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PERFORMANCE ANALYSIS OF PRIVATE PENSION COMPANIES IN TÜRKİYE: ENTROPY AND TOPSIS METHOD

Levent SEZAL[1]
Mesut DOĞAN[2*]

Abstract
The main purpose of the individual pension system is to direct the savings accumulated by individuals throughout their working lives into long-term investments, ensuring that they obtain an income to maintain their standard of living during retirement. Private pension companies are key components of the financial system, contributing to capital accumulation and fostering economic growth through the long-term funds they generate. This study seeks to assess the financial performance of thirteen private pension companies operating in Türkiye, utilizing eight financial ratios based on data from 2022. Initially, the entropy method was employed to determine the weight of each financial ratio criterion. Subsequently, the TOPSIS method was applied for performance analysis. According to the TOPSIS results, a ranking of private pension companies was established, identifying Viennalife Pension
Keywords: Multi-Criteria decision making, Private pension companies, Financial performance measurement, Entropy method, TOPSIS Method.
JEL Codes: G20, G22

TÜRKİYE'DEKİ BİREYSEL EMEKLİLİK ŞİRKETLERİNİN PERFORMANS ANALİZİ: ENTROPİ VE TOPSIS METODU

Öz
Bireysel emeklilik sisteminin temel amacı, bireylerin çalışma hayatları boyunca yaptıkları birikimleri uzun vadeli yatırımlara dönüştürerek, emeklilik dönemlerinde finansal güvence sağlayıp yaşam standartlarını korumalarına yardımcı olmaktır. Bireysel emeklilik şirketleri, bir ekonomide oluşturdukları uzun vadeli fonlarla sermaye birikimine katkı sağlayan ve ekonomik büyümeye doğrudan destek veren, finansal sistemin en önemli unsurlarındandır. Bu çalışmada, Türkiye'de faaliyet gösteren on üç bireysel emeklilik şirketinin finansal performansı 2022 yılı verileri ile sekiz finansal orandan yararlanılarak incelenmesi amaçlanmıştır. Çalışmada ilk olarak finansal oranlarla ilişkili kriterlerin ağırlıkları entropi yöntemi kullanılarak hesaplanmıştır. Analiz kısmında TOPSIS yöntemi kullanılmıştır. TOPSİS yöntemine göre bireysel emeklilik şirketlerinin performans sıralaması yapılmıştır. 2022 yılında en iyi performans gösteren bireysel emeklilik şirketi Viennalife Emeklilik olmuştur.
Anahtar Kelimeler: Çok kriterli karar verme, Finansal performans ölçümü, Bireysel emeklilik şirketleri, , Entropi yöntemi, TOPSİS yöntemi
JEL Kodları: G20, G22

[1] Doç. Dr., Kahramanmaraş Sütçü İmam Üniversitesi,ORCID: 0000-0002-8873-7335
[2] Prof. Dr., Bilecik Şeyh Edebali Üniversitesi, ORCID: 0000-0001-6879-1361
[*] **Sorumlu Yazar** (Corresponding Author): mesutdogan07@gmail.com
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Introduction

Examples of the concept of insurance have manifested itself in different ways from past to present. The idea of protecting themselves against certain risks that may arise during the lives of both individuals and businesses has pushed people and organisations to find methods to eliminate these risks. These risks are material, moral or risks to people's lives. The idea of protection from these risks has led to the concept of insurance. In the simplest terms, the concept of insurance is defined as the transfer of risks to insurance companies by individuals or organisations by paying a certain fee, i.e. premium, in order to secure themselves against possible dangers that may arise in the future, and the compensation of the loss that will arise in the event of the occurrence of these dangers by insurance companies (Öner Kaya & Kaya, 2015). In addition to the sense of trust it creates in the society, insurance companies, which mediate the transfer of funds as investors in financial markets, make significant contributions to the growth and development of the economy.

