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ORIGINAL ARTICLE

EVALUATION OF LIFE AND PENSION COMPANIES' PERFORMANCE WITH SD AND MARCOS METHODS

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Abstract
This study aims to evaluate the performance of life and pension companies operating in the Turkish insurance sector with a hybrid decision model consisting of SD and MARCOS procedures. Within the framework of the proposed performance evaluation model, the criteria selected in line with the previous literature are weighted using the SD procedure. Then, the weight coefficients obtained from the SD procedure are integrated into the MARCOS model, and the performance of the companies in the sample is compared and ranked. SD results demonstrate that the most efficient criterion for a company's performance is the total debts criterion. In addition, Garanti Pension and Life and Ziraat Life and Pension companies have demonstrated superior financial performance compared to other companies during the five-year period analyzed.

Keywords
Life and Pension Companies, Multi-Criteria performance analysis, SD, MARCOS

JEL Classification
G22, C44.

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1. INTRODUCTION

The insurance industry has a significant place in the daily life of modern society in developing economies as well as developed ones. The insurance sector provides assurance to individuals and companies by covering possible damages that may arise in daily life. It also has a positive and significant impact on the growth and development of the economy by creating resources for financial markets (Sharma et al., 2021).

As of 2019, it is known that the share of the insurance sector in the finance sector in Turkey is 4.1%. As of the beginning of 2020, a total of 66 insurance, reinsurance and pension companies operate in the sector, including 40 non-life, 17 life and pension companies, and 6 life and 3 reinsurance companies (MBMSAKB, 2020).

The long-term funds that life insurance firms offer to the economy are more crucial in building economic stability than the short-term funds produced by non-life insurance companies. Private pension businesses and life insurance companies both play an important role in maintaining economic growth and stability. (Şamiloğlu et al., 2019). Due to the structure of the system, a significant portion of the funds collected from the private pension system established as a supplement to the existing public social security system are evaluated on the financial markets. Thus, it is ensured that individual savings are transformed into long-term funds and large investments.

Regular analysis of the financial performance of the insurance sector, which functions both as a risk transfer mechanism and as a financial intermediary in an economy, is of great importance to various stakeholders such as managers, policyholders, insurance intermediaries, and policymakers. Performance analyses for companies operating in the insurance sector contribute to the evaluation of the market value and financial strength of individual companies and to the growth and development of the sector.

When the applied studies in the literature are examined, it is discovered that the majority of these studies focus on non-life companies. As a result, in this study, performance evaluation was made using a sample of life and pension companies.

The objective of this paper is to propose a hybrid MCDM approach for assessing the performance of life and pension companies operating in the Turkish insurance industry in the period of 2015-2019. The proposed performance assessment model consists of SD and MARCOS techniques. In this study, unlike previous studies in the literature, a long-term analysis is performed instead of a single-term analysis. Secondly, the performance evaluation model proposed in this study is applied to life and pension companies for the first time in the literature.

2. LITERATURE REVIEW

The literature review section is in threefold: (1) The Applications of the MCDM in the Performance Assessment of Life and Pension Firms, (2) The Application Areas of the SD procedure, (3) The Application Areas of MARCOS procedure.

