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ORIGINAL ARTICLE

A HYBRID MCDM FRAMEWORK FOR EVALUATING CORPORATE FINANCIAL PERFORMANCE

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Abstract

In today's competitive market conditions, companies need to increase their financial performance and implement effective performance measurement strategies, while improving their business processes. This paper introduces a methodology based on a hybrid multi-criteria decision-making (MCDM) approach, which is designed to assist companies in evaluating the extent to which they have attained their financial performance targets. The propounded decision-making framework employs the Grey entropy technique to ascertain the relative importance of the predetermined criteria, and subsequently, the Grey relational analysis model is utilized to priorities the decision alternatives. The present article employs a case study approach to evaluate the financial performance of a reinsurance company. Our aim is to assist decision-makers in making integrated decisions regarding financial performance and improving sustainability. Grey entropy's findings show that return on average equity, combined ratio vs return on average assets are the three most important indicators affecting corporate financial performance. According to the Grey relationship analysis results, the best and worst performance years in terms of financial performance were determined as 2020 and 2022, respectively.

Keywords

Reinsurance industry, financial performance, Grey entropy, Grey relational analysis..

JEL Classification

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1. INTRODUCTION

The insurance industry includes life insurance, non-life insurance, and reinsurance. It helps individuals and businesses manage financial uncertainties by transferring risks, such as loss from accidents, natural disasters, illness, or death, to an insurer in exchange for a premium (Gharizadeh Beiragh et al., 2020). This support enables policyholders to recover quickly from adverse events, protecting their financial stability.

Life insurance companies offer policyholders a financial safeguard against the potential risks of premature death, disability, or retirement income insecurity. This financial protection serves to support individuals and families, helping them to maintain economic stability. Life insurance products often include a savings or investment component (Çamlıbel, 2022). This allows policyholders to accrue wealth over time, thereby encouraging them to make long-term savings (Gohar, 2024). These savings can then be invested by insurers in capital markets, thus contributing to economic growth. Life insurance companies collect premium payments and invest them in long-term assets, including government bonds, real estate, and infrastructure (Erdebilli et al., 2023). These investments serve to enhance the availability of capital within the economy, thereby promoting infrastructure development and financial market stability. A significant number of life insurance providers offer pension products that assist individuals in accumulating savings for retirement. These products provide a regular income in later life and contribute to economic stability by reducing the burden on public pension schemes.

Non-life insurers facilitate the transfer of risk for both individuals and businesses, providing coverage for a number of eventualities, including, for example, accidents, natural disasters, damage to property and liability. In doing so, they act as a financial safety net, encouraging economic activity by mitigating financial uncertainties (Akyüz et al., 2020; Işık et al., 2024). It is vital for businesses to have non-life insurance to ensure the continuity of their operations (Bilbao-Terol et al., 2022). This type of insurance provides protection against a variety of risks, including operational risks, natural disasters, and liability issues (Zhang et al., 2023). By mitigating these risks, businesses can take anticipated and calculated risks, which can support business expansion and innovation.

Reinsurance enables insurance companies to manage large or volatile risks (like natural disasters), which could otherwise overwhelm their financial capacity. Reinsurance mitigates the impact of catastrophic losses on insurance companies, stabilizing premiums and reducing volatility. Reinsurers operate globally, spreading risks across countries and regions. This diversification limits the economic impact of large losses within any single economy, thereby enhancing global financial stability. All in all, reinsurance companies serve as the backbone of the insurance industry, ensuring that primary insurers remain stable, solvent, and capable of meeting their obligations. Their role in risk management, capital optimization, and global diversification not only stabilizes the insurance sector but also supports the broader economy, encouraging sustainable growth and resilience against unexpected events.

It is of paramount importance to analyze the financial performance of reinsurance companies to guarantee the continued strength and stability of the reinsurance sector. Also, analyzing the financial performance of reinsurance companies enables informed decision-making, helps protect policyholders, supports economic resilience, and ensures that the reinsurance industry can fulfill its essential role in stabilizing both insurance markets and the broader financial system.

Reinsurance companies operate in a highly complex environment with multiple financial metrics that must be considered simultaneously, including profitability, risk management, capital adequacy, liquidity, and underwriting performance. MCDM methods allow for the simultaneous assessment of these diverse factors, providing a holistic view of a company's financial health. For this reason, this study employs a hybrid MCDM methodology, combining Grey entropy and Grey relational analysis approaches, for the measurement and evaluation of corporate financial performance. The model is illustrated through a case study of a reinsurance company.

