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Analysis of the Performance of Companies in the Individual Pension System Using the Merec-Based Marcos Method

Merec Tabanlı Marcos Yöntemiyle Bireysel Emeklilik Sisteminde Yer Alan Şirketlerin Performanslarının Analizi

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ABSTRACT

The Individual Pension System (IPS) is an essential framework that helps individuals secure financial stability during their retirement years. By promoting regular savings, IPS enables individuals to gain supplementary income in retirement. Individual pension companies(IPCs) play a crucial role in the functioning of this system, offering various pension plans and managing savings efficiently for participants. This study aims to assess the performance of companies operating within Turkey's IPS. For this analysis, the MEREC-based MARCOS method, a multi-criteria decision-making (MCDM) technique, is employed. The MEREC method enabled the objective calculation of criterion weights and identified the number of retired participants as the most significant criterion. The remaining criteria, in order of importance, are as follows: state contribution fund amount, participants fund amount, the number of participants, the number of individual pension contracts, the number of employer group pension certificates and finally, the number of individual pension contracts associated with a group. Following this, the MARCOS method is applied to rank the performance of the companies, and the analysis revealed that Turkey Life and Pension is the highest-performing company.

Keywords
Bireysel emeklilik sistemi, Çok kriterli karar verme, MEREC, MARCOS

ÖZ

Bireysel emeklilik sistemi (BES), bireylerin emeklilik dönemlerinde finansal güvencelerini sağlamalarına yardımcı olan önemli bir sistemdir. BES, bireylerin düzenli tasarruf yapmasını teşvik ederek, emeklilik dönemlerinde ek gelir elde etmelerine olanak tanır. Bu sistemin işleyişinde bireysel emeklilik şirketleri kritik bir rol oynar. Bu şirketler, katılımcılara çeşitli emeklilik planları sunarak birikimlerin verimli bir şekilde yönetilmesini sağlar. Bu çalışma, Türkiye'de bireysel emeklilik sistemi kapsamında faaliyet gösteren şirketlerin performanslarının değerlendirilmesini amaçlamaktadır. Analiz için çok kriterli karar verme (ÇKKV) yöntemlerinden MEREC tabanlı MARCOS yöntemi kullanılmıştır. MEREC yöntemi, kriter ağırlıklarının objektif bir şekilde hesaplanmasına olanak tanımış ve en önemli kriterin emekli olan katılımcı sayısı olduğu sonucuna ulaşılmıştır. Bu kriterleri önem sırasına göre; devlet katkısı fon tutarı, katılımcı fon tutarı, katılımcı sayısı, bireysel emeklilik sözleşmesi sayısı, işveren grup emeklilik sertifikası sayısı ve son olarak gruba bağlı bireysel emeklilik sözleşmesi sayısı takip etmiştir. Ardından, MARCOS yöntemiyle şirketlerin performans sıralamaları oluşturulmuş ve analiz sonucunda en yüksek performansa sahip şirketin Türkiye Hayat ve Emeklilik olduğu tespit edilmiştir.

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1. Introduction

In the rapidly evolving and transforming business world, the sense of security has become an essential need for employees. To address this need, individuals often choose to make savings for the future or establish regular payment plans for their retirement. These payments entitle individuals to retirement benefits once a specified period or premium amount is completed. Today, the individual pension system has been developed to enhance quality of life and provide supplementary income during retirement.

The Individual Pension System (IPS) is a private pension program that enables employees' savings during their active working life to be transformed into long-term investment opportunities in addition to the retirement income provided by the social security system (EGM, 2019). The development of individual pension systems to ensure a peaceful and secure retirement period is of great importance for societies. Accordingly, many countries have initially focused on strengthening publicly-oriented social security systems, later implementing private individual pension models (IPS) to complement or provide an alternative to this structure (Genç et al., 2015: 48). IPS is based on voluntary participation, where the contributions collected from participants are invested through funds managed by individual pension companies, and the returns on these investments provide an additional income for participants during retirement. This system positively contributes to the national economy by increasing savings, expanding employment opportunities, and promoting economic growth and stability (Altay, 2013: 23). In Turkey, IPS was first implemented on October 27, 2003, with application methods that may vary across countries. In developed countries, this system generally plays a complementary role to social security structures. In Turkey, however, IPS has rapidly developed as part of social security reforms coordinated by the Undersecretariat of Treasury, with some life insurance companies transforming into pension companies. The primary objective of the system is to direct individuals' long-term savings into capital markets via private pension funds, thereby enabling efficient use of these funds, alleviating the financial burden on the social security system, and enhancing societal welfare. To earn the right to retire under this system, participants must make contributions for at least 10 years and reach the age of 56.

The aim of this study is to assess the performance of companies operating within Turkey's Individual Pension System (IPS) using multi-criteria decision-making (MCDM) techniques. MCDM methods are selected due to the necessity of simultaneously considering multiple interdependent criteria in evaluating company performance. The criterion weights for the analysis are calculated using the MEREC method, and these weights are subsequently applied in the MARCOS method to derive a performance ranking of individual pension companies. This study is one of the first in the literature to integrate the MEREC and MARCOS methods for evaluating the performance of companies operating within Turkey's Individual Pension System (IPS). By utilizing the most recent data following the mergers of individual pension companies, the study makes a significant contribution to both academic literature and sectoral decision-making processes.

This study is organized into five sections. The first section provides an overview of the individual pension system, while the second section presents a review of related literature. The third section outlines the steps of the methods used. In the fourth section, the performance evaluation of IPCs operating in Turkey is conducted. Lastly, the conclusion section offers an interpretation of the analysis results.

2. Literature Review

The literature review is discussed under two subheadings. First, studies conducted using the MEREC and MARCOS methods applied in this research are evaluated. Subsequently, the applications of multi-criteria decision-making methods in the selection and performance evaluation of individual pension companies are examined.

2.1. A Review of Studies Using MEREC and MARCOS Methods

First, recent studies utilizing the MEREC and MARCOS methods are analyzed, assessing their applications and contributions across various fields. In this context, Stevic and Brkovic(2020) proposed a novel decision model integrating the FUCOM-MARCOS methods to evaluate human resources in an international transport company. The model assesses 23 drivers based on five key criteria: fuel consumption, vehicle maintenance, damage costs, timely information provision, and loyalty. The FUCOM method was employed to determine the weight of the criteria, followed by the MARCOS method to rank driver performance. The results aim to enhance motivation by providing incentive rewards to the drivers with the best performance.Mastilo et al. (2022) conducted a study to evaluate the banking sector in Bosnia and Herzegovina based on financial indicators. Employing the MEREC and MARCOS methods, the study