The concept of social security, which includes health insurance and pension plans, first emerged in the United States of America (USA). When people reach the age when they cannot work, they need income to provide for their own livelihood. Thanks to the social security system, people finance their retirement periods by paying premiums during their working period. Today, problems have occurred in the pension systems implemented by countries (Şahin & Başarır, 2019). Due to these problems, the system has run a deficit and the social security systems of countries have started to make losses. Among the main problems are the prolongation of the average human life expectancy thanks to the developments in medical science, the unwillingness of the new generation of people to have children, and the decrease in the working population accordingly. These problems have pushed countries to take measures in this regard.

However, with the globalisation and crises experienced in recent years, it is seen that the economic function of insurance has become more important than its social function. Especially when the economies of developed countries are analysed, it is seen that the insurance sector is one of the key players of the financial system. With the premiums collected by insurance companies, large funds are created within the national economies and great benefits are provided to economic development by directing these funds to investments. With these premiums collected, the development and depth provided in the capital markets brings about a stable development in the economy (Işık, 2021). In addition, the functions of the insurance sector such as providing efficiency in the distribution of resources, reducing transaction costs, being a source of liquidity and increasing employment opportunities show that it has a very important position in the financial system (Pjanic et al., 2018).

It is observed that important steps have been taken especially in recent years in order to increase the savings awareness of individuals and to encourage them for new investments. With these steps, it is aimed to increase the savings of individuals by encouraging their savings. The most important system developed in line with this objective is the Private Pension System (PPS) (Durdağı, 2013). In recent years, it is noteworthy that significant changes have been made in pension systems with the increase in the elderly population and thus the public financing need. Although there are different practices all over the world, it is seen that these reforms are based on three main pillars. Accordingly, it is stated that observing public benefit, encouraging private pension systems and gradually increasing the retirement age constitute the basis of reforms (Yazıcı, 2015).

The private pension system is defined as a system that contributes positively to both the preservation of the welfare level of individuals during the active working period in the retirement period by converting their savings into investment and to economic development and employment. It is seen that different regulations and amendments have been made in the world

and in Türkiye, which are closely related to social security systems. The purpose of the individual pension system, which ranks first among these regulations, is to reduce the burden on the Social Security Institution (SSI) and to establish a system that allows participants to increase their welfare level in retirement (Sezgin & Yıldırım, 2015). While the healthy functioning of the private pension system is closely related to legal regulations, incentives and supports, the financial performance of private pension companies is also considered to be important for the efficient functioning of the system.

In Türkiye, the private pension system, known as the Private Pension System, was established under the "Private Pension Savings and Investment System Law" enacted in 1999. Following its implementation on 27 October 2003, various incentives have been introduced since 2004 to encourage participation. This regulation, regarded as a significant reform, raised the state contribution rate from 25% to 30%. Additionally, an important update allowed participants to benefit from state contributions in subsequent years for payments exceeding the annual limit, a revision to the framework initially introduced in 2013. This change enabled contributors to invest their full payments in pension funds immediately, rather than delaying a portion for later investment. These regulatory adjustments have significantly contributed to the system's expansion.

Looking at the general outlook of the Life and Pension Insurance sector in Türkiye, a total of 21 companies are operating. Premium production in the sector increased by 73.7% to TL 30.9 billion in 2022. The share of the life insurance sector in the total insurance sector was 13.1%. As of the end of the fourth quarter of 2022, the number of participants in the private pension system increased by 9.3% compared to the previous year, while the total fund size, including state contributions, increased by 77.3% to reach TL 433.4 billion. With the inclusion of under-18 participants in the system, the PPS gained a new momentum. As of 31.12.2022, the number of participants under the age of 18 was 594,164 and the fund size including state contribution was approximately TL 3 million (Insurance Association of Türkiye, 2022).

This study aims to assess the financial performance of private pension companies operating in Türkiye in 2022 using the Entropy and Topsis methods. The research is structured into three main sections. The first section reviews national and international literature on the performance evaluation of private pension companies. The second section outlines the Entropy and Topsis methods. In the third section, the financial ratios utilized in the analysis and the corresponding findings are presented. Lastly, the conclusion section provides an overall evaluation of the results.