The following is a summary of the key contributions of the recommended tool:

I. The present work offers a methodological framework for the evaluation of financial performance, which is of particular relevance to those engaged in decision-making processes within the reinsurance industry.

II. The GRA approach, utilizing Grey entropy objective weights, has been employed for the first time in the field of multiple criteria decision-making for the assessment of financial performance.

III. In order to demonstrate the effectiveness of the introduced decision framework, we perform a real case study to assess the corporate financial performance of a reinsurance companies in the Turkish insurance industry.

IV. In order to assess the validity of the presented approach, a detailed sensitivity and benchmarking study was conducted.

2. LITERATURE REVIEW

Many studies have been conducted in the insurance sector using various decision-making algorithms. A detailed summary of some of these recent studies is given in Table 1.

Table 1
MCDM studies in the field of insurance

Studies	Weighting Method	Ranking Metod	Aim	Insurers	Number of criteria
Işık et al. (2024)	Pythagorean fuzzy AHP	MAIRCA	Multidimensional performance evaluation	Publicly quoted insurers in Turkey	14
Gohar (2024)	Subjective approach that takes into account expert opinion	TOPSIS	Performance comparison	Pakistani insurance companies	6
Sunitha (2024)	Equal weights	COPRAS	Financial performance assessment	Indian insurance companies	5
Khabbazi and Fashkace (2024)	AHP	TOPSIS, VIKO, MABAC, ARAS, EDAS, MAIRCA, MARCOS, OCRA, and WASPAS	Performance analysis	Different types of insurance companies in North America, Europe, Asia	5
Erdebilli et al. (2023)	Q-rung orthopair fuzzy based method	TOPSIS and VIKOR	Choosing sustainable private health insurance policies	Turkish life insurers	10
Puška et al. (2023)	LMAW	CRADIS	Selection of insurers	Serbian insurers	9
Zhang et al. (2023)	Subjective method based on single-values neutrosophic numbers	TODIM	Evaluation of insurers based on Balanced Scorecard (BSC)	Iranian insurers	26
Işık et al. (2023)	LOPCOW and SWARA II	MARCOS	Financial performance analysis	Turkish non-life insurers	8
Çamlıbel (2022)	Standard Deviation	MARCOS	Performance comparison	Turkish life and pension firms	10
Bilbao-Terol et al. (2022)	Fuzzy BWM	MRP	Performance assessment	Spanish non-life insurance companies	7
Rahmati and Darestani (2022)	BWM	TOPSIS	Performance evaluation based on BSC	Insurance companies in Iran	9
Işık (2021)	AHP and CRITIC	WEDBA	Financial performance evaluation	Axa insurance company	9
Akyüz et al. (2020)	BWM	TOPSIS	Performance measurement	Turkish non-life insurers	5
Gharizadeh Beiragh et al. (2020)	BWM	TOPSIS	Performance evaluation	Health and non-health insurance firms in Iran	13

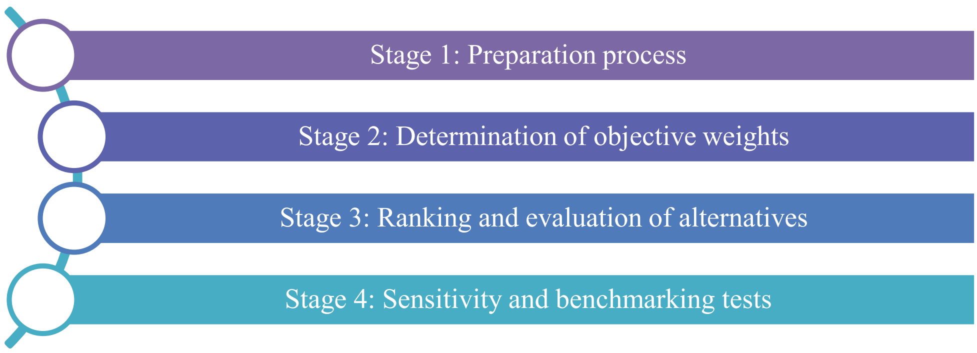
As can be seen from Table 1, a hybrid model based on Grey entropy and Grey relational analysis algorithms has not been used before in the insurance sector. Also, the case study addressed in the present manuscript does not exist to the best of our knowledge. Therefore, 'the developed decision-making framework in this work offers a reliable, robust and reasonable decision tool for decision makers in the insurance industry.