analyzed the financial stability and sustainability of banks, ranking them according to their financial indicators using data from 2022.Ersoy(2022) aimed to evaluate the innovation performance of 34 member countries of the OECD and the European Union using Multi-Criteria Decision-Making methods. The Global Innovation Index database was utilized to determine the innovation capacities and achievements of these countries. The MEREC method was employed to determine the criterion weights, while the MARCOS method was applied to rank the countries based on their innovation performance. Koca and Bingöl(2022) evaluated the performance of 26 non-life insurance companies operating in Turkey between 2016 and 2020 using the CRITIC and MARCOS methods. The market performance of insurance companies was analyzed based on financial indicators such as personnel expenses, written premiums, equity, total assets, and paid compensation. The CRITIC method was employed to determine the weights of the criteria, followed by the application of the MARCOS method to rank the companies' performance. Altıntaş (2023) employed the CRITIC-based MARCOS method to analyze the marine health performances of Mediterranean countries. Based on the evaluation of the Ocean Health Index components for 19 Mediterranean countries in 2021, livelihoods and economies was identified as the most significant marine health component. The analysis results indicated that Slovenia, Spain, and France exhibited the highest marine health performance.Yalman et al.(2023) evaluated the macroeconomic performance of the Turkish economy during the 2000-2020 period using the MEREC-LOPCOW-MARCOS decision model. The weights of the selected macroeconomic indicators were determined using the MEREC and LOPCOW methods, while the performance ranking by years was conducted using the MARCOS method. According to the results, economic growth, current account balance, and inflation rate were identified as the most influential criteria affecting the performance of the Turkish economy.Meral (2023) evaluated the innovation performance of BRICS-T countries as an alternative to the Global Innovation Index. The MEREC method was employed to determine the criterion weights, while the MARCOS method was used to rank the countries. According to the findings, the most influential criteria in innovation performance are investments, R&D, and online creativity, whereas the least influential criteria are the political environment, information and communication technologies, and innovation linkages. China and India emerged as the countries with the highest innovation performance, while Brazil and South Africa demonstrated the lowest performance. Sarıgül et al. (2023) examined the evaluation of airport service quality using a Multi-Criteria Decision-Making (MCDM) approach. In their study, 17 airports that were rated as five-star by Skytrax in 2021 were analyzed based on 11 criteria, including transportation services, security screenings, immigration services, and terminal comfort. The importance weights of the criteria were determined using the MEREC method, while the ranking of the airports was conducted using the MARCOS and CoCoSo methods. As a result, Chubu Centrair Airport was identified as the airport with the highest service quality, whereas Tokyo Haneda Airport was found to have the lowest service quality. Seyhan (2023) evaluated the production and consumption performances of the circular economy in the European Union (EU) using the MEREC and MARCOS methods. Based on 2020 data, the study analyzed 27 EU member states using indicators such as material footprint, recyclable raw material trade, resource productivity, and greenhouse gas emissions. The findings indicated that recyclable raw material trade was the most significant criterion. According to the MARCOS method ranking, the highest-performing countries in the circular economy were the Netherlands, Germany, and France. Duran (2023) analyzed the supply chain resilience of N-11 countries by integrating the MEREC, EDAS, MARCOS, and WASPAS methods. The criterion weights were determined using the MEREC method, and the countries were ranked accordingly. The results indicate that supply chain visibility and corporate governance emerged as the most critical criteria, while South Korea and Türkiye were identified as the countries with the most resilient supply chains. Badi et al. (2023) proposed a decision support model for evaluating wind farm site selection in Libya using the BWM-AHP-MARCOS method. The study compared five different locations based on six criteria to determine the most suitable site. The findings identified safety and quality as the most significant criterion, with Derna being selected as the optimal location. Taş and Alptekin (2023) employed a two-stage methodology integrating the MEREC and MARCOS methods to assess the smart city performance of 30 metropolitan municipalities in Türkiye. The smart city index indicators, identified through a comprehensive literature review, were weighted using the MEREC method and ranked via the MARCOS method. The findings revealed that Istanbul exhibited the highest smart city performance, followed by Antalya, İzmir, and Konya. Taşçı (2023) proposed an integrated model utilizing MCDM techniques, specifically the MEREC and CRADIS methods, to evaluate the performance of the Natural Catastrophe Insurance Pool (DASK) in Turkey for the period 2009-2021. In this study, the objective weights of the evaluation criteria were determined using the MEREC method, followed by the application of the CRADIS method to rank DASK's performance over the years.

2.2. A Review of Studies on Multi-Criteria Decision-Making Methods for the Selection of IPCs

In the literature, various studies have evaluated individual pension companies using multi-criteria decision-making methods. For instance, Vorona (2011) assessed the pension funds of the Republic of Latvia using the AHP method. Sönmez (2012) conducted a study using AHP to determine the prioritization of criteria that are important when entering individual pension systems. Karakaya et al. (2014) measured the performance of 14 pension companies in Turkey using Data Envelopment Analysis, finding that 3 out of the 14 companies are deemed efficient according to the scale. Genç et al. (2015) evaluated individual pension companies based on criteria such as fund return rates, company information, ease of exit from the system, accessibility, and employee qualifications using the MACBETH method. Arefjevs (2015) measured the efficiency of pension fund management companies in the Baltic states (Estonia, Latvia, Lithuania) through Data Envelopment Analysis. Göktolga and Karakış (2018) assessed the financial performance of IPCs by applying Fuzzy AHP to determine the weight of financial ratios. Using financial data from 2014-2016, they analyzed these companies with the VIKOR method and ranked their performance. Bayrakçı and Aksoy (2019) performed a comparative analysis of the performance of IPCs in Turkey, utilizing the ARAS and COPRAS methods. According to the analysis results, the most important criteria are the number of retired participants, the total value of individual pension contracts, and employer group pension certificates. The top three companies are Anadolu Life Pension, Allianz Life and Pension, and Avivasa Pension and Life. Noyan et al. (2019) applied an AHP-based VIKOR method, examining five individual pension companies using criteria such as the number of participants, participants fund amount, the number of retired participants, total individual pension contracts, and investment-directed amounts. The study concluded that the number of participants is the most significant criterion, followed by investment-directed amounts, total contract numbers, participants fund amount, and the number of retired participants. Acer et al. (2020) analyzed the performance of 17 individual pension companies operating in Turkey based on 2018 data using the Entropy and COPRAS methods. Their criteria included the number of participants, participants fund amount, contribution amounts, state contribution fund amount, and retirement technical expenses. They found that the participants fund amount is the most important criterion. Demir et al. (2020) evaluated the performance of 18 individual pension companies under the supervision of the Treasury, the Capital Markets Board, and the Pension Monitoring Center using the Grey Relational Analysis method. Their findings indicated that Anadolu Life Pension is the highest performance, while Aegon Pension and Life is the lowest. Uçar and Şahin (2020) analyzed the financial performance of ten life and pension companies in Turkey during the pre-automatic enrollment period (2011-2015) using the TOPSIS method. Ziraat Life and Pension achieved the highest financial performance, while Allianz Life and Pension ranked last. In a study by Çınaroğlu (2022), the performance of pension companies operating in Turkey is analyzed using Entropy-based EDAS and CODAS methods. The study determined that the most important criterion in evaluating the performance of individual pension companies is the number of retired participants, and Turkey Life and Pension is the highest performance. Çamlıbel(2022) evaluated the financial performance of life and pension companies operating in the Turkish insurance sector using the Standard Deviation (SD) and MARCOS methods. The study analyzed company performance based on financial data from 2015 to 2019, with criterion weights determined using the SD method, identifying total debts as the most influential criterion. Subsequently, companies were ranked using the MARCOS method, revealing that Garanti Pension and Life had the highest performance between 2015 and 2017, while Ziraat Life and Pension demonstrated the best performance in 2018 and 2019. Küçükkıralı and Aydın(2022) aimed to analyze the efficiency levels and efficiency change trends of private pension companies operating in Turkey using the Data Envelopment Analysis (DEA) method. A six-year dataset covering the period 2014-2019 was utilized, and the analysis was conducted from two different perspectives: operating efficiency and fund management efficiency. In the operating efficiency model, the number of employees and total assets were considered as input variables, while collected contributions and the number of participants were taken as output variables. In the fund management efficiency model, collected contributions and fund operating expenses were used as input variables, whereas fund size was selected as the output variable. The findings indicate that the average operating efficiency was calculated as 64%, showing a declining trend, while the average fund management efficiency was determined as 94%, exhibiting an increasing trend. Durgut(2022) evaluated the performance of private pension companies operating in Turkey using the SWARA-SD-MAIRCA decision model. A total of 13 private pension companies, which have been actively operating during the 2015-2020 period, were analyzed. First, subjective weights were determined using the SWARA method, while objective weights were calculated using the SD method, and these weights were combined to assess company performance through the MAIRCA model. The findings indicate that the fund amount of participants was identified as the most significant performance criterion in all years. Garanti Pension and Life consistently demonstrated the highest performance, whereas Aegon Pension and Life had the lowest