Table 1
Literature Summary

Insurance studies applied MCDM methods	
Author/s	**Aim**
Kung et al. (2006)	Ranking the non-life insurers operating in Taiwan
Tsai et al. (2008)	Evaluation of property-liability insurance firms in Taiwan
Huang and Eling, (2013)	Assessing efficiency of the non-life insurers in the BRIC countries
Özbek, (2015)	Private pension system assessment in Turkey
Genç et al. (2015)	Private pension system selection
Shen et al. (2016)	Financial performance evaluation of life insurance companies operating in Taiwan
Ege et al. (2016)	Performance Analysis of Pension Funds in Turkey
Mandić et al. (2017)	Ranking the financial performance of insurance companies operating in the Serbian insurance sector
Tayyar et al. (2018)	Performance analysis of BIST Insurance Companies
Torbati and Sayadi, (2018)	Measuring the performance of insurance branches in Iran
Aydın, (2019)	Analysis of the Performance of the Life and Pension Insurance Sector in Turkey
Şahin and Başarir, (2019)	Evaluation of financial performance of private pension companies
Noyan et al. (2019)	Selection of private pension companies in Turkey
Bayrakci and Aksoy, (2019)	Comparison of performance of private pension firms in Turkey
Altan and Yildirim, (2019)	Evaluation of the financial performance of the insurance industry
Suvvari et al. (2019)	Selection of the best life insurance firm in India
Işık, (2019)	Evaluation of Financial Performance of Non-Life Insurance Sector in Turkey
Gharizadeh Beiragh et al. (2020)	Sustainability performance assessment of Iranian insurance companies
Acer et al. (2020)	Performance assessment of private pension firms

Uçar and Şahin, (2020)	Analysis of financial performance of life and private pension companies in Turkey
Pattnaik et al. (2021)	Ranking the life insurance firms in India
Aydın, (2021)	Analysis of the market performance of five insurance companies whose shares are traded on the BIST
Rani, (2021)	Assessing life insurance recommendation system
Ecer and Pamucar, (2021)	Assessment and Comparison of private health insurance companies during the COVID-19 pandemic in Turkey
Işık, (2021)	Assessing the financial performance of Axa insurance company in Turkey
Demir, (2022)	Measuring and evaluating the performance of Anadolu Insurance
Koca and Bingöl, (2022)	Determination of firm performance in the non-life branch in Turkey
Pala, (2022)	Analysis of the financial success of companies in the BIST Insurance Index
Studies applied the SD method	
Diakoulaki et al. (1995)	Performance evaluation of industrial companies
Jahan et al. (2012)	Material selection
Zaidan et al. (2017)	MCDM comparison
Ulutaş and Karaköy, (2019)	Evaluation of the logistics performance index of G-20 countries
Bağcı and Yiğiter, (2019)	Analysis of the performance of energy companies
Işık, (2020)	Performance analysis of state-owned development and investment banks
Koşaroğlu, (2020)	Analysis of the performance of listed deposit banks
Işık and Koşaroğlu, (2020)	Performance assessment of oil companies
Maheshwari et al. (2021)	Parameter selection of solid ventilated brake disc
Baydaş and Pamučar, (2022)	Assessment of financial performance of companies in the BIST-30 index
Çoşkun, (2022)	Electric car selection

Studies applied the MARCOS method	
Stević et al. (2020)	Sustainable supplier selection in healthcare industries
Stević and Brković, (2020)	Evaluation of human resources
Badi and Pamucar, (2020)	selection of suppliers for the Libyan Iron and Steel firm
Chakraborty et al. (2020)	selection of competing suppliers
Simić et al. (2020)	risk assessment of railway infrastructure
Ecer, (2021)	performance analysis of battery electric vehicles
Çinaroğlu, (2021)	Ranking the innovation and entrepreneurship performances of 50 universities in Turkey
Bakır and Atalık, (2021)	Assessment of E-Service Quality in the Airline Sector
Topal, (2021)	Evaluation of the financial performance of electricity generation companies
Torkayesh et al. (2021)	Assessment of information and communication technology development in G7 countries
Vesković et al. (2022)	Evaluation and selection of reach stacker for a container terminal
Stević et al. (2022)	Evaluating the Efficiency of Transport Firms
Zhang et al. (2022)	Ranking the regulatory risks of market-oriented business
Karaaslan et al. (2022)	Ranking the renewable energy sources for seven regions of Turkey

