

$$dT(AS_j)_i^+ = \sum_{j=1}^{m}\tau^+|AS_j - \omega_j \times \alpha_{ij}| \qquad \forall_i = 1, \ldots\ldots, n, \ \forall_j = 1, \ldots\ldots, m, \tag{20}$$

$$\tau^+ = \begin{cases} 1 \ \text{eğer} \ AS_j < \omega_j \times \alpha_{ij} \\ 0 \ \text{eğer} \ AS_j > \omega_j \times \alpha_{ij} \end{cases}, \tag{21}$$

Euclidian and Taxicab distances are calculated for the negative distance from the average solution using Equation (22-24), respectively.

$$dE(AS_j)_i^- = \sqrt{\sum_{j=1}^{m}\tau^-(AS_j - \omega_j \times \alpha_{ij})^2} \ \forall_i = 1, \ldots\ldots, n, \ \forall_j = 1, \ldots\ldots, m, \tag{22}$$

$$dT(AS_j)_i^- = \sum_{j=1}^{m}\tau^-|AS_j - \omega_j \times \alpha_{ij}| \qquad \forall_i = 1, \ldots\ldots, n, \ \forall_j = 1, \ldots\ldots, m, \tag{23}$$

$$\tau^- = \begin{cases} 1 \ \text{eğer} \ AS_j > \omega_j \times \alpha_{ij} \\ 0 \ \text{eğer} \ AS_j < \omega_j \times \alpha_{ij} \end{cases}, \tag{24}$$

Step 6: In the final step of the method, the *(dC_i)* values of the alternatives are calculated using Equation (25), and then the decision alternatives are ranked.

$$dC_i = \frac{d(PIS_j)_i - dE(NIS_j)_i - d(AS_j)_i^+ + dT(AS_j)_i^-}{4} \qquad \forall_i = 1, \ldots\ldots, n, \tag{25}$$

4. Results

In this section, the financial performance of companies located in the earthquake-affected region and whose stocks are traded on Borsa Istanbul (BIST) has been examined before and after the Kahramanmaras-centered earthquakes using the Lopcow-based Cobra method.

To enhance the reliability and validity of the proposed model, the obtained results have been compared with other MCDM methods. In the scope of the research, the financial performance of 8 companies has been examined for the period of 2022Q1-2023Q3.

4.1. Lopcow Result

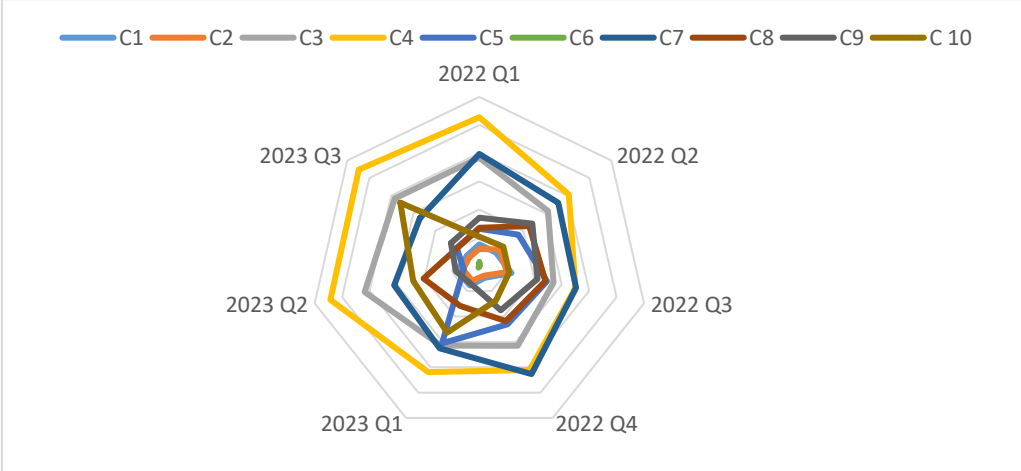
In this section, the weights of the criteria in the decision matrix for the companies in the earthquake-affected region using the Lopcow method have been determined. The decision matrix consists of alternatives created for each criterion. In this study, 8×10 decision matrix has been created for each year for the period of 2022Q1-2023Q3. Table 2 illustrates the weights of the criteria, both within themselves and over time. It is observed that the variable with the lowest weight in the 2022Q1-2023Q3 period is the Cost of Goods Sold / Average Inventory rate (C6). It has been determined that the variable with the highest weight varies according to periods. For example, in the periods 2022Q1-2022Q2 and 2023Q1-2023Q3, the Total Debt / Equity rate (C4) is the variable with the highest weight, while in the period 2022Q3-2022Q4, the Net Sales / Total Assets rate (C7) is the variable with the highest weight.