performance. Umut (2023) conducted a study to assess the performance of IPCs in Turkey for the period 2016-2022 using the Grey Relational Analysis method. The findings revealed that Turkey Life and Pension, Anadolu Life and Pension, and Garanti Pension and Life are among the top three performing companies.
Table1 presents a comparison of the methods and criteria used in studies from the literature.

Table 1. Comparison of methods and criteria in the literature

Authors	Method	Criteria
Voronova(2011)	AHP	Financial indicators, client base, investment strategy,professionalism and business potential
Sönmez(2012)	AHP	Company name, minimum contribution, annual fund operating expenses, management cuts costs, entrance fee, risk level
Karakaya et al.(2014)	DEA	Number of employees, total assets, total premiums collected, and total fund sizes
Genç et al. (2015)	MACBETH	Company information, entrance fee, management fee deduction, fund size, fund returnrates, qualifications of employees,accessibility options,ease of exit from the system,total retirement pension return
Arefjevs (2015)	DEA and Cluster Analysis	Commission fees, administrative fees, profit before tax, assets under management,share of non-pension fund management revenue
Göktolga and Karakış(2018)	Fuzzy AHP and VIKOR	Current ratio, return on equity, return on assets, leverage ratio, technical profit ratio, net profit premium ratio, loss-premium ratio, investment income ratio
Bayrakçı and Aksoy (2019)	Entropy-Weighted ARAS and COPRAS	Number of participants , total fund amount of participants, total contribution amount, number of individual pension contracts, number of individual pension contracts associated with a group, number of employer group pension certificates, amount allocated for investment (Individual Pension Contracts), amount allocated for investment (Group-linked individual pension contracts), amount allocated for investment (employer group pension certificates), number of retired participants
Noyan et al. (2019)	AHP and GRA	Number of participants, total fund amount of participants, state contribution fund amount, total contribution amount, number of retired participants, number of individual pension contracts, number of individual pension contracts associated with a group, number of employer group pension certificates, total fund size, amount allocated for investment.
Acer et al. (2020)	Entropy-Weighted COPRAS	Number of participants, participant fund value, state contribution fund value, contribution amount, pension technical expenses
Demir et al. (2020)	GRA	Number of participants, participant fund value, state contribution fund value, contribution amount, number of retired participants.
Uçar and Şahin (2020)	TOPSIS	Current assets / short-term liabilities, net profit / total assets, equity / total assets, net profit / equity, premiums collected / total assets, fund management income / net profit, company participant ratio, premiums collected / equity, liquid assets / total assets, fund management expenses / fund management income.
Çınaroğlu (2022)	Entropy-Weighted EDAS and CODAS	Number of participants, participant fund amount, state contribution fund amount, number of retired participants, number of individual pension contracts, Number of individual pension contracts associated with a group, number of employer group pension certificates.
Çamlıbel(2022)	SD-Weighted MARCOS	Premium production, total assets, shareholders' equity, profit / loss before tax, liquidity ratio, conservation rate, number of employees, net loss premium ratio, total debt, premiums received / shareholders' equity.
Küçükkıralı and Aydın(2022)	DEA	Number of employees, total assets, collected contributions, number of participants, fund operating expenses, fund size.
Durgut(2022)	SWARA and SD-Weighted MAIRCA	Number of participants, participant fund amount, state contribution fund amount, contribution amount, number of retired participants, total expenses.

Umut (2023)	GRA	Equity, total assets, number of participants, total participant fund amount, pension technical revenue, pension technical profit/loss.

When studies in the literature are examined, it is observed that there are few studies evaluating the performance of individual pension companies using multi-criteria decision-making methods. Additionally, except for the studies by Çınaroğlu (2022) and Umut(2023), the existing studies use data from the years prior to the mergers of individual pension companies (Halk Life and Pension, Ziraat Life and Pension, Vakıf Pension and Life). Furthermore, no study has been identified that employs both the MEREC and MARCOS methods in an integrated manner on this topic. In this respect, the study is expected to contribute to the literature.

3. Research Methods

The performance evaluation of individual pension companies is conducted using multi-criteria decision-making (MCDM) methods, specifically the MEREC and MARCOS approaches.

The selection of the MEREC and MARCOS methods in this study is based on their complementary strengths within MCDM processes. The MEREC (Method based on the Removal Effects of Criteria) method was chosen for its capability to objectively determine the weights of criteria. Unlike subjective weighting methods that rely on expert opinions, MEREC calculates the significance of each criterion based on its impact on the overall decision-making model. This approach minimizes subjectivity and promotes a data-driven weighting process, making it particularly suitable for the performance analysis of individual pension companies, where financial and operational metrics require a high level of objectivity. Studies by Keshavarz-Ghorabaee et al. (2021) and Goswami et al. (2022) have demonstrated that the MEREC method yields more reliable and precise results compared to traditional weighting methods such as CRITIC and Entropy.

The MARCOS (Measurement of Alternatives and Ranking according to Compromise Solution) method was selected for ranking alternatives due to its ability to incorporate both ideal and anti-ideal solutions. This method evaluates each alternative's proximity to the best and worst scenarios, allowing for a more comprehensive analysis of company performance. MARCOS provides a structured ranking process that enables decision-makers to accurately distinguish between superior and inferior alternatives. Furthermore, studies by Stević et al. (2020) have shown that the MARCOS method is particularly effective in financial and economic evaluations, offering a robust framework for complex MCDM problems.The combination of the MEREC and MARCOS methods ensures a comprehensive, objective, and reliable evaluation framework for assessing the performance of individual pension companies.

The following sections explain the methods applied in the analysis in detail.

3.1. MEREC Method

MEREC (Method based on the Removal Effects of Criteria) is an objective weighting method introduced into the MCDM literature by Keshavarz-Ghorabaee and colleagues in 2021. In the MEREC method, the weight of a criterion is determined by observing the changes in total weights when that criterion is excluded from the analysis (Ayçin and Arsu, 2020: 68; Ghorabaee, 2021: 5). This approach results in higher weights for criteria with greater performance impact on decision alternatives (Keshavarz-Ghorabaee et al., 2021: 9). Goswami et al. (2022) noted that the MEREC method, which provides more accurate and precise results, is a more effective objective weighting tool than the CRITIC and Entropy weighting methods.

The solution steps of the MEREC method are outlined by Keshavarz-Ghorabaee et al. (2021) in six steps.