The contribution of this study to the literature lies in its methodological integration of the entropy method for objective weighting and the application of the TOPSIS method for performance ranking. Unlike previous studies that focus on pension funds or general insurance sector data, this research conducts a firm-level analysis based on financial ratios from the year 2022, allowing for a comparative evaluation using a current and relevant dataset. In this respect, the study distinguishes itself from recent works that utilize ESG-based or multi-criteria financial performance evaluation methods by offering a more focused and data-driven approach. It provides a concrete framework for assessing the competitive positions of private pension companies through objective and quantifiable indicators.

1. Literature Review

CRM methods are widely used in the performance evaluation of companies and financial sectors. Entropy and Topsis methods used in the study, some of the studies in the domestic and foreign literature on the performance of private pension companies are briefly summarised below. These studies are primarily handled in 2 categories as domestic and foreign.

Research conducted in Türkiye has explored various aspects of the insurance sector. In their 2005 study, Başkaya & Akar evaluated the efficiency of insurance companies by considering the number of agencies, bank branches involved in insurance transactions, and employees as input factors. Meanwhile, the number of policies issued and the total premium volume were taken as output variables. Based on data from 2003, their analysis determined that 6 out of the 12 examined companies were efficient, while recommendations for improvement were provided for those identified as inefficient.

In the study conducted by Köseoğlu (2009), the efficiency of private pension companies operating in Türkiye between 2004-2008 was analysed by DEA. In the investigation of the efficiency of the companies, equity capital, pension technical expenses and total debts from pension activities are inputs. Management expense deduction and entrance fee revenues are outputs. As a result of the analysis, it is seen that technical efficiency, which measures how effectively resources are used, and scale efficiency, which is a management indicator, are achieved in most of the companies. It is observed that both the technical efficiency averages and scale efficiency averages of the companies are around 80% at the same levels. Although the average is not low, the result shows that 33% of the companies are efficient and the others cannot achieve efficiency.

Akın & Ece (2013) analysed the financial performance of insurance companies traded on the ISE for the period 2006-2010 by using ratio analyses and comparative financial statements analysis method using basic ratios and indicators.

Göktolga & Karakış (2018) analyzed the financial performance of private pension companies using VIKOR method in their study. They concluded that the fuzzy AHP method can be used in integration with other methods in selection, ranking and evaluation problems in fuzzy situations and when analysing fuzzy data.

Ova (2018) examined the effects of state contribution regulations on pension companies in the private pension system. In this context, data envelopment analysis technique was used for three years before and three years after the legal regulation on state contribution. In general, it was concluded that the sector could not fully utilise its resources effectively and that the 2013 legal regulation negatively affected the efficiency of the sector.

Şahin and Başarır (2019) examined the comparison of the financial performance of private pension companies through pension mutual funds and the issue of assisting participants in company selection. In the study, TOPSIS method were used. As a result of the study, Allianz Yaşam ve Emeklilik was determined as the best performing company according to both methods.

Looking at the foreign literature; Borros et al. (2010) evaluated the efficiency of 71 life and non-life insurance companies in the Greek insurance sector for the period 1994-2003 by using the CRS model with DEA method. It was found that the Greek insurance sector was not efficient in the period analysed. In the study, the efficiency value decreased after 1997 until 2003. Cummins et al. (2010) analyzed the efficiency of life and non-life insurance companies in the U.S. insurance sector between 1993 and 2006 using the DEA method. Their study assessed both revenue-profit efficiency and cost factors. The results revealed that life insurance companies were inefficient in managing both costs and income, whereas non-life insurance companies experienced inefficiencies primarily in cost management.

Charumathi (2012) investigated the determinants of insurance company performance in India for the period 2009-2011. The study examined 24 insurance firms using a multiple linear regression model, incorporating variables such as liquidity, equity, premium growth, firm size, leverage ratio, and return on assets.

Burca and Batrinca (2014), using panel data analysis in a study involving 21 insurance companies operating in Romania, tried to determine the determinants of financial performance. They concluded that variables such as loss/premium ratio, leverage ratio, asset size, insurance leverage ratio play an active role in determining financial performance. Delibašić et al. (2017) utilized the Fuzzy Analytical Hierarchy Process and TOPSIS methods to rank the relationship between the financial data of Serbian insurance companies from 2007 to 2014 and sector-specific indicators.