Table 2: Weight Values of Criteria According to the Lopcow Method

PERIODS	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
2022 Q1	0.0380	0.0302	0.1920	**0.2639**	0.0657	0.0070	0.1987	0.0674	0.0854	0.0517
2022 Q2	0.0378	0.0458	0.1561	**0.2032**	0.0887	0.0011	0.1794	0.1133	0.1202	0.0545
2022 Q3	0.0585	0.0505	0.1352	0.1750	0.1231	0.0011	**0.1762**	0.1203	0.1059	0.0543
2022 Q4	0.0235	0.0193	0.1575	0.2056	0.1154	0.0005	**0.2134**	0.1090	0.0876	0.0682
2023 Q1	0.0387	0.0294	0.1573	**0.2095**	0.1529	0.0036	0.1627	0.0790	0.0353	0.1316
2023 Q2	0.0402	0.0298	0.2090	**0.2714**	0.0285	0.0008	0.1552	0.1016	0.0428	0.1206
2023 Q3	0.0285	0.0233	0.1920	**0.2738**	0.0515	0.0012	0.1354	0.0503	0.0644	0.1796

The change graph of the financial criteria used in the research for quarterly periods is shown in Figure 2.

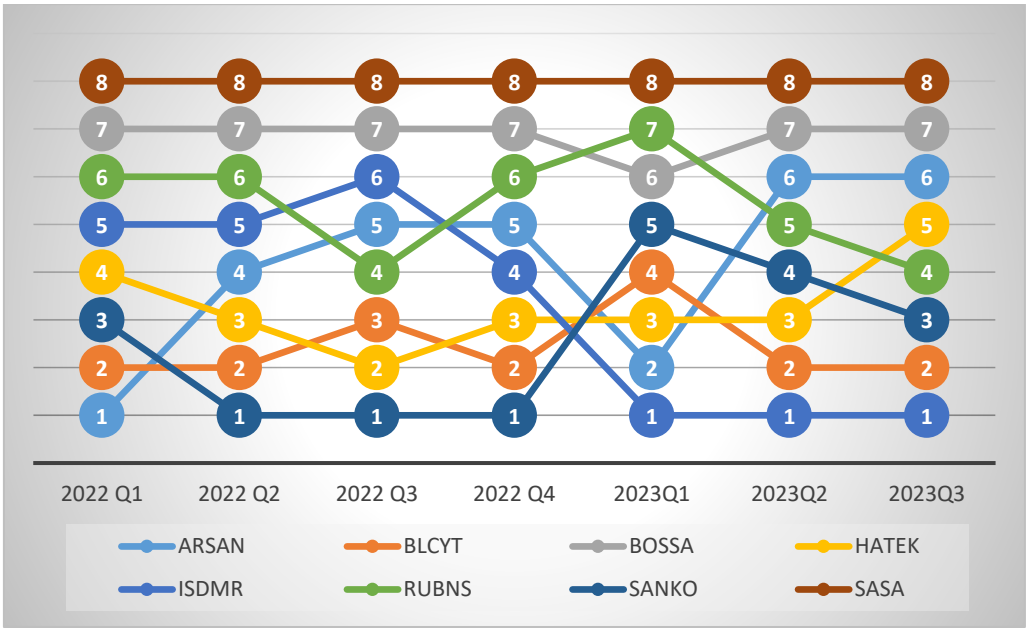
Figure 2: Quarterly Changes in Financial Criteria



4.2. Cobra Result

After determining the weight values of criteria for companies operating in the earthquake-affected region using the Lopcow method, their financial performances were examined using the Cobra method. The performance ranking of these companies according to the Cobra method for the period of 2022Q1-2023Q3 is presented in Figure 3.