Step 1: The initial decision matrix (X) is constructed, displaying the value of each alternative for each criterion, where 'm' represents the alternatives and 'n' represents the criteria. The initial decision matrix is provided in Equation (1).

$$X = \begin{bmatrix} x_{11} & x_{12} & . & . & x_{1n} \\ x_{21} & x_{22} & . & . & x_{2n} \\ . & . & . & . & . \\ . & . & . & . & . \\ x_{m1} & x_{m2} & . & . & x_{mn} \end{bmatrix} \quad (1)$$

Step 2: Normalization is performed. The elements of the initial decision matrix (X) are normalized using Equation (2).

$$n_{ij}^{x} = \begin{cases} \dfrac{\min x_{ij}}{x_{ij}} & \text{if } j \in \text{benefit criteria} \\ \dfrac{x_{ij}}{\max x_{ij}} & \text{if } j \in \text{cost criteria} \end{cases} \quad (2)$$

Step 3: Overall performance is determined. The overall performance value of the alternatives is calculated by applying a logarithmic measure with equal criterion weights based on a nonlinear logarithmic function. This calculation is provided in Equation (3).

$$S_i = \ln\left(1+\left(\frac{1}{m}\sum\nolimits_j \left|\ln\left(n_{ij}^{x}\right)\right|\right)\right) \quad (3)$$

Step 4: Performance is measured by removing criteria. The performance of each alternative ($S_{ij}^{'}$) is calculated separately by removing the value of each criterion from the overall performance, as shown in Equation (4).

$$S^{'}{}_{ij} = \ln\left(1+\left(\frac{1}{m}\sum\nolimits_{k,k\neq j} \left|\ln\left(n_{ik}^{x}\right)\right|\right)\right) \quad (4)$$

Step 5: Removal/deviation effect is measured. The effect of removing a criterion, denoted as 'Ej' is calculated by summing the absolute deviations. This process is presented in Equation (5).

$$Ej = \sum_i \left|S_{ij}^{'} - S_i\right| \quad (5)$$

Step 6: Final weights of the criteria are determined. 'Ej' values are normalized to determine the final weights of the criteria. This process is calculated using Equation (6).

$$wj = \frac{E_j}{\sum_k E_k} \quad (6)$$

3.2. MARCOS Method

The MARCOS (Measurement of Alternatives and Ranking according to COmpromise Solution) method, developed in 2019 by Stević and his research team, is one of the MCDM methods. This method evaluates the relationship between alternatives and both ideal and anti-ideal reference points. Alternatives are ranked based on their performance, calculated by their closeness to the ideal reference and their distance from the anti-ideal reference. The core principle of this method is that alternatives should be as close as possible to the ideal solution point and as far as possible from the anti-ideal solution point. The benefit functions assess these proximities to establish a ranking of alternatives, with the best alternative being the one closest to the ideal solution (Stević et al., 2020:5).
The steps involved in the MARCOS method are outlined below (Stević & Brković, 2020: 3–4).

Step 1: A decision matrix containing *m* alternatives and *n* criteria is constructed as shown in Equation (1).
Step 2: In this step, the extended initial matrix shown in Equation (7) is created by adding ideal (AI) and anti-ideal (AAI) solutions to the initial decision matrix.

$$X = \begin{matrix} AAI \\ A_1 \\ . \\ A_m \\ AI \end{matrix} \begin{bmatrix} x_{aa1} & x_{aa2} & . & . & x_{aan} \\ x_{11} & x_{12} & . & . & x_{1n} \\ . & . & . & . & . \\ x_{m1} & x_{m2} & . & . & x_{mn} \\ x_{ai1} & x_{ai2} & . & . & x_{ain} \end{bmatrix} \quad (7)$$

Step 3: This step involves normalizing the extended initial matrix.

$$n_{ij} = \frac{x_{ai}}{x_{ij}} \text{ if } j \in \text{cost criteria} \quad (8)$$

$$n_{ij} = \frac{x_{ij}}{x_{ai}} \text{ if } j \in \text{benefit criteria} \quad (9)$$

Step 4: In this step, the weighted matrix is obtained by multiplying the normalized matrix by the criterion weight values, as shown in Equation (10).

$$v_{ij} = n_{ij} * w_j \quad (10)$$

Step 5: This step calculates the utility degree (K_i) of the alternatives. The utility degree of an alternative is determined based on the anti-ideal and ideal solutions, as indicated in Equations (11) and (12).

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

$$K_i^- = \frac{S_i}{S_{aai}} \quad (12)$$

The value S_i, used above, represents the sum of the weighted matrix elements for each alternative, as shown in Equation (13).

$$S_i = \sum_{i=1}^{n} v_{ij} \quad (13)$$

Step 6: In this stage, the benefit functions $f(K_i)$ of the alternatives are determined. The benefit function can be considered as the compromise of the relevant alternative with respect to the ideal and anti-ideal solutions. The benefit function of the alternatives is defined in Equation (14). Equations (15) and (16) provide the calculation of benefit functions $f(K_i^+)$ and $f(K_i^-)$ based on ideal and anti-ideal solutions.

$$f(K_i) = \frac{K_i^+ + K_i^-}{1 + \frac{1 - f(K_i^+)}{f(K_i^+)} + \frac{1 - f(K_i^-)}{f(K_i^-)}} \quad (14)$$

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

$$f(K_i^-) = \frac{K_i^+}{K_i^+ + K_i^-} \tag{16}$$

Step 7: The ranking of alternatives is obtained based on the final values of their benefit functions. The best alternative is the one with the highest benefit function value.

4. Application

This study is conducted to evaluate the performance of companies operating within Turkey's individual pension system. In evaluating the performance of companies, it is necessary to consider numerous interrelated criteria simultaneously; therefore, multi-criteria decision-making methods are chosen for this analysis. The criterion weights used in the analysis are calculated using the MEREC method, and these weights are subsequently applied in the MARCOS method to obtain performance rankings of individual pension companies. The MEREC method are chosen for determining criterion weights due to its objective approach, which derives weights by assessing the impact of each criterion on the total performance of alternatives. This approach helps prevent biased results, contributing to more reliable and impartial outcomes. The MARCOS method is selected for the performance ranking of companies primarily due to its ability to bring clarity to the evaluation process by defining ideal and anti-ideal solutions, which represent the best and worst performances in each criterion, respectively. The ideal solution embodies the highest values for each criterion, representing the optimal scenario sought by the decision-maker, while the anti-ideal solution contains the lowest values, indicating the least desirable state. Through this approach, alternatives closer to the ideal solution stand out as options with higher performance potential, whereas those closer to the anti-ideal solution are evaluated as options involving greater risk. The MARCOS method not only provides a ranking of alternatives but also enables decision-makers to perform a more comprehensive risk-performance assessment by analyzing each alternative's potential opportunities and weaknesses. In this way, while offering a ranking of alternatives, the MARCOS method also allows decision-makers to make more informed strategic decisions based on each alternative's distance from the ideal solution.