Zainudin et al. (2018) analysed 21 life insurance companies operating in 8 Asian countries using panel data analysis technique. As a result of the study, it was found that capital volume and company asset size are effective on profitability, while growth in premiums and liquidity are insignificant indicators.

Karaş (2024) evaluated the financial performance of banks operating in the Turkish banking sector using multi-criteria decision-making (MCDM) methods, highlighting the sector's strengths and weaknesses. Yılmaz and Yakut (2023) examined the impact of the COVID-19 pandemic on the financial performance of firms listed in the BIST Tourism Index by applying CRITIC-based COPRAS and PROMETHEE methods, revealing performance variations during the pandemic. Say (2022), on the other hand, analyzed the financial performance of companies in the BIST Technology Index using ARAS and COPRAS methods, emphasizing the effectiveness of these techniques in comparative evaluations. Collectively, these studies demonstrate the applicability of MCDM techniques in financial performance analysis across different sectors. Çilek and Şeyranlıoğlu (2025) in their study used LODECI, CRADIS, and AROMAN multi-criteria decision-making (MCDM) methods to assess the financial performance of reinsurance companies in Türkiye. The study reveals that these methods are effective in determining the most successful companies, and different MCDM approaches yield varying rankings. However, the results show that all methods consistently evaluate the companies' performance.

2. Scope and Methodology of the Study

This research seeks to evaluate and compare the financial performance of 13 private pension companies operating in Türkiye in 2022. In that year, a total of 21 private pension firms were active in the country. The financial data used in this research were obtained from the annual reports published on the companies' official websites. However, since financial data for 8 private pension companies were not accessible, these firms were excluded from the study. The private pension companies included in the analysis are listed in Table 1 in alphabetical order.

Table 1: *Company Names and Abbreviations*

Company Name	Code
AgeSA Hayat	AGS
Anadolu Hayat	AND
Allianz Hayat	ALZ
Axa Hayat	AXA
Bereket Emeklilik	BRK
Cigna Sağlık	CGN
Garanti BBVA Emeklilik	GRT
HDI Fiba Emeklilik	HDI
Katılım Emeklilik	KTL
Metlife Emeklilik	MTL
NN Hayat	NNH
Türkiye Hayat Emeklilik	THE
Viennalife Emeklilik ve Hayat	VEH

Some financial and technical ratios used in the study, which are regulated by the sectoral characteristics of private pension companies, are shown in Table 2. The ratios to be used in the

study were selected by taking into account the studies in the existing literature (Doğan, 2013; Doğan, 2015; İzci & Köse, 2023; Doğan &Topal, 2016; Göktolga & Karakış, 2018; Doğan, 2020; Uçar & Şahin, 2020).

Table 2: *Financial and Technical Ratios*

RATE NAME	CALCULATION OF THE RATIO
FINANCIAL RATIOS	
Current Ratio	Current Assets/Short Term Liabilities
Return on Equity Ratio	Net Profit for the Period / Shareholders' Equity
Total Assets Profitability Ratio	Net Profit for the Period /Total Assets
Leverage Ratio	Equity/Total Assets
TECHNICAL RATES	
Technical Profit Ratio	Total Technical Profit/Loss/Net Premium Earned
Net profitability Premium Ratio	Net Profit for the Period/Net Premiums Earned
Loss Premium Ratio	Net Incurred Loss/Net Premium Earned
Investment Income Rate	Total Investment Income/Total Assets

2.1. Entropy Method

The concept of entropy was first introduced by Rudolph Clausius in 1865 and later adapted by Shannon in 1948 for use in the field of information technology. One of the most notable aspects of the entropy method is its ability to quantify useful information (Zhang et al., 2012), while also being objective and applicable across various disciplines. The method follows a structured process consisting of five consecutive stages (Zhou et al., 2008: 728).