Figure 3: Ranking Results of Companies in the Earthquake-Affected Region According to the Cobra Method.



According to the results of the Cobra method, it has been observed that in the 2022Q1 period, ARSAN, in the 2022Q2-2022Q4 period, SANKO, and in the 2023Q1-2023Q3 period, ISDMR have the best financial performance relative to others. It has been determined that SASA is the company with the worst relative performance in all periods.

The results of the recommended Lopcow based Cobra model, comprehensively reveal the performance ranking of the included companies for the period from 2022Q1 to 2023Q3. Additionally, a significant portion of these companies shows a change in financial performance before and after earthquakes centered in Kahramanmaras. For instance, the ISDMR was ranked fourth in the pre-earthquake period (2022Q4), but it rose to the first position in the post-earthquake period (2023Q1-2023Q3). This can be attributed to an increase in demand for iron used in the construction sector following the earthquakes. ARSAN, on the other hand, was ranked fifth in the pre-earthquake period (2022Q4), but it rose to the second position in the post-earthquake period (2023Q1), and then declined to the sixth position (2023Q2-2023Q3). While the financial performance of ARSAN was relatively more successful in the immediate post-earthquake period, but it could not sustain this success in the subsequent periods.

According to the ranking results of the Cobra method, BLCYT, SANKO, and RUBNS were observed to be in the upper ranks in terms of financial performance in the pre-earthquake

period (2022Q4), but they fell to lower ranks in the immediate post-earthquake period (2023Q1). However, in the subsequent periods (2023Q2-2023Q3), they were seen to rise again to the upper ranks. While these companies exhibited relatively poorer financial performance in the immediate post-earthquake period, they showed better performance in the later periods.

4.3. Validation

In this section, the results of the model applied to verify the validity and reliability of the ranking results obtained with the Cobra method have been compared with other multi-criteria decision-making methods. In this context, Codas, Edas, Mairca, and Marcos methods have been employed. The ranking results the companies for the 2023 Q3 period according to all multi-criteria decision-making methods are presented in Table 3.

Table 3: Ranking Results According to All MCDM Methods

Companies	Cobra	Codas	Edas	Mairca	Marcos
ARSAN	6	6	3	5	4
BLCYT	2	2	**1**	2	**1**
BOSSA	7	5	6	7	6
HATEK	5	7	7	4	7
ISDMR	**1**	**1**	5	**1**	2
RUBNS	4	4	4	6	3
SANKO	3	3	4	3	5
SASA	8	8	8	8	8

According to Table 4, it has been determined that BLCYT and ISDMR have the best financial performance in the 2023 Q3 period according to five different MCDM methods. Although there are some differences, generally, similar ranking results were observed across the five different methods. In this context, the obtained ranking results support the validity and reliability of the proposed model.

Spearman correlation was conducted to reveal the direction and strength of the relationship between the proposed model and other MCDM methods. The Spearman correlation results for the five different MCDM methods are shown in Table 4.

Table 4: Spearman Correlation Results for All MCDM Methods

	Cobra	Codas	Edas	Mairca	Marcos
Cobra	1				
Codas	0.9047	1			
Edas	0.6156	0.6574	1		
Mairca	0.9285	0.7857	0.5523	1	
Marcos	0.8095	0.8571	0.8546	0.6904	1

According to the correlation results in Table 5, there is a positive relationship among the five different MCDM methods. This indicates a supportive nature for the validity and reliability of the results obtained with the Lopcow-based Cobra method.

5. Conclusion

In this study, we investigated the impact of the significant destruction caused by the earthquakes in Kahramanmaras on the financial performance of companies operating in the earthquake area, on the date of February 6, 2023. Simultaneously, we compared the financial performance of these companies (ARSAN, BLCYT, BOSSA, HATEK, ISDMR, RUBNS, SANKO, SASA) before and after the earthquakes. In this context, we examined the financial performance of 8 companies listed on the BIST and operating in the earthquake area for the period from 2022Q1 to 2023Q3 using the Lopcow-based Cobra method.