In this study, the criteria were selected based on the most recent and comprehensive data published by the Pension Monitoring Center (EGM). The report issued by EGM serves as an authoritative and reliable source for objectively evaluating the performance of individual pension companies operating in Turkey. Utilizing criteria directly from this official report enhances the study's reliability, objectivity, and relevance to current market conditions. A review of previous studies reveals that many researchers (e.g., Bayrakçı & Aksoy, 2019; Çınaroğlu, 2022) have focused on similar metrics for performance evaluation. However, some of these studies also incorporated subjective assessments, potentially introducing bias into the evaluation process. In contrast, this study exclusively relies on objective and comparable criteria provided by EGM, thereby minimizing subjectivity and ensuring consistency in the analysis. For this reason, the data for this study were derived from individual pension key indicators listed in the EGM report dated August 31, 2024. Based on this data, a decision matrix was constructed, as presented in Table 4. The study evaluates 15 individual pension companies using 7 specific criteria, which are detailed in Table 2, while the list of pension companies included in the analysis is provided in Table 3.

Table 2. Criteria included in the study

Criterion Code	Criterion Name	Type of Criterion
C1	Number of participants (units)	Benefit
C2	Participants fund amount (TL)	Benefit
C3	State contribution fund amount (TL)	Benefit
C4	Number of retired participants (units)	Cost
C5	Number of individual pension contracts (units)	Benefit
C6	Number of individual pension contracts associated with a group (units)	Benefit
C7	Number of employer group pension certificates (units)	Benefit

Table 3. Individual pension company alternatives

Individual Pension Companies Code	Company Name	Individual Pension Companies Code	Company Name
IPCs1	AgeSA Life and Pension Inc.	IPCs9	HDI Fiba Pension and Life Inc.
IPCs2	Allianz Life and Pension Inc.	IPCs10	Katılım Pension and Life Inc.
IPCs3	Allianz Living and Pension Inc.	IPCs11	Metlife Pension and Life Inc.
IPCs4	Anadolu Life Pension Inc.	IPCs12	NN Life and Pension Inc.
IPCs5	Axa Life and Pension Inc.	IPCs13	QNB Health, Life Insurance, and Pension Inc.
IPCs6	BNP Paribas Cardif Pension Inc.	IPCs14	Turkey Life and Pension Inc.
IPCs7	Bereket Pension and Life Inc.	IPCs15	Viennalife Pension and Life Inc.
IPCs8	Garanti Pension and Life Inc.		

4.1. Determining Criteria Weights Using the MEREC Method

To calculate the criterion weights using the MEREC technique, a decision matrix is first organized with alternatives in the rows and criteria in the columns, as presented in Table 4.

Table 4. Decision Matrix

Alternatives	C1	C2	C3	C4	C5	C6	C7
IPCs1	932.334	177.424.712.585	22.829.993.643	55.873	1.208.303	88.057	60.347
IPCs2	92.748	27.518.290.849	2.954.471.484	7.841	97.374	10.179	3.243
IPCs3	1.124.758	132.362.561.466	12.743.687.332	28.183	1.021.464	123.181	182.541
IPCs4	1.517.435	157.772.103.306	23.754.842.770	73.088	1.489.251	245.103	49.866
IPCs5	54.683	4.292.728.346	660.659.827	3.691	66.006	1.715	1.404
IPCs6	199.783	17.968.962.195	2.346.252.119	7.326	165.932	74.823	24.044
IPCs7	83.758	2.929.162.685	342.555.239	1.551	29.999	35.738	24.780
IPCs8	1.461.272	121.032.377.130	17.519.743.391	45.816	1.324.452	127.989	98.880
IPCs9	123.767	15.705.395.111	1.625.354.792	6.629	100.002	39.111	14.321
IPCs10	520.717	22.633.702.251	3.155.627.509	2.239	634.079	97.932	80.774
IPCs11	290.021	11.121.398.460	1.803.838.536	4.728	296.287	28.659	24.122
IPCs12	256.184	24.973.047.367	3.580.392.686	14.031	283.875	20.854	8.813
IPCs13	48.270	3.301.437.208	507.555.375	3.360	42.813	7.206	1.177
IPCs14	2.521.458	170.738.104.306	26.545.617.766	60.278	2.478.025	445.306	205.760
IPCs15	33.380	373.211.702	33.933.848	1.630	25.460	11.674	622

Source: http://www.egm.org.tr

In the second step, considering whether the criteria are benefit-oriented or cost-oriented, the decision matrix is normalized using Equation (2), with the results shown in Table 5.

Table 5. Normalized Decision Matrix

Alternatives	C1	C2	C3	C4	C5	C6	C7
IPCs1	0.036	0.002	0.001	0.764	0.021	0.019	0.010
IPCs2	0.360	0.014	0.011	0.107	0.261	0.168	0.192
IPCs3	0.030	0.003	0.003	0.386	0.025	0.014	0.003
IPCs4	0.022	0.002	0.001	1.000	0.017	0.007	0.012
IPCs5	0.610	0.087	0.051	0.051	0.386	1.000	0.443
IPCs6	0.167	0.021	0.014	0.100	0.153	0.023	0.026
IPCs7	0.399	0.127	0.099	0.021	0.849	0.048	0.025
IPCs8	0.023	0.003	0.002	0.627	0.019	0.013	0.006
IPCs9	0.270	0.024	0.021	0.091	0.255	0.044	0.043
IPCs10	0.064	0.016	0.011	0.031	0.040	0.018	0.008
IPCs11	0.115	0.034	0.019	0.065	0.086	0.060	0.026
IPCs12	0.130	0.015	0.009	0.192	0.090	0.082	0.071
IPCs13	0.692	0.113	0.067	0.046	0.595	0.238	0.528
IPCs14	0.013	0.002	0.001	0.825	0.010	0.004	0.003
IPCs15	1.000	1.000	1.000	0.022	1.000	0.147	1.000

In the third step, the overall performances of the individual pension company alternatives are calculated using Equation (3). Subsequently, the values of all criteria are subtracted using Equation (4) to calculate the variations in company performance. The general and individual performance values of the companies are displayed in Table 6.

Table 6. S_i and $S_{ij}^{'}$ Values

		$S_{ij}^{'}$						
Alternatives	Si	C1	C2	C3	C4	C5	C6	C7
IPCs1	0.614	0.317	0.032	0.017	0.063	0.387	0.379	0.374
IPCs2	0.237	0.115	0.297	0.280	0.003	0.123	0.100	0.083
IPCs3	0.521	0.167	0.143	0.136	0.169	0.369	0.309	0.377
IPCs4	0.679	0.355	0.103	0.166	0.112	0.428	0.418	0.399
IPCs5	0.338	0.286	0.052	0.013	0.015	0.152	0.232	0.135
IPCs6	0.248	0.026	0.240	0.199	0.055	0.004	0.209	0.223
IPCs7	0.243	0.134	0.019	0.054	0.094	0.035	0.113	0.027
IPCs8	0.622	0.280	0.037	0.099	0.140	0.415	0.414	0.398
IPCs9	0.276	0.122	0.196	0.181	0.012	0.127	0.109	0.108
IPCs10	0.397	0.091	0.094	0.037	0.106	0.070	0.175	0.072
IPCs11	0.327	0.075	0.093	0.015	0.149	0.114	0.159	0.051
IPCs12	0.272	0.022	0.253	0.201	0.033	0.133	0.144	0.125
IPCs13	0.300	0.261	0.038	0.035	0.017	0.181	0.201	0.167
IPCs14	0.758	0.416	0.229	0.289	0.072	0.437	0.436	0.459
IPCs15	0.238	0.238	0.238	0.238	0.242	0.238	0.434	0.238

In the fifth step, the removal effect of each criterion on the overall performance of the alternatives is calculated using Equation 5. The calculated results are presented in Table 7.