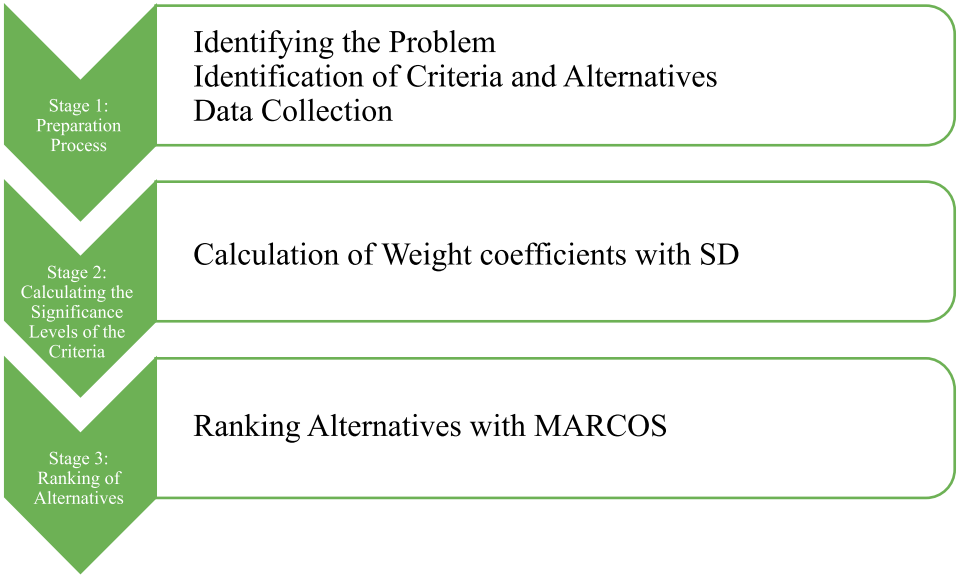
As can be seen from the literature summary, an assessment model that includes SD and MARCOS methods has not been used in previous studies. Therefore, in this study, these two MCDM techniques will be used in the long-term performance evaluation of life and pension companies.

3. PROPOSED PERFORMANCE EVALUATION MODEL

In this section, the details of the proposed approach to measuring and evaluating the performance of life and pension companies operating in the Turkish insurance sector are presented. The proposed approach consists of two main parts including SD and MARCOS procedures. First, the SD procedure is employed to determine the weight coefficients of the criteria. Then, a hybrid approach is developed by integrating the criterion weights obtained from the SD procedure with the MARCOS method. The general framework of the model proposed within the scope of the study is presented in Figure 1.

Figure 1

Systematic Steps of the Proposed Methodology



3.1. Standart Deviation (SD) Method

The SD method, based on calculating how much each variable deviates from its mean, allows the weights of criteria to be calculated objectively from the existing data set and has three application steps (Diakoulaki et al., 1995: 766):

Step 1: Decision matrix $X = [x_{ij}]_{mxn}$ is constructed as shown in Equation (1).

$$X = [x_{ij}]_{mxn} = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \quad (1)$$

In Equation (1), x_{ij} denotes the performance value of the ith alternative on the jth criterion

Step 2: The elements of the above decision matrix are normalized employing Equation (2) or Equation (3).

a) For benefit-type criteria

$$x_{ij}^{*} = \frac{x_{ij} - x_j^{min}}{x_j^{max} - x_j^{min}} \qquad i = 1,2,\ldots\ldots m;\ \ j = 1,2,\ldots n \quad (2)$$

b) For cost-type criteria

$$x_{ij}^{*} = \frac{x_j^{max} - x_{ij}}{x_j^{max} - x_j^{min}} \qquad i = 1,2,\ldots\ldots m;\ \ j = 1,2,\ldots n \quad (3)$$

x_{ij}^{*} is the normalized performance value of ith alternative on jth criterion.

Step 3: The criteria weights are determined by applied Equation (4).

$$w_j = \frac{\sigma_j}{\sum_{j=1}^{n} \sigma_j} \qquad j = 1,2,\ldots.m \quad (4)$$

In Equation (4), σ_j denotes the standard deviation value of the jth criterion.