Stage 1: The decision matrix is normalized. This step involves adjusting the values based on the benefit and cost structures of the criteria to ensure consistency in the evaluation process.

$$D = \begin{Bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ & & & \\ & & & \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{Bmatrix} \quad (1)$$

Stage 2: In this step, r_{ij} is calculated by normalisation to eliminate outliers in different units of measurement. The purpose of normalisation is to eliminate attribute differences in size and order of magnitude. The normalisation equation (2) for the matrix is as follows:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{p-1}^{m} x_{pj}}} \quad i = 1,2,\dots.,m \text{ ve } j = 1,2,\dots.,n \quad (2)$$

Stage 3: The entropy (e_j) of each criterion is calculated. The value of m in Eq, refers to the number of alternatives.

$$e_j = -k \sum_{i=1}^{m} r_{ij}\, lnr_{ij}, \quad j = 1,2,\dots.,n. \quad (3)$$

Stage 4: After calculating the entropy of each criterion, the uncertainty or deviation degree (d_j) is calculated.

d_j= 1-e_j , j= 1,2, …., n (4)

Finally, the weight of each criterion (wj) is determined according to equation (5) as follows.$w_j = \frac{d_j}{\sum_{p=1}^{n} d_j}$, $j = 1,2,\dots.,n.$ (5)

2.2. Topsis method

The TOPSIS method is a widely used approach for ranking multiple alternatives and selecting the most suitable option. Initially introduced by Yoon in 1980 and later enhanced by Hwang & Yoon in 1981, it has since evolved into its present form (Zhang et al., 2011: 444). This method identifies the best alternative by considering predetermined weights (Gülbandılar et al., 2019, p. 82). Due to its solid mathematical foundation and straightforward application, it is frequently employed in research studies (Chakraborty, 2022, p.1).

The steps involved in applying the TOPSIS method are detailed below (Muvingi et al., 2023, p. 4; Karcıoğlu & Yalçın, 2022, p. 159; Karami & Johanson, 2014, pp. 521-522; Behzadian et al., 2012, p. 13052; Hwang & Yoon, 1981, p. 128-130):

Step 1: The first step in the TOPSIS method is constructing the decision matrix (A). This matrix, which has dimensions of mxn, is created by the decision-maker and is represented as follows.

$$A = \begin{Bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ & & & \\ & & & \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{Bmatrix} \quad (6)$$

Step 2: Formation of Normalised Decision Matrix; Since different criteria may have different units of measurement in the decision matrix, the matrix needs to be normalised. Using the vector normalisation method, each r_{ij} value is standardised by dividing it by the square root of the sum of squares of the values of the relevant criterion for all alternatives.

$$r_{ij} = \frac{a_{ij}}{\sqrt{\sum_{k-1}^{m} a_{kj}^2}} \quad (7)$$

Step 3: Constructing the weighted decision matrix; Criteria weights (w_j) were determined to reflect the efficiency of each criterion in the decision process. The normalised decision matrix is multiplied by these weights to obtain the weighted normalised decision matrix (v_{ij}):

Step 4: Determining the Positive Ideal and Negative Ideal Solutions; The best (positive ideal, A*) and worst (negative ideal, A^-) values were determined for each criterion:

$$A^* = \{(max_i\, v_{ij} \,|j \in J), (min_i v_{ij} | j \in J'\} \quad (8)$$

$$A^* = \{(minx_i\, v_{ij} \,|j \in J), (max_i v_{ij} | j \in J'\} \quad (9)$$

Here, J^+ is the benefit type criteria (high value is preferred) and J^- is the cost type criteria (low value is preferred).

Step 5: Calculating Positive and Negative Discrimination Distances; The Euclidean distances of each alternative to the positive and negative ideal solution are estimated:

$$S_i^* = \sqrt{\sum_{j-1}^{n} (v_{ij} - v_j^*)^2} \quad (10)$$

$$S_i^- = \sqrt{\sum_{j-1}^{n} (v_{ij} - v_j^-)^2} \quad (11)$$

This persistence determines the distance of each alternative from the ideal solution.

Step 6: Calculation of Similarity Values with respect to the Ideal Solution; For each alternative, the similarity value(C_i^*), is calculated according to the ideal solution:

$$(C_i^*) = \frac{S_i^-}{S_i^- + S_i^*} \quad 0 \leq C_i^* \leq 1 \tag{12}$$

This value is between 0 and 1, and the closer it is to 1, the closer the alternative is to the ideal solution.