Table 7. Ej Values

	C1	C2	C3	C4	C5	C6	C7
Ej	3.167	4.126	4.197	4.797	2.858	2.630	2.838

In the final step, the weights of the criteria are calculated using Equation 6. The criteria weights determined by the MEREC method are presented in Fig. 1.

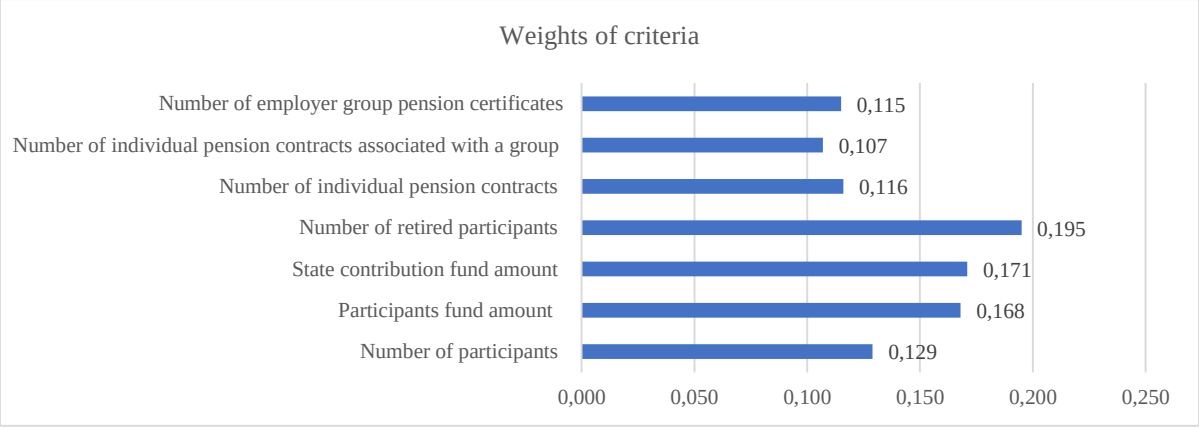

Figure1. Weights of Criteria

According to the results of the MEREC method presented in Fig. 1, the number of retired participants emerged as the most significant criterion, highlighting its critical role as an indicator of service quality, customer satisfaction, and long-term engagement. This criterion is followed by the state contribution fund amount and participants fund amount, both of which emphasize the importance of financial strength and the role of state support in enhancing company

performance. Moderate importance was assigned to the number of participants and the number of individual pension contracts, which reflect the company's customer base and market reach. The number of employer group pension certificates ranked slightly lower, while the number of individual pension contracts associated with a group was identified as the least important criterion, suggesting a lesser emphasis on group-based contracts in evaluating company performance. The variation in criterion weights can be attributed to the distinct impacts each factor has on the overall performance of individual pension companies. The MEREC method effectively highlights the critical elements shaping a company's success and competitive standing in the sector. High-weighted criteria, such as the number of retired participants and financial indicators, underscore the value placed on customer retention and financial sustainability. In contrast, criteria related to customer diversity, like the number of participants and individual pension contracts, received moderate weights, reflecting their supportive but not primary role in performance evaluation. Lower-weighted group-oriented criteria indicate a sector preference for individual-focused strategies. These insights provide valuable guidance for pension companies to optimize their strategies and enhance overall performance.

4.2. Evaluation of the Performance of IPCs Using the MARCOS Method

After calculating the importance weights of the criteria using the MEREC method, the MARCOS method was employed to rank the performance of the IPCs. The decision matrix used in the MARCOS method is the same as the matrix used in the MEREC method. In this step, ideal and non-ideal solutions are added to the initial decision matrix, transforming it into the extended initial decision matrix shown in Table 8.

Table 8. Extended Initial Decision Matrix

Alternatives	C1	C2	C3	C4	C5	C6	C7
AAI(Anti-Ideal Solution)	33.380	373.211.702	33.933.848	1.551	25.460	1.715	622
IPCs1	932.334	177.424.712.585	22.829.993.643	55.873	1.208.303	88.057	60.347
IPCs2	92.748	27.518.290.849	2.954.471.484	7.841	97.374	10.179	3.243
IPCs3	1.124.758	132.362.561.466	12.743.687.332	28.183	1.021.464	123.181	182.541
IPCs4	1.517.435	157.772.103.306	23.754.842.770	73.088	1.489.251	245.103	49.866
IPCs5	54.683	4.292.728.346	660.659.827	3.691	66.006	1.715	1.404
IPCs6	199.783	17.968.962.195	2.346.252.119	7.326	165.932	74.823	24.044
IPCs7	83.758	2.929.162.685	342.555.239	1.551	29.999	35.738	24.780
IPCs8	1.461.272	121.032.377.130	17.519.743.391	45.816	1.324.452	127.989	98.880
IPCs9	123.767	15.705.395.111	1.625.354.792	6.629	100.002	39.111	14.321
IPCs10	520.717	22.633.702.251	3.155.627.509	2.239	634.079	97.932	80.774
IPCs11	290.021	11.121.398.460	1.803.838.536	4.728	296.287	28.659	24.122
IPCs12	256.184	24.973.047.367	3.580.392.686	14.031	283.875	20.854	8.813
IPCs13	48.270	3.301.437.208	507.555.375	3.360	42.813	7.206	1.177
IPCs14	2.521.458	170.738.104.306	26.545.617.766	60.278	2.478.025	445.306	205.760
IPCs15	33.380	373.211.702	33.933.848	1.630	25.460	11.674	622
AI(Ideal Solution)	2.521.458	177.424.712.585	26.545.617.766	73.088	2.478.025	445.306	205.760

After the normalization process of the decision matrix, the weighted normalized decision matrix shown in Table 9 is obtained by multiplying it with the criterion weight values determined using the MEREC method.

Table 9. Weighted Normalized Decision Matrix

Alternatives	C1	C2	C3	C4	C5	C6	C7
AAI(Anti-ideal Solution)	0.103	0.013	0.007	0.109	0.089	0.036	0.026
IPCs1	2.866	5.952	5.029	3.920	4.204	1.848	2.550
IPCs2	0.285	0.923	0.651	0.550	0.339	0.214	0.137
IPCs3	3.458	4.441	2.807	1.977	3.554	2.585	7.714
IPCs4	4.665	5.293	5.233	5.128	5.181	5.144	2.107
IPCs5	0.168	0.144	0.146	0.259	0.230	0.036	0.059

IPCs6	0.614	0.603	0.517	0.514	0.577	1.570	1.016
IPCs7	0.258	0.098	0.075	0.109	0.104	0.750	1.047
IPCs8	4.493	4.060	3.860	3.215	4.608	2.686	4.179
IPCs9	0.381	0.527	0.358	0.465	0.348	0.821	0.605
IPCs10	1.601	0.759	0.695	0.157	2.206	2.055	3.414
IPCs11	0.892	0.373	0.397	0.332	1.031	0.601	1.019
IPCs12	0.788	0.838	0.789	0.984	0.988	0.438	0.372
IPCs13	0.148	0.111	0.112	0.236	0.149	0.151	0.050
IPCs14	7.752	5.728	5.848	4.229	8.621	9.346	8.696
IPCs15	0.103	0.013	0.007	0.114	0.089	0.245	0.026
AI(Ideal Solution)	7.752	5.952	5.848	5.128	8.621	9.346	8.696

Subsequently, the benefit degrees and benefit functions of the alternatives relative to the non-ideal solution, as well as the benefit degrees and benefit functions relative to the ideal solution, are calculated. These results are presented in Table 10.