3. MULTI-CRITERIA METHODOLOGY

This section presents a multi-criteria framework for corporate financial performance analysis based on the application of two MCDM techniques: (i) Grey entropy method for objective weightings of criteria and (II) Grey relationship analysis for assessment of decision alternatives. The methodological framework followed for corporate financial performance analysis is illustrated in Figure 1 below.

Figure 1

Methodological framework



3.1 Data

The reinsurance sector is essential to the insurance industry and economic sustainability as it improves risk management, stabilizes insurance costs, supports insurance sector resilience, supports regulatory compliance and contributes to long-term sustainable growth. By supporting the financial stability of insurers and the wider economy, reinsurance helps to build a resilient and inclusive economic base that benefits society as a whole. In this section, financial performance of a firm operating in reassurance sector in Turkey has been gauged. This company is also the leading company in the Turkish reinsurance sector. The five years (2019–2023) considered as alternatives to compare this company's financial performance are shown in Table 2. Additionally, the evaluation criteria used in measuring financial performance are provided in Table 3.

Table 2

Decision Alternatives

Alternatives	Code
2023	A1
2022	A2
2021	A3
2020	A4
2019	A5

Table 3

Financial Performance Criteria

Rank	Evaluation Criteria	Aim	Code
1	Gross Premiums/Equity	Cost	C1
2	Equity/Total Assets	Benefit	C2
3	Liquidity Ratio	Benefit	C3
4	Current Ratio	Benefit	C4
5	Retention Ratio	Cost	C5
6	Combined Ratio	Cost	C6
7	ROAA	Benefit	C7
8	ROAE	Benefit	C8

3.2. Grey Entropy (GE) Algorithm

The entropy approach, which is employed to compute the weight values based on the comparison of the entropy value of each criterion, is an objective weight determination method based on the GST developed by Deng (1982). GE, an objective weighting method, has been successfully applied to analyze the influence of Internet marketing on the operational performance of hotels (Shuai and Wu, 2011), evaluate the efficiency of hotels (Wu, 2012), assess the air quality trend (You et al., 2017), optimize the design of automotive S-rail (Cai et al., 2017), compare the performance of logistics firms (Işık, 2022), to evaluate banking performance (Akbulut, 2020), and to assess the service capability for the third-party logistics suppliers (Li et al., 2022). Considering the MCDM literature, however, it is noteworthy that the number of studies using the GE procedure is relatively few compared to other objective weighting procedures. The implementation steps for this technique are as follows (Wang et al., 2007; Wen et al., 1998):

Step 1. A decision matrix (*X*) consisting of *m* alternative and n criteria is formed as in Eq. (1).

$$X = [x_{ij}]_{mxn} = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ \cdots & \cdots & \ddots & \cdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \tag{1}$$

where x_{ij}: $i.$ refers to the value of the alternative according to criteria *j*. ($i = 1,2,...,m$ and $j = 1,2,...,n$).

Step 2. Each value of the decision matrix is normalized with the help of Eq. (2) to obtain the normalized decision matrix (Z).

$$z_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} \tag{2}$$

Step 3. Identifying the grey Entropy values for each criterion by applying Eq. (3).

$$e_j = K \sum_{i=1}^{m} W_e(z_{ij}) \tag{3}$$

where

$$W_e(z_{ij}) = z_{ij} e^{(1-z_{ij})} + (1 - z_{ij}) e^{z_{ij}} - 1 \tag{4}$$

$$K = \frac{1}{(\sqrt{e} - 1)n} \tag{5}$$

where K denotes the normalization value

Step 4. The total entropy value (E) is obtained with the help of Eq. (6).

$$E = \sum_{j=1}^{n} e_j \tag{6}$$

Step 5. The relative weightings are calculated through Eq. (7).

$$\lambda_j = \frac{1 - e_j}{n - E} \tag{7}$$

Step 6. The normalized weights are obtained using Eq. (8).