In the first step of the analysis, financial data for companies in the earthquake area were weighted using the Lopcow method. According to the results of the Lopcow method, the Total Debt / Equity rate was found to be the variable with the highest weight in the periods 2022Q1-2022Q2 and 2023Q1-2023Q3, while the Net Sales / Total Assets rate had the highest weight in the period 2022Q3-2022Q4. In this regard, it was observed that these companies were more sensitive to the amount of borrowing both before and after the earthquakes. In the second step of the analysis, the financial performance ranking of companies in the earthquake area was conducted through the Cobra method. According to the results of the Cobra method, it was observed that the ARSAN had the best relative financial performance in the 2022Q1 period, SANKO in the periods 2022Q2-2022Q4, and ISDMR in the periods 2023Q1-2023Q3.

According to the ranking results of the Cobra method, it has been observed that ISDMR, operating in the metal industry sector, has a better financial performance after the earthquakes compared to the period before the earthquakes. Among the possible reasons for this situation, an increase in demand for iron in the construction sector in the post-earthquake period can be highlighted.

According to the results of the Lopcow-based Cobra method, it is observed that BLCYT, RUBNS, and SANKO showed relatively better performance in the pre-earthquake period, while they exhibited worse performance in the immediate post-earthquake period. However, improvements in the financial performance of these companies were observed in the subsequent periods. Among the possible reasons for this situation, a decrease in total revenues and a disruption in liquidity structures of these companies in the immediate post-earthquake period can be highlighted.

According to the findings obtained from the analysis, ARSAN exhibited relatively poor performance in the pre-earthquake period, while it showed better performance in the immediate post-earthquake period. However, in the subsequent periods, a decline in the financial performance of the ARSAN was observed. This situation can be explained by the strong liquidity structure of the company in the immediate post-earthquake period.

This study, utilizing the Lopcow and Cobra methods, is believed to contribute to the growing literature on how the earthquakes in Kahramanmaras (2023) affected the financial performance of companies in the region. Additionally, it provides information about the financial performance of these companies' post-earthquake period. However, there are some limitations to our study. These limitations include the exclusive examination of performance from a financial perspective, the potential for changes in performance rankings based on the included criteria, the inclusion of only those companies for which financial data is available, and the relative measurement of performance by MCDM methods. In the future, studies could be conducted that include many companies in the earthquake area and examine performance from various perspectives.

References

Açıkgöz, T. (2021), "Investigation of cash flow profiles of manufacturing sector and comparison of financial performances with TOPSIS method", *The Journal of Accounting and Finance,* Vol.15, No. 90: 127-148.

AFAD. (2023). *06 Şubat 2023 Pazarcık-Elbistan Kahramanmaras (Mw: 7.7- 7.6) Earthquakes Report.* Ankara: AFAD.

Akbulut, O. Y., & Hepşen, A. (2021), "Analysis of the relationship between financial performance and stock return with entropy and CoCoSo MCDM techniques", *Journal of Research in Economics, Politics & Finance,* Vol.6*,* No. 3: 681-709.

Alnıpak, S., & Kale, S. (2021), "The effects of the Covid-19 pandemic on the financial performance of the transport sector", *Journal of Economic Policy and Finance Research,* Vol.6, No. Special Issue: 139-156.

Atabay, E., & Kamilçelebi Öztürk, A. (2023), "The effect of earthquakes on the financial situation of companies: 2023 earthquake based on the 1999 and 2011 Earthquakes", (Ed. S. Sarıbaş, & T. Akkuş), *Innovative Studies in Social, Human and Administrative Sciences*, İzmir: Duvar Publications: 1208-1243.

Baydaş, M., & Eren, T. (2021), "A different approach to the selection of MCDM method for financial performance measurement: an application in Borsa Istanbul", *Eskisehir Osmangazi University Journal of Economics and Administrative Sciences,* Vol.16, No. 3: 687.

Ecer, F., & Pamucar, D. (2022), "A novel LOPCOW-DOBI multi-criteria sustainability performance assessment methodology: An application in developing country banking sector", *Omega,* Vol. 112, 1-17.