Table 10. Utility degree of alternatives and utility functions

Alternatives	K_i^-	K_i^+	$f(K_i^-)$	$f(K_i^+)$	$f(K_i)$
IPCs1	68.979	0.514	0.007	0.993	0.514
IPCs2	8.106	0.060	0.007	0.993	0.060
IPCs3	69.414	0.517	0.007	0.993	0.517
IPCs4	85.672	0.638	0.007	0.993	0.638
IPCs5	2.725	0.020	0.007	0.993	0.020
IPCs6	14.156	0.105	0.007	0.993	0.105
IPCs7	6.387	0.048	0.007	0.993	0.048
IPCs8	70.887	0.528	0.007	0.993	0.528
IPCs9	9.167	0.068	0.007	0.993	0.068
IPCs10	28.479	0.212	0.007	0.993	0.212
IPCs11	12.152	0.090	0.007	0.993	0.090
IPCs12	13.592	0.101	0.007	0.993	0.101
IPCs13	2.502	0.019	0.007	0.993	0.019
IPCs14	131.363	0.978	0.007	0.993	0.978
IPCs15	1.561	0.012	0.007	0.993	0.012

In the final step, the performance ranking of the individual pension company alternatives is obtained based on the final values of the benefit functions using Equation 16. The results are given in Table 11.

Table 11. Utility function values and ranking results of the companies

Alternatives	f(Ki)	Ranking
IPCs1	0.514	3
IPCs2	0.060	11
IPCs3	0.517	5
IPCs4	0.638	2
IPCs5	0.020	13
IPCs6	0.105	7
IPCs7	0.048	12
IPCs8	0.528	4
IPCs9	0.068	10
IPCs10	0.212	6

IPCs11	0.090	9
IPCs12	0.101	8
IPCs13	0.019	14
IPCs14	0.978	1
IPCs15	0.012	15

According to the ranking results obtained using the MEREC-based MARCOS method, the top three individual pension companies with the best performance are Turkey Life and Pension, Anadolu Life Pension and AgeSA Life and Pension. The three companies with the lowest performance are Axa Life and Pension, QNB Health Life Insurance and Pension, and Viennalife Pension and Life.

The ranking of companies derived from the MEREC and MARCOS methods is primarily driven by the varying impacts of specific criteria on company performance. Turkey Life and Pension secured the highest rank due to its strong performance in high-weighted criteria such as the number of retired participants, participants fund amount, and state contribution fund amount. This outcome reflects the company's extensive customer base, effective fund management, and strong financial support, which collectively enhance its competitive position. Anadolu Life Pension and AgeSA Life and Pension, ranked in the middle tier, demonstrate solid financial strength and offer a wide range of products. However, their slightly lower scores in critical criteria, particularly the number of retired participants, explain why they did not surpass the leading company. Companies positioned at the lower end of the rankings generally underperformed in key indicators such as participants fund amount, state contribution fund amount, and number of retired participants. Furthermore, firms that focused more on group-based pension plans rather than individual contracts scored lower, reflecting the higher weight placed on individual customer-oriented strategies in the evaluation process.

4.3. Sensitivity Analysis

In the ranking of alternatives using the MARCOS method, the criteria weights were initially determined by the MEREC method. As part of the sensitivity analysis, Entropy and CRITIC methods were also applied to evaluate the impact of different weighting schemes on the alternative rankings. Using the criteria weights obtained from these methods, the alternatives were re-ranked with the MARCOS method, and the changes in the results were analyzed to assess the stability of the approach.

The criteria weights significantly influence the ranking results in multi-criteria decision-making (MCDM) methods. Sensitivity analysis is used to assess the impact of changes in criteria weights on the final ranking of alternatives. If modifications in the weights lead to different rankings, the model is considered sensitive to these changes, raising concerns about its stability (Biswas et al., 2019: 74). In this study, a sensitivity analysis was conducted to examine potential fluctuations in the results. The criteria weights were recalculated using the Entropy and CRITIC methods, and the analysis was repeated accordingly. The MARCOS ranking results, along with the utility function values (F(ki)) derived from the three different weighting techniques (MEREC, Entropy, and CRITIC), are presented in Table 12.

Table 12. MARCOS ranking results based on different criteria weighting techniques

	MEREC		ENTROPY		CRITIC	
Alternatives	f(Ki)	Ranking	f(Ki)	Ranking	f(Ki)	Ranking
IPC1	0.514	3	0.564	3	0.502	5
IPC2	0.060	11	0.069	11	0.058	11
IPC3	0.517	5	0.515	5	0.513	4
IPC4	0.638	2	0.683	2	0.625	2
IPC5	0.020	13	0.023	13	0.019	13
IPC6	0.105	7	0.103	8	0.104	7
IPC7	0.048	12	0.042	12	0.046	12
IPC8	0.528	4	0.549	4	0.525	3
IPC9	0.068	10	0.070	10	0.066	10
IPC10	0.212	6	0.192	6	0.219	6

IPC11	0.090	9	0.087	9	0.092	9
IPC12	0.101	8	0.111	7	0.097	8
IPC13	0.019	14	0.020	14	0.017	14
IPC14	0.978	1	0.969	1	0.990	1
IPC15	0.012	15	0.011	15	0.011	15

As presented in Table 12, the sensitivity analysis revealed that changes in the weighting schemes had a limited impact on the final rankings of individual pension companies. The top-ranked company, Turkey Life and Pension Inc. (IPCs14), and the lowest-ranked company, Viennalife Pension and Life Inc. (IPCs15), consistently maintained their positions across all three weighting methods. This consistency demonstrates the robustness of the MARCOS method in producing stable rankings under varying weighting scenarios. Minor deviations were observed among mid-tier companies. For example, AgeSA Life and Pension Inc. (IPCs1) dropped from 3rd to 5th position under the CRITIC weighting, while Allianz Living and Pension Inc. (IPCs3) slightly improved its ranking under the Entropy method. Despite these minor changes, the overall stability in rankings confirms that the MARCOS method remains reliable and resilient, even when different weighting techniques are applied.