3.2. Marcos Method

The steps of the MARCOS method are as follows:

Step 1: A decision matrix (X) is formed. This matrix is shown in Equation (1).

Step 2: An extended decision matrix (G) is created as shown in Equation (5):

$$G = \begin{array}{c} \\ A_1 \\ A_2 \\ \vdots \\ A_m \\ AAI \\ AI \end{array} \begin{bmatrix} C_1 & C_2 & \cdots & C_n \\ x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \\ x_{aai1} & x_{aa2} & \cdots & x_{aan} \\ x_{ai1} & x_{ai2} & \cdots & x_{ain} \end{bmatrix} \text{i} = 1,2,\dots\dots\text{m};\ \text{j} = 1,2,\dots\text{n} \quad (5)$$

The anti-ideal solution (AAI) is the worst alternative, while the ideal solution (AI) is the best alternative. These values are computed as follows;

$$AI = (x_{ij})\ if\ j \in BT\ and\ AI = (x_{ij})\ if\ j \in CT \quad (6)$$

$$AAI = (x_{ij})\ if\ j \in BT\ and\ AAI = (x_{ij})\ if\ j \in CT \quad (7)$$

In Eqs. (6) and (7), BT and CT denote the benefit-type and cost-type criteria, respectively.

Step 3: Normalization of the extended initial matrix (G). The elements b_{ij} of the normalized matrix ($B = [b_{ij}]_{m\times n}$) are identified as follows:

$$b_{ij} = \begin{cases} \frac{x_{ai}}{x_{ij}}\ if\ j \in CT \\ \frac{x_{ij}}{x_{ai}}\ if\ j \in BT \end{cases} \quad (8)$$

Step 4: Calculation of the weighted matrix ($Y = [y_{ij}]_{m\times n}$). In this step, the normalized matrix (Z) is multiplied by the weight coefficients of criterion w_j.

$$y_{ij} = b_{ij} \times w_j \quad (9)$$

Step 5: Calculation of the utility degree (K_i) of alternatives. In this step, K_i values of an alternative in relation to the anti-ideal and ideal solution are computed by applied Eqs. (10) and (11).

$$K_i^- = \frac{S_i}{S_{aai}} \quad (10)$$

$$K_i^+ = \frac{S_i}{S_{ai}} \quad (11)$$

where:

$$S_i = \sum_{i=1}^{n} b_{ij} \quad (12)$$

Step 6: Determination of the utility function $f(K_i)$ of each alternative via Equation (13).

$$f(K_i) = \frac{K_i^+ + K_i^-}{1 + \frac{1-f(K_i^+)}{f(K_i^+)} + \frac{1-f(K_i^-)}{f(K_i^-)}} \quad (13)$$

where:

$$f(K_i^-) = \frac{K_i^+}{K_i^+ + K_i^-} \quad (14)$$

$$f(K_i^+) = \frac{K_i^-}{K_i^+ + K_i^-} \quad (15)$$

In Eqs. (14) and (15), while $f(K_i^-)$ presents the utility function concerning the anti-ideal solution, $f(K_i^+)$ denotes the utility function regarding the ideal solution.

Step 7: The alternatives are ranked according to the final utility function. The best alternative has the highest value of the utility function.

4. APPLICATION

This study aims to evaluate the performance of life and pension companies operating in the Turkish Insurance sector in the 5-year period covering 2015-2019 using integrated SD and MARCOS methods. Tables 2 and 3 contain explanations about the companies and performance criteria used in the study. The data comprising the study's sample are compiled from the annual reports of the companies.