$$\beta_j = \frac{\lambda_j}{\sum_{j=1}^{n} \lambda_j} \tag{8}$$

3.3. Grey Relational Analysis (GRA) Algorithm

The traditional GRA has been widely utilized in many fields such as selecting stock (Hamzaçebi and Pekkaya, 2011), ranking the teaching performance of business schools (Murat Ar et al., 2013), assessment of the sustainable development capacity of cities (Li and Zhang, 2014), personnel selection (Kundakçı, 2016), evaluation of macroeconomic indicators (Duran et al., 2017), analysis of human development and global competitiveness (Eren and Kaynak, 2017), sustainable supplier selection (Diba and Xie, 2019), assessment of patient attitudes related to medical service (Zhang et al., 2019), evaluation of green growth dynamics (Koçak, 2020), city selection (Kose et al., 2020), measurement of city sustainability (Yi et al., 2021), industrial sustainability performance assessment (Candan and Cengiz Toklu, 2022), performance assessment in education (Peng et al., 2023). The steps to be followed for GRA approach are as follows (Wu, 2002; Candan and Cengiz Toklu, 2022):

Step 1. Forming initial decision matrix. Initial decision matrix presented in Eq. (1).
Step 2. Determining the reference series.
The reference series X is obtained by employing Eq. (9).

$$X_0 = (x_0(j)), j = 1,2, \dots, n \tag{9}$$

where $x_0(j)$ indicates the optimal value of criterion j. The best values determined for each criterion in the initial decision matrix form the values in the reference series.

Step 3. Normalizing initial decision matrix.
The normalization procedure differs depending on the cost, benefit, or optimum feature of the objective function of the problem handled. For beneficial criteria, normalization is performed with the help of Eq. (10).

$$x_i^* = \frac{x_i(j) - \min_j x_i(j)}{\max_j x_i(j) - \min_j x_i(j)} \tag{10}$$

For cost criteria, normalization is carried out via Eq. (11).

$$x_i^* = \frac{\max_j x_i(j) - x_i(j)}{\max_j x_i(j) - \min_j x_i(j)} \tag{11}$$

When the optimal values are determined by the decision maker, normalization is performed through Eq. (12).

$$x_i^* = \frac{|x_i(j) - x_{ob}(j)|}{\max_j x_i(j) - x_{ob}(j)} \tag{12}$$

In Eq. (12), x_{ob} (j) denotes the optimal value.

Step 4. Calculating the absolute value matrix.
The absolute value of the difference between x_o and x_j^* is shown as $\Delta_{oi}(j)$ and identified as in Eq. (13).

$$\Delta_{0i}(j) = |x_0(j) - x_i^*(j)|, i = 1, \ldots, m;\ j = 1, \ldots, n \tag{13}$$

Step 5. Determining the grey relational coefficient matrix.
Grey relationship coefficient matrix is computed through Eq. (14).

$$\gamma_{0i}(j) = \frac{\Delta_{min} + \psi\Delta_{max}}{\Delta_{0i}(j) + \psi\Delta_{max}} \tag{14}$$

where $\Delta_{max} = \max_i \max_j \Delta_{0i}(j)$ and $\Delta_{min} = \min_i \min_j \Delta_{0i}(j)$.

In Eq. (14), ψ parameter stands for the separator coefficient and represents the significance of Δ_{max}, where ψ takes values between [0,1]. It is commonly employed as 0.5 in MCDM literature.

Step 6. Calculating grey relational degrees.
The grey relationship degree is the weighted sum of the grey relationship coefficients given by Eq. (15).

$$\Gamma_{0i} = \sum_{j=1}^{n} [w(j) * \gamma_{0i}(j)] \tag{15}$$

where $w(j)$ is the importance weight of the criteria j.
Next, decision options are ranked by considering the grey relationship degrees of the alternatives. As a result, it is decided that the alternative with the highest relationship degree is the best option.

4. COMPUTATIONAL ANALYSES AND RESULTS

This section presents the findings of the Grey Entropy (GE) algorithm, followed by the outcomes of the Grey Relational Analysis (GRA) algorithm.

4.1. Results Regarding Gray Entropy Approach

The decision matrix formed for the implementation of GE is given in Table 4. Each evaluation criterion in the decision matrix is normalized using Eq. (2) (Table 5). Then, W_e (z_{ij}) values (Table 6) and the normalization value (K) in Eq. (3) are computed with the help of Eqs. (4) and (5) to obtain the grey entropy values (e_j). Total entropy value (E), the relative weightings (λ_j), and the normalized weight values (β_j) is computed through Eqs. (6), (7), and (8). Finally, the findings regarding the relevant calculations are presented in Table 7. Given Table 7, it is concluded that the importance weights of the criteria are quite similar to each other. Further, the Grey entropy's findings show that return on average equity (C8), combined ratio (C6) vs return on average assets (C7) are the three most important indicators affecting corporate financial performance.