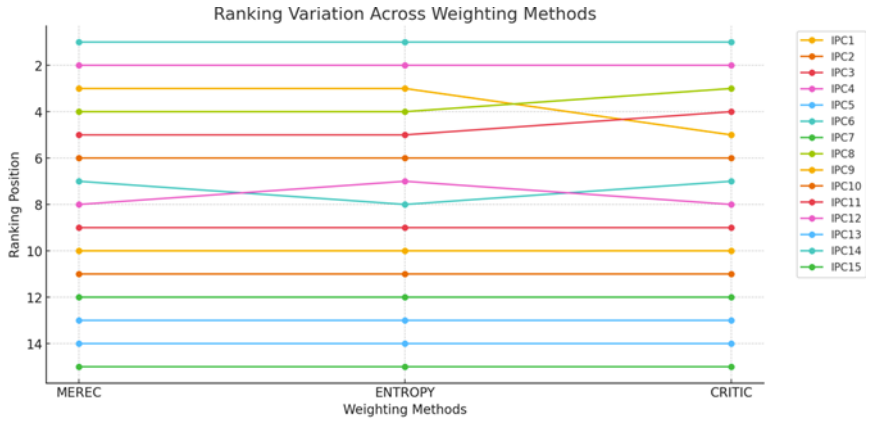

Figure2. Ranking Variation of IPCs Across Different Weighting Methods

Figure 2 visually illustrates the ranking variations of individual pension companies under different weighting methods. The graph highlights that while the top and bottom positions specifically Turkey Life and Pension Inc. (IPCs14) and Viennalife Pension and Life Inc. (IPCs15) remain unchanged, several mid-tier companies experienced slight shifts depending on the weighting approach applied. For instance, Anadolu Life Pension Inc. (IPCs4) consistently maintained a strong ranking across all weighting methods, whereas Katılım Pension and Life Inc. (IPCs10) experienced occasional drops in its position under certain weighting schemes. The figure complements the findings from Table 12, providing a clearer visualization of how minor changes in criteria weights can influence company rankings, particularly among mid-tier companies.

Table 13. Spearman's Rank Correlation Coefficients

Spearman p	MEREC-MARCOS	ENTROPY-MARCOS	CRITIC-MARCOS
MEREC-MARCOS	1	0.996	0.989
ENTROPY-MARCOS	0.996	1	0.986
CRITIC-MARCOS	0.989	0.986	1

*Correlation is significant at the 0.01 level.

To validate the consistency of the MARCOS method, a Spearman's rank correlation test was conducted, with results displayed in Table 13. The Spearman correlation coefficient of 0.99 among the rankings derived from MEREC, Entropy and CRITIC weighting methods confirms a strong positive correlation, reinforcing the robustness and stability of the MARCOS approach.

5. Conclusion and Discussion

Rapid technological advancements and economic fluctuations have increasingly intensified competition among companies within the individual pension system. In this dynamic competitive environment, the sustainability and growth of companies are closely related to comprehensive performance analysis. This study aims to evaluate the performance of companies within Turkey's individual pension system. To achieve a performance ranking of the companies, the MEREC-based MARCOS method is applied. According to the analysis results, the criterion with the highest weight (0.195) is identified as the number of retired participants. This finding indicates that the capacity of individual pension companies to provide retirement is regarded as a significant measure of success in terms of customer loyalty and service sustainability. State contribution fund amounts (0.171) and the amount of participant funds (0.168) are determined as the second and third most prioritized criteria, respectively. This highlights the critical role of financial scale and state support in company performance and their contribution to competitive advantage in the sector. The number of participants (0.129) and the number of individual pension contracts (0.116) received moderate weights, demonstrating that the breadth of a company's customer base impacts its performance. On the other hand, the relatively lower importance weights of employer group pension certificates (0.115) and number of group-based individual pension contracts (0.107) suggest that a focus on individual customer approaches is more decisive in company performance. These results reveal that the customer acquisition and fund management strategies of individual pension companies are shaped around policies directed towards individual participants. After determining the criteria weights, the performance ranking of individual pension company alternatives is established using the MARCOS method. According to the performance results, Turkey Life and Pension ranked first. This company is followed, respectively, by Anadolu Life Pension, AgeSA Life and Pension, Garanti Pension and Life, Allianz Living and Pension, Katılım Pension and Life, BNP Paribas Cardif Pension, NN Life and Pension , Metlife Pension and Life , HDI Fiba Pension and Life, Allianz Life and Pension, Bereket Pension and Life, Axa Life and Pension, QNB Health, Life Insurance and Pension, Viennalife Pension and Life. An evaluation of the analysis results reveals that Turkey Life and Pension demonstrates the highest performance in the sector. This outcome can be attributed to the company’s commitment to service quality, financial strength, and customer satisfaction within the individual pension sector. Following Turkey Life and Pension, Anadolu Life Pension and AgeSA Life and Pension have secured competitive positions within the industry, distinguished by their extensive product range and robust fund management capabilities. The companies positioned in the middle rankings maintain certain strengths in terms of performance; however, enhancing their competitive advantage may require further focus on expanding their customer base or optimizing pension fund management. For example, Garanti Pension and Life and Allianz Living and Pension, despite having a large customer base and strong financial backing, are ranked lower than the top-performing companies. The companies at the lower end of the rankings could benefit from focusing on development areas to improve their standings in the sector. Strategies aimed at enhancing customer satisfaction, increasing fund size, and achieving operational efficiency may help these companies elevate their performance.

After ranking the companies using the MEREC based MARCOS method, a sensitivity analysis was conducted to assess the robustness of the MARCOS approach. In this analysis, alternative criteria weights were determined using the Entropy and CRITIC methods, and the impact of these different weighting schemes on company rankings was examined. The analysis revealed that changes in weighting methods had a limited effect on the final rankings. Notably, Turkey Life and Pension Inc. consistently maintained its top position, while Viennalife Pension and Life Inc. remained at the bottom across all weighting methods, demonstrating the stability of the MARCOS method. Although minor deviations were observed among mid-tier companies, a high Spearman’s rank correlation coefficient of 0.99 indicates a strong positive relationship between the rankings obtained from the MEREC, Entropy, and CRITIC weighting methods. This finding confirms that the MARCOS method produces consistent and reliable results, and that performance evaluations are not significantly influenced by changes in weighting techniques.These results provide decision-makers with confidence in using the MARCOS method for strategic planning and performance assessments in the individual pension sector.

A review of studies evaluating the performance of individual pension companies in the literature reveals findings similar to those of Bayrakçı and Aksoy (2019) and Çınaroğlu (2022). Both studies concluded that the most critical criterion in terms of importance level is the number of retired participants. In the ranking of individual pension companies, Çınaroğlu (2022) identified Turkey Life and Pension as the highest-performing company, while Viennalife Pension and Life, formerly known as Aegon Pension and Life before its rebranding, is identified as the lowest-performing company.In studies conducted by Bayrakçı and Aksoy (2019) and Demir, Bircan, and Dündar (2020), aimed at

evaluating performance within the individual pension sector, Anadolu Life Pension is found to have the highest performance. However, in our study, this company ranked second. The reason for this difference is that Halk Life and Pension, Ziraat Life and Pension, and Vakıf Pension and Life merged on August 24, 2020, and continued their operations under the name Turkey Life and Pension. This merger strengthened the company's position in the sector, and the results of our analysis reflect the impact of this consolidation. Accordingly, the ranking results obtained after the merger differ from those of previous studies conducted using pre-merger data.

The findings obtained from this study are expected to contribute to companies' understanding of strategies for maintaining competitive advantage and strengthening their position in the sector. Furthermore, the results may serve as a guide for new investors considering participation in the individual pension system by providing insights into the key performance indicators that influence company rankings. In future studies, performance evaluations can be expanded by incorporating alternative multi-criteria decision-making methods such as TOPSIS, PROMETHEE, or ELECTRE to compare and validate different methodological approaches. Additionally, the scope of criteria can be broadened to include qualitative factors such as customer satisfaction, digitalization level, and investment portfolio diversification, offering a more comprehensive assessment of company performance. Furthermore, instead of objective criterion weighting techniques, subjective techniques can be applied to compare the results obtained through different weighting approaches, providing insights into the impact of expert judgment on decision-making outcomes.

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