Step 7: Ranking of Alternatives; The alternatives are ranked according to their similarity differences and the alternative with the highest (C_i^*) ranges is determined as the most suitable option.

3. Analysis Findings

This section categorizes financial and technical ratios under two key dimensions. The entropy method was utilized to determine the importance weights of the eight selected criteria, and the calculated weights are displayed in Table 3.

Table 3: *Entropy Weights*

-ENTROPY VALUES RELATED TO THE CRITERIA-								
	Financial Ratios				**Technical Ratios**			
	Current Ratio	**ROE**	**ROA**	**SYR**	**Technical Profit Ratio**	**Net Profitability Premium Ratio**	**Loss Premium Ratio**	**Investment Income Rate**
ej	0,937595	0,972275	0,815427	0,89092	0,771151702	0,950151225	0,7010587	0,583775115
dj	0,062405	0,027725	0,184573	0,10908	0,228848298	0,049848775	0,2989413	0,416224885
wj	0,045298	0,020125	0,133977	0,07918	0,166115427	0,036184016	0,2169942	0,302127547
TOTAL	**%28**				**%72**			

According to the entropy values assigned to each criterion, the investment income ratio was identified as the most significant factor in evaluating the performance of pension companies, with a weight of 30.2%. The loss ratio followed with 21.6%, while the technical profit ratio and return on assets ratio were weighted at 16.6% and 13%, respectively. On the other hand, return on equity (ROE), net profitability premium ratio, and another net profitability premium ratio had the lowest significance, with weights of 2%, 3.6%, and 4.5%, respectively. In assessing private pension company performance, technical ratios accounted for 72%, while financial ratios contributed 28%.

Once the importance weights were established, the TOPSIS method was applied as the next step. As detailed in the methodology section, the process begins with forming an initial decision matrix. In this matrix, for criteria where a higher value is preferable, the maximum alternative value is selected, while for criteria where a lower value is more desirable, the minimum alternative value is taken into account. Table 4 below presents the initial decision matrix.

Table 4: *Initial Matrix*

	↑	↑	↑	↑	↑	↑	↓	↑
Weights	**0,0452**	**0,0201**	**0,1339**	**0,0791**	**0,1661**	**0,0361**	**0,2169**	**0,3021**
	Current Ratio	**ROE**	**ROA**	**SYR**	**Technical Profit Ratio**	**Net Profitability Premium Ratio**	**Loss Premium Ratio**	**Investment Income Rate**
AND	103,1	56	1,4	4	6	14	1,7	1,3
AGS	628	50,7	1,2	2	1,2	8,1	11	1,3
GRT	105,9	64,8	2,11	3,1	40,5	38,8	19	1,2
ALZ	299,6	18,2	0,6	1,1	0,03	9,7	0,04	0,01
AXA	137,9	2,1	0,04	2	-16,7	2,5	73,8	1,6
THE	229,9	54,6	3	5,5	0,09	1,4	0,06	2,2
KTL	202,2	37,2	0,99	2,6	79,8	51,2	2,5	1,2
NNH	141,9	-16,3	-0,02	1,3	176,8	-14,3	30,2	0,38
MTL	117,6	41	5	12,8	28,1	21,8	5,3	0,47
HDI	161,5	53,8	1,1	2,1	61,9	8,9	0,27	0,67
CGN	272,1	94,5	9,2	9,8	14	20,6	25,9	7,6
VEH	135,2	49,2	3,1	6,3	15,5	10,7	17,8	27,5
BRK	184	61,9	6,9	11,2	38,9	32,1	1,2	1,2

After forming the initial decision matrix, it is converted into a normalised decision matrix by dividing each column value by the total sum of the respective column. Table 5 presents the normalised decision matrix. In the next phase, the previously determined weights are integrated into the analysis, leading to the creation of the weighted normalised decision matrix, which is displayed in Table 6.