Table 2
Life and pension companies

Companies	Ownership structure	Symbol
Aegon Pension and Life Inc	Foreign-Owned Insurance Inc.	**S1**
Allianz Life and Pension Inc.	Foreign-Owned Insurance Inc.	**S2**
Anadolu Life and Pension Inc.	Domestic-Owned Insurance Inc.	**S3**
AvivaSA Pension and Life Inc	Domestic-Owned Insurance Inc.	**S4**
Cigna Finance Pension and Life Inc	Foreign-Owned Insurance Inc	**S5**
Garanti Pension and Life Inc	Foreign-Owned Insurance Inc.	**S6**
Halk Life and Pension Inc.	State-Owned Insurance Inc.	**S7**
Metlife Pension and Life Inc.	Foreign-Owned Insurance Inc.	**S8**
Vakıf Pension Inc.	State-Owned Insurance Inc.	**S9**
Ziraat Life and Pension Inc.	State-Owned Insurance Inc.	**S10**

Table 3
Performance Criteria Used in the Study

Symbol	Performance Criteria	Aim
K1	Premium Production (TL)	Max.
K2	Total Assets (TL)	Max.
K3	Shareholders' Equity (TL)	Max.
K4	Profit (Loss) Before Tax	Max.
K5	Liquidity Ratio (%)	Max.
K6	Conservation Rate (%)	Max.
K7	Number of Employees	Min.
K8	Net Loss Premium Ratio (%)	Min.
K9	Premiums received net Shareholders' Equity ratio (%)	Min.
K10	Total debt (TL)	Min.

4.1. Determination of Criteria Weights With SD Method

Table 4 shows the decision matrix created by considering the 2015 data of the companies.

Table 4
Decision Matrix for 2015

	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10
S1	196	630	63	-36	12.60	0.95	673	0.16	2.94	566
S2	433	7983	338	177	4.46	0.90	774	0.31	1.17	7645
S3	402	11894	778	176	0.29	0.97	1017	1.09	0.50	11111
S4	218	10233	173	56	2.06	0.96	1572	0.48	1.43	10060
S5	250	1009	70	18	1.52	0.97	688	0.20	3.34	789
S6	329	11388	1068	241	0.17	0.87	861	0.16	0.28	8007
S7	316	3173	311	133	4.94	0.98	406	0.38	0.99	1937
S8	232	2356	545	107	0.44	0.91	350	0.41	0.49	1405
S9	182	5591	201	39	2.91	0.97	788	0.65	1.12	4027
S10	619	3751	304	204	3.76	0.99	270	0.88	2.08	2337

According to Equation (2) and Equation (3), the elements of the decision matrix are normalized. The normalized matrix created depending on the benefit and cost targets is presented in Table 5.

Table 5
Normalized Decision Matrix for 2015

	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10
S1	0.0320	0.0000	0.0000	0.0000	1.0000	0.6667	0.6905	1.0000	0.1307	1.0000
S2	0.5744	0.6528	0.2736	0.7690	0.3451	0.2500	0.6129	0.8387	0.7092	0.3287
S3	0.5034	1.0000	0.7114	0.7653	0.0097	0.8333	0.4263	0.0000	0.9281	0.0000
S4	0.0824	0.8525	0.1095	0.3321	0.1521	0.7500	0.0000	0.6559	0.6242	0.0997
S5	0.1556	0.0336	0.0070	0.1949	0.1086	0.8333	0.6790	0.9570	0.0000	0.9789
S6	0.3364	0.9551	1.0000	1.0000	0.0000	0.0000	0.5461	1.0000	1.0000	0.2944
S7	0.3066	0.2258	0.2468	0.6101	0.3837	0.9167	0.8955	0.7634	0.7680	0.8700
S8	0.1144	0.1532	0.4796	0.5162	0.0217	0.3333	0.9386	0.7312	0.9314	0.9204
S9	0.0000	0.4404	0.1373	0.2708	0.2204	0.8333	0.6022	0.4731	0.7255	0.6718
S10	1.0000	0.2771	0.2398	0.8664	0.2888	1.0000	1.0000	0.2258	0.4118	0.8321

The objective weighting coefficients calculated for each criterion using Equation (4) for 2015 data as well as the other year's data are given in Table 6. According to the results reported in Table 6 for all years, the most effective criterion on the performance of companies is the total debts criterion, symbolized by K10.