Table 4

Decision Matrix

	Min	Max	Max	Max	Min	Min	Max	Max
	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
2023	131	33	90	87	79	296	16	68
2022	119	32	131	101	85	135	7	27
2021	88	39	157	119	87	120	9	29
2020	76	43	161	124	87	103	7	18
2019	86	43	159	121	88	108	8	21

Table 5

Normalized Decision Matrix

	C1	C2	C3	C4	C5	C6	C7	C8
2023	0.2620	0.1737	0.1289	0.1576	0.1854	0.3885	0.3404	0.4172
2022	0.2380	0.1684	0.1877	0.1830	0.1995	0.1772	0.1489	0.1656
2021	0.1760	0.2053	0.2249	0.2156	0.2042	0.1575	0.1915	0.1779
2020	0.1520	0.2263	0.2307	0.2246	0.2042	0.1352	0.1489	0.1104
2019	0.1720	0.2263	0.2278	0.2192	0.2066	0.1417	0.1702	0.1288

Table 6

Findings Regarding W_e (Z_{ij}) Values

	C1	C2	C3	C4	C5	C6	C7	C8
2023	0.5071	0.3799	0.2990	0.3521	0.3993	0.6179	0.5854	0.6317
2022	0.4767	0.3710	0.4029	0.3953	0.4215	0.3857	0.3366	0.3662
2021	0.3838	0.4302	0.4588	0.4455	0.4287	0.3519	0.4090	0.3870
2020	0.3421	0.4608	0.4668	0.4584	0.4287	0.3110	0.3366	0.2622
2019	0.3771	0.4608	0.4628	0.4507	0.4322	0.3233	0.3740	0.2988

Table 7

Calculation of e_j, λ_j ve β_j Values

	C1	C2	C3	C4	C5	C6	C7	C8
e_j	0.4021	0.4052	0.4028	0.4050	0.4066	0.3834	0.3934	0.3750
$1-e_j$	0.5979	0.5948	0.5972	0.5950	0.5934	0.6166	0.6066	0.6250
λ_j	0.1239	0.1232	0.1237	0.1233	0.1229	0.1278	0.1257	0.1295
β_j	0.1239	0.1232	0.1237	0.1233	0.1229	0.1278	0.1257	0.1295

4.2. Results Regarding Grey Relational Analysis Approach

Following the construction of the initial decision matrix shown in Table 4, the reference series is computed by employing Eq. (9). The initial decision matrix with the reference series is presented in Table 8. Next, the normalized decision matrix is calculated by Eqs. (10) - (12) and given in Table 9.

Table 8

Decision Matrix Created with Reference Series

	C1	C2	C3	C4	C5	C6	C7	C8
Referans	76	43	161	124	79	103	16	68
2023	131	33	90	87	79	296	16	68
2022	119	32	131	101	85	135	7	27
2021	88	39	157	119	87	120	9	29
2020	76	43	161	124	87	103	7	18
2019	86	43	159	121	88	108	8	21

Table 9

Normalized Decision Matrix

	C1	C2	C3	C4	C5	C6	C7	C8
Referans	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2023	0.0000	0.0909	0.0000	0.0000	1.0000	0.0000	1.0000	1.0000
2022	0.2182	0.0000	0.5775	0.3784	0.3333	0.8342	0.0000	0.1800
2021	0.7818	0.6364	0.9437	0.8649	0.1111	0.9119	0.2222	0.2200
2020	1.0000	1.0000	1.0000	1.0000	0.1111	1.0000	0.0000	0.0000
2019	0.8182	1.0000	0.9718	0.9189	0.0000	0.9741	0.1111	0.0600

After performing the normalization procedure, the absolute values matrix (Table 10) and the grey relational coefficients are obtained by Eqs. (13) and (14) (Table 11). In the last step of the application, grey relational degrees are computed by Eq. (15) and presented in Table 12. Based on Table 12, While the year of 2022 has the lowest, 2020 has the highest performance.