Table 5: *Normalised Decision Matrix*

	↑	↑	↑	↑	↑	↑	↓	↑
Weights	**0,0452**	**0,0201**	**0,1339**	**0,0791**	**0,1661**	**0,03618**	**0,2169**	**0,3021**
	Current Ratio	**ROE**	**ROA**	**SYR**	**Technical Profit Ratio**	**Net Profitability Premium Ratio**	**Loss Premium Ratio**	**Investment Income Rate**
AND	0,114913	0,300928	0,10258	0,17836	0,02792857	0,169538372	0,0191667	0,045125717
AGS	0,699957	0,272448	0,087926	0,08918	0,005585714	0,098090058	0,1240199	0,045125717
GRT	0,118034	0,348217	0,154603	0,13823	0,188517847	0,469863489	0,2142162	0,041654508
ALZ	0,333928	0,097802	0,043963	0,04905	0,000139643	0,117465872	0,000451	0,000347121
AXA	0,153701	0,011285	0,002931	0,08918	-0,07773452	0,030274709	0,832061	0,055539344
THE	0,256242	0,293405	0,219815	0,24525	0,000418929	0,016953837	0,0006765	0,076366597
KTL	0,225368	0,199902	0,072539	0,11594	0,371449981	0,620026047	0,0281863	0,041654508
NNH	0,158159	-0,08759	-0,00147	0,05797	0,822961863	-0,173171337	0,3404911	0,013190594
MTL	0,131075	0,220322	0,366358	0,57076	0,130798803	0,263995465	0,0597551	0,016314682
HDI	0,180005	0,289106	0,080599	0,09364	0,288129747	0,107777965	0,0030441	0,0232571
CGN	0,303277	0,507816	0,674098	0,43699	0,065166663	0,249463605	0,2920106	0,263811882
VEH	0,150691	0,264387	0,227142	0,28092	0,072148806	0,129575756	0,2006868	0,954582467
BRK	0,205083	0,332633	0,505574	0,49941	0,181070229	0,388727268	0,0135294	0,041654508

Table 6: *Weighted Normalized Decision Variables*

	↑	↑	↑	↑	↑	↑	↓	↑
Weights	**0,0452**	**0,0201**	**0,1339**	**0,0791**	**0,1661**	**0,0361**	**0,2169**	**0,3021**
	Current Ratio	**ROE**	**ROA**	**SYR**	**Technical Profit Ratio**	**Net Profitability Premium Ratio**	**Loss Premium Ratio**	**Investment Income Rate**
AND	0,005205	0,006056	0,013743	0,01412	0,004639366	0,006134579	0,0041591	0,013633722
AGS	0,031707	0,005483	0,01178	0,00706	0,000927873	0,003549292	0,0269116	0,013633722
GRT	0,005347	0,007008	0,020713	0,01094	0,031315723	0,017001548	0,0464837	0,012584974
ALZ	0,015126	0,001968	0,00589	0,00388	2,31968E-05	0,004250387	9,786E-05	0,000104875
AXA	0,006962	0,000227	0,000393	0,00706	-0,0129129	0,001095461	0,1805524	0,016779966
THE	0,011607	0,005905	0,02945	0,01942	6,95905E-05	0,000613458	0,0001468	0,023072453
KTL	0,010209	0,004023	0,009719	0,00918	0,061703572	0,022435033	0,0061163	0,012584974
NNH	0,007164	-0,00176	-0,0002	0,00459	0,136706662	-0,006266035	0,0738846	0,003985242
MTL	0,005937	0,004434	0,049084	0,04519	0,021727699	0,009552416	0,0129665	0,004929115
HDI	0,008154	0,005818	0,010798	0,00741	0,047862796	0,00389984	0,0006606	0,007026611
CGN	0,013738	0,01022	0,090314	0,0346	0,010825188	0,009026595	0,0633646	0,079704837
VEH	0,006826	0,005321	0,030432	0,02224	0,01198503	0,004688571	0,0435479	0,288405659
BRK	0,00929	0,006694	0,067735	0,03954	0,030078558	0,014065714	0,0029358	0,012584974
A*	0,031707	0,01022	0,090314	0,04519	0,136706662	0,022435033	9,786E-05	0,288405659
A-	0,005205	-0,00176	-0,0002	0,00388	-0,0129129	-0,006266035	0,1805524	0,000104875

In this step of the method, while finding the ideal (S^+) solution values shown in Table 7, the maximum values of the benefit-oriented criteria were taken into consideration. The minimum values of the cost-side criteria (loss ratio) were taken into consideration. The performances of the variables are calculated in Table 7. In 2022, the significance rankings of the results were established, and the performance of thirteen private pension companies is presented below.