Table 6
Weights of criteria by years

		K1	K2	K3	K4	K5	K6	K7	K8	K9	K10
2015	w_j	0.1199	0.1467	0.1241	0.1254	0.1145	0.1276	0.1116	0.1301	0.1313	0.1474
2016	w_j	0.1161	0.1471	0.1208	0.1298	0.1189	0.1368	0.1131	0.1175	0.1337	0.1501
2017	w_j	0.1168	0.1503	0.1176	0.1116	0.1257	0.1441	0.1125	0.1213	0.1411	0.1531
2018	w_j	0.1150	0.1444	0.1401	0.1152	0.1232	0.1333	0.1137	0.1151	0.1354	0.1480
2019	w_j	0.1166	0.1459	0.1386	0.1044	0.1261	0.1213	0.1253	0.1218	0.1326	0.1486

4.2. Ranking of Companies With Marcos Method

Despite the fact that our study covers the years 2015-2019, application procedures for the 2015 case are given in this paper. Table 11 displays the results of the MARCOS procedure's application to the rankings for the remaining years. First, the weight coefficients calculated using the SD technique are transferred to the MARCOS method, followed by the application of Equation (5) to determine identify the extended decision matrix. Table 7 shows the extended decision matrix.

Table 7
Extended decision matrix (2015)

	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10
S1	196	630	63	-36	12.60	0.95	673	0.16	2.94	566
S2	433	7983	338	177	4.46	0.90	774	0.31	1.17	7645
S3	402	11894	778	176	0.29	0.97	1017	1.09	0.50	11111
S4	218	10233	173	56	2.06	0.96	1572	0.48	1.43	10060
S5	250	1009	70	18	1.52	0.97	688	0.20	3.34	789
S6	329	11388	1068	241	0.17	0.87	861	0.16	0.28	8007
S7	316	3173	311	133	4.94	0.98	406	0.38	0.99	1937
S8	232	2356	545	107	0.44	0.91	350	0.41	0.49	1405
S9	182	5591	201	39	2.91	0.97	788	0.65	1.12	4027
S10	619	3751	304	204	3.76	0.99	270	0.88	2.08	2337
AI	619	11894	1068	241	12.6	0.99	270	0.16	0.28	566
AII	182	630	63	-36	0.17	0.87	1572	1.09	3.34	11111

The extended decision matrix is normalized employing Equation (8). Table 8 demonstrates the normalized matrix.

Table 8

Normalized decision matrix (2015)

	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10
S1	0.3166	0.0530	0.0590	-0.1494	1.0000	0.9596	0.4012	1.0000	0.0952	1.0000
S2	0.6995	0.6712	0.3165	0.7344	0.3540	0.9091	0.3488	0.5161	0.2393	0.0740
S3	0.6494	1.0000	0.7285	0.7303	0.0230	0.9798	0.2655	0.1468	0.5600	0.0509
S4	0.3522	0.8603	0.1620	0.2324	0.1635	0.9697	0.1718	0.3333	0.1958	0.0563
S5	0.4039	0.0848	0.0655	0.0747	0.1206	0.9798	0.3924	0.8000	0.0838	0.7174
S6	0.5315	0.9575	1.0000	1.0000	0.0135	0.8788	0.3136	1.0000	1.0000	0.0707
S7	0.5105	0.2668	0.2912	0.5519	0.3921	0.9899	0.6650	0.4211	0.2828	0.2922
S8	0.3748	0.1981	0.5103	0.4440	0.0349	0.9192	0.7714	0.3902	0.5714	0.4028
S9	0.2940	0.4701	0.1882	0.1618	0.2310	0.9798	0.3426	0.2462	0.2500	0.1406
S10	1.0000	0.3154	0.2846	0.8465	0.2984	1.0000	1.0000	0.1818	0.1346	0.2422
AI	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
AII	0.2940	0.0530	0.0590	-0.1494	0.0135	0.8788	0.1718	0.1468	0.0838	0.0509

After the normalization process of the decision matrix, the weighted normalized decision matrix in Table 9 is obtained as a result of the multiplication of the criteria weight values obtained by the SD method and the elements of the normalized matrix.