Table 10

Absolute Value Matrix

	C1	C2	C3	C4	C5	C6	C7	C8
2023	1.0000	0.9091	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000
2022	0.7818	1.0000	0.4225	0.6216	0.6667	0.1658	1.0000	0.8200
2021	0.2182	0.3636	0.0563	0.1351	0.8889	0.0881	0.7778	0.7800
2020	0.0000	0.0000	0.0000	0.0000	0.8889	0.0000	1.0000	1.0000
2019	0.1818	0.0000	0.0282	0.0811	1.0000	0.0259	0.8889	0.9400

Table 11

Grey Relational Coefficient Matrix

	C1	C2	C3	C4	C5	C6	C7	C8
2023	0.3333	0.3548	0.3333	0.3333	1.0000	0.3333	1.0000	1.0000
2022	0.3901	0.3333	0.5420	0.4458	0.4286	0.7510	0.3333	0.3788
2021	0.6962	0.5789	0.8987	0.7872	0.3600	0.8502	0.3913	0.3906
2020	1.0000	1.0000	1.0000	1.0000	0.3600	1.0000	0.3333	0.3333
2019	0.7333	1.0000	0.9467	0.8605	0.3333	0.9507	0.3600	0.3472

Table 12

Grey Relational Analysis Results

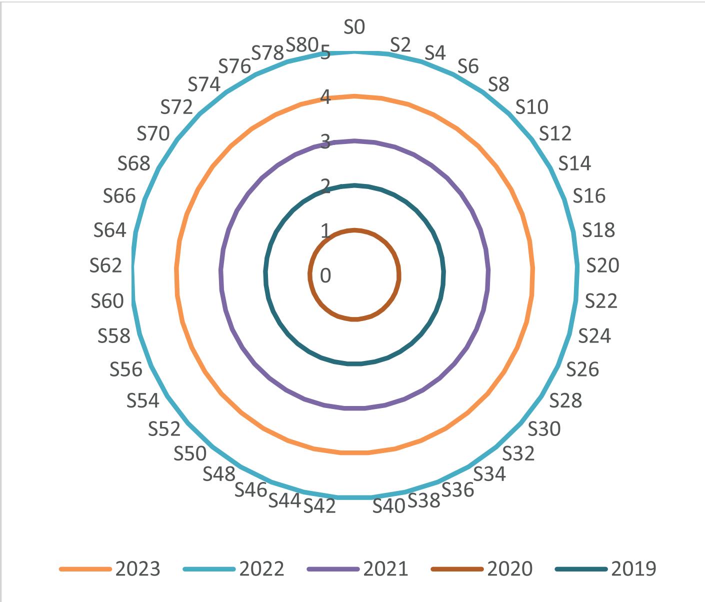
	C1	C2	C3	C4	C5	C6	C7	C8	∑	Rank
2023	0.0413	0.0437	0.0412	0.0411	0.1229	0.0426	0.1257	0.1295	0.5881	4
2022	0.0483	0.0411	0.0671	0.0550	0.0527	0.0959	0.0419	0.0491	0.4510	5
2021	0.0862	0.0714	0.1112	0.0970	0.0443	0.1086	0.0492	0.0506	0.6185	3
2020	0.1239	0.1232	0.1237	0.1233	0.0443	0.1278	0.0419	0.0432	0.7512	1
2019	0.0908	0.1232	0.1171	0.1061	0.0410	0.1215	0.0452	0.0450	0.6899	2

5. ROBUSTNESS CHECK

In order to assess the credibility and effectiveness of the introduced hybrid approach, a detailed sensitivity and benchmark analyses have been performed. It is of great importance to explore the modifications in the weights of the criteria so as to ensure the dependability of the initial ranks. To ascertain the stability of the initial ranks derived from the proposed MCDM methodology, 80 distinct experimental cases have been formulated (Görçün et al., 2022). This is achieved by determining the new values of each criterion, starting from the first, by decreasing the previous values of the relevant criteria by 10%, 20%, and so forth, up to 100%. This is done irrespective of the relative importance of the various criteria. The results obtained from the scenarios regarding changing the weights are given in Fig. 2. The results show that the results obtained from the GE-GRA model are quite stable and robust.