At this phase of the method, the ideal solution values (S^+) presented in Table 7 were determined by selecting the highest values for benefit-based criteria. Meanwhile, for cost-related factors such as the loss ratio, the lowest values were considered. The calculated performance results of the variables are shown in Table 7. In 2022, the importance ranking was determined based on the findings, and the performance assessment of thirteen private pension companies is presented below.

Table 7: *Measurement of Positive Ideal (S^+) and Negative Ideal (S^-) Discrimination*

	Si+	Si-	Ci*	Ranking
AND	0,317445	0,17922	0,682555	10
AGS	0,320398	0,158066	0,679602	11
GRT	0,30998	0,145574	0,69002	7
ALZ	0,333627	0,181635	0,666373	12
AXA	0,373414	0,018701	0,626586	13
THE	0,307146	0,185768	0,692854	5
KTL	0,300053	0,192769	0,699947	4
NNH	0,31265	0,183803	0,68735	9
MTL	0,310336	0,183664	0,689664	8
HDI	0,309411	0,190802	0,690589	6
CGN	0,253021	0,173835	0,746979	2
VEH	0,150046	0,322421	0,849954	1
BRK	0,297626	0,199849	0,702374	3

Based on the (C_i^*) values, which serve as the performance indicator for private pension companies, the firms included in the study were ranked from best to worst. As presented in Table 7, Viennalife Emeklilik ve Hayat (VEH) was identified as the top-performing private pension company. Cigna Sağlık Hayat ve Emeklilik (CGN) ranked second, Bereket-Emeklilik ve Hayat (BRK) ranked third, Katılım-Emeklilik ve Hayat (KTL) ranked fourth and Axa Hayat Emeklilik (AXA) ranked last.

4. Conclusion

Private pension companies are key participants in financial markets and the broader financial sector. Assessing their financial performance is crucial for various stakeholders, including shareholders, executives, regulatory bodies, investors, and other decision-makers. The insurance industry, as an economic institution, facilitates capital accumulation, supports investment funding, and contributes to national development. Additionally, insurance services play a vital role in maintaining social welfare by offering financial protection against unforeseen risks. Due to these macro and microeconomic benefits, the insurance sector holds significant importance worldwide. In developed economies, private pension systems are an essential component of the insurance sector. Similarly, in Türkiye, the private pension system is expanding steadily and gaining greater influence within financial markets.

In this study, the **Entropy** and **TOPSIS** methods were applied to evaluate the financial performance of 13 private pension companies. Eight financial and technical ratios were selected as key performance indicators for this analysis. As detailed in the methodology section, the **Entropy method** was used to assign weightings to these indicators. Following this step, the **TOPSIS method** was employed to determine the performance rankings of the private pension companies.

The results indicated that **Viennalife Emeklilik ve Hayat (VEH)** achieved the highest performance score among the evaluated companies. **Cigna Sağlık Hayat ve Emeklilik (CGN)** secured second place, followed by **Bereket Emeklilik ve Hayat (BRK)** in third, and **Katılım Emeklilik ve Hayat (KTL)** in fourth. **Axa Hayat Emeklilik (AXA)** ranked last in the performance assessment. Among the eight selected criteria, **Viennalife Emeklilik ve Hayat** outperformed its competitors, largely due to its superior investment income ratio, which held a **30% weight**—a key factor in its leading position.

In terms of future studies, the reasons affecting the performance of the companies can be investigated by evaluating the service components offered by the companies ranked in the top three in this study and the same study can be conducted comparatively with the companies ranked in the last places in the ranking with end-to-end sampling. The results obtained for practitioners can be a guide for them to see the performance of their own companies and to be better. At the same time, as presented in the literature review section of the study, in terms of methodology and criteria used, it has been an alternative study to other studies that evaluate the performance of private pension companies using CRM methods. In this context, it is also thought that it can serve as a source for other researchers.

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