Table 9

Weighted decision matrix (2015)

	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10
S1	0.0380	0.0078	0.0073	-0.0187	0.1145	0.1225	0.0448	0.1301	0.0125	0.1474
S2	0.0839	0.0985	0.0393	0.0921	0.0405	0.1160	0.0389	0.0672	0.0314	0.0109
S3	0.0779	0.1467	0.0904	0.0916	0.0026	0.1251	0.0296	0.0191	0.0735	0.0075
S4	0.0422	0.1262	0.0201	0.0291	0.0187	0.1238	0.0192	0.0434	0.0257	0.0083
S5	0.0484	0.0124	0.0081	0.0094	0.0138	0.1251	0.0438	0.1041	0.0110	0.1057
S6	0.0637	0.1405	0.1241	0.1254	0.0015	0.1122	0.0350	0.1301	0.1313	0.0104
S7	0.0612	0.0391	0.0361	0.0692	0.0449	0.1263	0.0742	0.0548	0.0371	0.0431
S8	0.0450	0.0291	0.0633	0.0557	0.0040	0.1173	0.0861	0.0508	0.0750	0.0594
S9	0.0353	0.0690	0.0234	0.0203	0.0264	0.1251	0.0382	0.0320	0.0328	0.0207
S10	0.1199	0.0463	0.0353	0.1061	0.0342	0.1276	0.1116	0.0237	0.0177	0.0357
AI	0.1199	0.1467	0.1241	0.1254	0.1145	0.1276	0.1116	0.1301	0.1313	0.1474
AII	0.0353	0.0078	0.0073	-0.0187	0.0015	0.1122	0.0192	0.0191	0.0110	0.0075

Equations (10) to (15) are used to define the parameters of $S_i, Z_i^-, Z_i^+, f(Z_i^-), f(Z_i^+)$ and $f(Z_i)$ as shown in Table 10.

Table 10
Utility degrees and utility functions of alternatives (2015)

	S_i	Z_i^-	Z_i^+	$f(Z_i^-)$	$f(Z_i^+)$	$f(Z_i)$	Rank
S1	0.6060	0.4740	2.9986	0.1365	0.8635	0.4640	5
S2	0.6187	0.4839	3.0613	0.1365	0.8635	0.4737	4
S3	0.6641	0.5193	3.2856	0.1365	0.8635	0.5084	2
S4	0.4567	0.3572	2.2598	0.1365	0.8635	0.3497	9
S5	0.4819	0.3769	2.3842	0.1365	0.8635	0.3689	8
S6	0.8743	0.6838	4.3258	0.1365	0.8635	0.6693	1
S7	0.5861	0.4584	2.9000	0.1365	0.8635	0.4487	6
S8	0.5856	0.4580	2.8974	0.1365	0.8635	0.4483	7
S9	0.4232	0.3310	2.0938	0.1365	0.8635	0.3240	10
S10	0.6581	0.5147	3.2561	0.1365	0.8635	0.5038	3

MARCOS ranking results for all years examined within the scope of the analysis are given in Table 11. When the performance scores in Table 11 are analyzed, it is seen that Garanti Pension and Life is the most successful company in 2015, 2016 and 2017. However, in 2018 and 2019, Ziraat Life and Pension is the company with the highest performance. Also, the results in Table 11 reveal that Vakıf Pension is the most unsuccessful company in all the years examined.