Figure 2

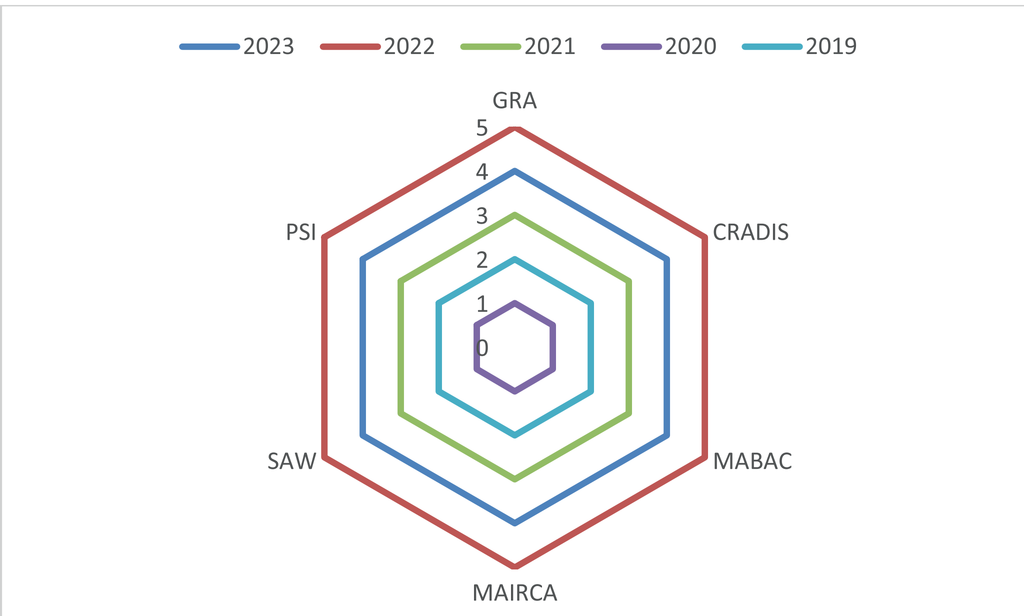
Ranking the alternatives based on modified criteria weights



In our study, GRA results are compared with those obtained from other approaches such as CRADIS (Puska et al., 2021), MABAC (Pamučar and Ćirović, 2015), MAIRCA (Pamučar et al., 2014), SAW (MacCrimmon, 1968), and PSI (Maniya and Bhatt, 2011). As can be seen in Fig. 3, there is no change in the ranking position of the decision alternatives in terms of all MCDM procedures applied, indicating that the obtained results have high consistency.

Figure 3

Comparison among ranking performances of the MCDM procedures



6. MANAGERIAL IMPLICATIONS

The managerial implications of our paper can be summarized as follows.

Measuring and evaluating the financial performance of insurers is at the core of all their operational activities and provides valuable information to all relevant stakeholders about operational activities. It is also a key factor in achieving sustainable competitive advantage among competitors.

The systematic evaluation of a company's financial performance in certain periods provides strategic information to the board of directors and top managers about the company's competitiveness, efficiency and effectiveness. Accordingly, the findings of the suggested model in this study can primarily guide the management staff to improve the overall performance of the company.

The introduced methodology simplifies the financial performance assessment procedure and facilitates benchmarking analysis for all industry stakeholders.

Considering the fund-raising capacity of the insurance market and its effects on the capital market, the results of this study provide critical implications for the authorities regulating and supervising the insurance sector introduced, which is a developing economy, in terms of maturing awareness within the country and increasing the quality of insurance services.

7. CONCLUSION, LIMITATIONS, and FUTURE DIRECTIONS

The existing manuscript introduces a decision-making framework based on an integrated MCDM model that is designed to assist companies in evaluating the level of achievement of their financial performance objectives. In order to identify the relative importance of predetermined criteria, the recommended decision-making framework employs the Grey entropy technique, which is then followed by the utilisation of the Grey relational analysis model for the determination of priorities amongst decision alternatives. In this investigation, a case study methodology has been employed for the evaluation of the financial performance of a reinsurance company.

The outputs of Grey entropy indicate that the three most significant indicators influencing corporate financial performance are return on average equity, combined ratio, and return on average assets. The outcomes of the Grey relationship analysis demonstrate that the most and least favorable performance years in terms of financial performance were 2020 and 2022, respectively. In order to test the reliability and validity of the ranking outputs obtained with the aid of the suggested model, weight sensitivity and comparison analyses are conducted respectively. Both weight sensitivity and comparison results show that the outputs produced by the recommended model are robust and reliable.

As in other studies, there are some limitations in this study. Firstly, the use of only one reinsurance company in this study can be considered as a limitation. Secondly, the relatively limited number of years in this study can be considered as another limitation. In future studies, different weighting and ranking techniques can be used to add depth to the analysis. In addition, more than one reinsurance company can be included in the analysis. The hybrid method proposed in this research may be applied by researchers and practitioners to the solution process of other decision-making problems in the insurance sector.

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