Ecer, F., Küçükönder, H., Kayapınar Kaya, S., & Görçün, Ö. F. (2023), "Sustainability performance analysis of micro-mobility solutions in urban transportation with a novel IVFNN-Delphi-LOPCOW-CoCoSo framework", *Transportation Research Part A,* Vol. 172, 1-20.

Ersoy, N. (2020), "Evaluation of financial performance with grey relational analysis method: a research study on companies in Borsa Istanbul transportation index", *The Journal of Accounting and Finance,* Vol. 86, *No.*2: 223-246.

Ertaş, F. C., & Yetim, A. (2022), "Investigation of financial performance of businesses in the food and beverage sector in the Covid-19 pandemic with TOPSIS method: BIST Example", *The Journal of Accounting and Finance,* Vol. 16, No. 93: 53-74.

Gök Kısa, A., & Perçin, S. (2020), "Performance evaluation of Turkish manufacturing industry with fuzzy multicriteria decision making approach", *International Journal of Economic and Administrative Studies*, Special ıssue: 31-56.

Göktaş, L. S. (2023), "The impact of earthquakes centered in Kahramanmaras on the tourism industry and suggestions for steps to be taken after the earthquake", *Journal of Gastronomy, Hospitality and Travel,* Vol. 6, No. 2: 624-635.

Gürsoy, S., Zeren, F., Kevser, M., Akyol, G., & Tunçel, M. B. (2023), "The impact of 2023 Turkey earthquake on İstanbul Stock Market: evidence from Fourier volatility spillover test", *Social Sciences Research Journal,* Vol. 12, No. 1: 98-105.

Hamurcu, Ç. (2022), "Could earthquakes have an effect on insurance sector stocks? a study on the Izmir earthquake in 2020", *İzmir Journal of Economics,* Vol. 37, No. 2: 428-442.

hmb.gov.tr, w. (2023, 3 10). *T.C. Hazine ve Maliye Bakanlığı Web Sitesi*. T.C. Hazine ve Maliye Bakanlığı Web Sitesi: https://ms.hmb.gov.tr/uploads/2023/03/Asrin-Felaketi-Sonrasi-Hazine-ve-Maliye-Bakanligi-Olarak-Atilan-Adimlar. Retrieved from pdf

Joseph, I.-L. (2022), "The effect of natural disaster on economic growth: Evidence from a major earthquake in Haiti", *World Development,* Vol. *159, No.* 1: 1-20.

Kanat, E., & Tetik, N. (2023), "Effects of 6 February 2023 Kahramanmaras centered earthquakes on BIST (Borsa Istanbul)", *Academic Recommendations for the Aftermath of Kahramanmaras Centered Earthquakes,* (Ed. M. Öztürk, & M. Kırca), Gaziantep: Özgür Publications: 113-122.

Karadeniz, E., & İskenderoğlu, Ö. (2022), "Financial performance of football clubs and the impact of the covid-19 epidemic: comparison of the five national league of union of European football associations", *Business and Economics Research Journal,* Vol. 13, No. 2: 299-317.

Karamahmutoğlu, M. (2022), "The impact of covid-19 on the financial performance of transportation and tourism companies: an application in Borsa Istanbul (BIST)", *Accounting and Auditing Review,* Vol.21, No. 65: 65-88.

Kehribar, Ö., Karademir, F., & Evci, S. (2021), "Evaluation of the financial performance of businesses during the Covıd-19 pandemic process with entropy and MAIRCA methods: BIST food, beverage index example", *Business & Management Studies: An International Journal,* Vol. 9*, No.* 1: 200-214.

Kırkağaç, M., & Karpuz, E. (2023), "An event study analysis on the effect of 2023 Kahramanmaras earthquakes on BIST bank and insurance markets", Kırıkkale University Journal of Social Sciences*,* Vol. 13, No. 2: 390-402.

Köse, A., & Akıllı, K. (2021), "Financial performance of brokerage firm evaluation with VIKOR method", *Cumhuriyet University Journal of Economics and Administrative Sciences,* Vol. 22, No. 2: 168-192.

Krstic, M., Agnusdei, G. P., Miglietta, P. P., Tadic, S., & Roso, V. (2022), "Applicability of Industry 4.0 technologies in the reverse logistics: a circular economy approach based on comprehensive distance-based ranking (COBRA) method", *Sustainability,* Vol.14, 1-30.