Table 11
MARCOS Results by years

	2015		**2016**		**2017**		**2018**		**2019**	
	$f(Z_i)$	Rank	$f(Z_i)$	Rank	$f(Z_i)$	Rank	$f(Z_i)$	Rank	$f(Z_i)$	Rank
S1	0.4640	5	0.4279	7	0.4308	6	0.4261	9	0.4004	9
S2	0.4737	4	0.4388	5	0.4428	5	0.4965	5	0.4931	5
S3	0.5084	2	0.4815	3	0.4434	4	0.5060	4	0.4977	3
S4	0.3497	9	0.3514	9	0.3933	9	0.4613	7	0.4811	6
S5	0.3689	8	0.3596	8	0.4062	8	0.4263	8	0.4155	8
S6	0.6693	1	0.6253	1	0.5875	1	0.5644	2	0.5346	2
S7	0.4487	6	0.4552	4	0.4617	3	0.5458	3	0.4969	4
S8	0.4483	7	0.4344	6	0.4288	7	0.4750	6	0.4342	7
S9	0.3240	10	0.3257	10	0.3334	10	0.3949	10	0.4004	10
S10	0.5038	3	0.5187	2	0.5386	2	0.6373	1	0.6044	1

5. CONCLUSION

In this study, the integrated SD and MARCOS models are proposed to analyze the life and pension companies' financial performance in Turkey. In the performance analysis, we have employed the 2015-2019 financial data of ten companies. The evaluation criteria selected based on the previous literature in financial performance analysis are premium production, total assets, shareholders' equity, profit (loss) before tax, liquidity ratio, conservation rate, number of employees, net loss premium ratio, premiums received net shareholders' equity—ratio and total debt, respectively.

In the financial performance analysis, the SD method is employed to compute the weighting co-

efficients for the financial criteria determined. Then, the MARCOS procedure is used to rank private pension and life insurance companies. As far as we know, unlike previous studies (Genç et al., 2015; Özbek, 2015; Ege et al., 2016; Şahin and Başarir, 2019; Noyan et al., 2019; Bayrakci and Aksoy, 2019; Acer et al., 2020; Uçar and Şahin, 2020), the financial performance analysis of life and pension companies is carried out within the framework of the SD-MARCOS model for the first time in this study. In other words, in spite of the fact that there are many studies in the previous literature focusing on financial performance analysis of life and pension companies in Turkey, no study using the SD-MARCOS performance evaluation model is found in the previous literature.

The results obtained with the SD objective criterion weight determination method indicate that the most influential criterion on the financial performance of life and pension companies in the analysis period is total debt. When the MARCOS ranking results are analyzed, it has been determined that Garanti Pension and Life and Ziraat Life and Pension companies stand out in terms of financial performance in the analyzed 5-year period.

The systematic monitoring and analysis of the performance of insurance and pension companies are of great importance for both the financial markets and the future of the economy. Thanks to these analyzes, companies can gain a competitive advantage by better understanding their place in the market. Moreover, regulatory authorities can make more appropriate decisions for the development and growth of the sector. In addition, the increase in the number of studies on life and pension companies can contribute to better understanding and recognition of these companies in the society, which in turn can help these companies to increase their market share and grow.

Like many others, this study has some limitations. Firstly, the results obtained from this study are valid only for 10 companies. Findings from the study may not be valid for other insurance companies in Turkey that are not included in the sample. Period considered in this study is another limitation of the study. In the future studies, the validity of the results of this study can also be checked by using different weighting (MEREC, LOPCOW, CRITIC, SV, PSI, LBWA, BWM, DEMATEL etc.) and ranking methodologies (MAIRCA, MACONT, COCOSO, WEDBA, COPRAS, EDAS, ARAS, etc.) within the framework of MCDM methods.

Declaration of Research and Publication Ethics

This study which does not require ethics committee approval and/or legal/specific permission complies with the research and publication ethics.

Researchers' Contribution Rate Statement

The authors declare that they have contributed equally to the article.

Declaration of Researcher's Conflict of Interest

There are no potential conflicts of interest in this study.

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