Krstic, M., Elia, V., Agnusdei, G. P., De Leo, F., Tadic, S., & Miglietta, P. P. (2023), "Evaluation of the agri-food supply chain risks: the circular economy context", *British Food Journal,* Vol. 125*, No.* 4: 1-21.

Kurt, G., & Kablan, A. (2022), "Analyzing the effects of COVID-19 on the financial performance of the airlines trading in BIST transportation index with multiple-criteria-decision-making methods", *Journal of Business Academy,* Vol. 3, No. 1: 16-33.

Oral, C., & Şenen, M. (2023), "Evaluation of financial performance using the gray relational analysis method: an application on technology companies Traded in BIST", *Journal Of companBusiness Research-Turk,* Vol. 15, No. 2: 894-906.

Özdemir, O., & Parmaksız, S. (2022), "Comparison of financial performance of BIST energy enterprises with multi-criteria decision-making techniques: analysis with TOPSIS and EDAS methods", *Başkent University Journal of Commercial Sciences,* Vol. 6, No. 1: 34-56.

Pala, O. (2021), "Financial performance analysis of BIST transportation companies based on IDOCRIW and MARCOS", *Kafkas University Economics and Administrative Sciences Faculty,* Vol. 12, No. 3: 263-294.

Popoviç, G., Pucar, D., & Smarandache, F. (2022), "MEREC-COBRA approach in E-commerce Development strategy selection", *Journal of Process Management and New Technologies,* Vol. 10, No. 3-4: 66-74.

Reliefweb Situation Report. (2023, 3 10). *Türkiye Earthquake March 2023, Bi-weekly Highlights - 10/03/2023.* Reliefweb: https://reliefweb.int/report/turkiye/turkiye-earthquake-march-2023-bi-weekly-highlights-10032023 retrieved from

Satır, H., Kısakürek, M. M., & Yaşar, F. (2020), "Evaluation of the relationship between liquidity and financial performance by TOPSIS analysis method: an application in BIST retail trade sector", *Journal of Kahramanmaras Sütçü İmam University Faculty of Economics and Administrative Sciences,* Vol. 10, *No.* 1: 1-15.

Say, S., & Doğan, M. (2023), "The Effect of Earthquakes on Stock Returns: The Example of the 2023 Kahramanmaras Earthquake", *Social Sciences Research Journal,* Vol. 12, No*.* 1, 90-97.

Söylemez, Y. (2020), "Comparison of Topsis and gray relative analysis methods in financial performance evaluation", *Journal of Management and Economics Research, Vol. 18, No.*3: 61-79.

Şahin, A., & Sarı, E. B. (2019), "Comparison of financial and stock exchange performance of BIST-manufacturing companies with entropi based TOPSIS and VIKOR methods", *Journal of Accounting and Taxation Studies, Vol. 12, No.*2: 255-270.

Şen, S. (2023), "The effect of Kahramanmaras earthquakes on the economy", *The Journal of Diplomacy and Strategy, Vol. 4*(, No: 1: 1-55.

Tetik, N., & Albulut, İ. İ. (2023), "Economic and financial effects of the earthquake on February 6, 2023: a review on exports", (ed. M. Öztürk, & M. Kırca), *Academic Recommendations for the Aftermath of Kahramanmaras Centered Earthquakes,* Gaziantep: Özgür Publications: 93-103.

Tetik, N., & Öner, A. (2023), "Possible economic and financial effects of the 6 February 2023: Kahramanmaras centered earthquake on SMEs in the region", (ed. M. Öztürk, and M. Kırca), *Academic Recommendations for the Aftermath of Kahramanmaras Centered Earthquakes,* Gaziantep: Özgür Publications: 83-93.

Yıldırım, H., & Alola, A. A. (2020), "Do Earthquakes Affect Stock Market Index. *International Journal of Society Researches",* Vol. 15, No. 10: 4770-4780.

Yıldırım, H., & Kılıç, M. (2021), "Effect of covıd-19 on financial statements of transport sectors operating in BIST" *International Journal of Strategic Dimensions,* Vol. 1, No. 1: 58-70.