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CONTENTS

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   STATEMENT OF THE PROBLEM

   OBJECTIVES

   HYPOTHESES

   RESEARCH METHODOLOGY

   RESULTS & DISCUSSION

   FINDINGS

   RECOMMENDATIONS/SUGGESTIONS

   CONCLUSIONS

   SCOPE FOR FURTHER RESEARCH

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   APPENDIX/ANNEXURE

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CONTRIBUTIONS TO BOOKS

- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

JOURNAL AND OTHER ARTICLES

- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

CONFERENCE PAPERS

- Garg, Sambhav (2011): "Business Ethics" Paper presented at the Annual International Conference for the All India Management Association, New Delhi, India, 19–22 June.

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- Garg, Bhavet (2011): Towards a New Natural Gas Policy, Political Weekly, Viewed on January 01, 2012 http://epw.in/user/viewabstract.jsp

PERFORMANCE EVALUATION OF TURKISH PENSION FUNDS BY USING ELECTRE METHOD

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ABSTRACT

The pension funds are very important for the deepening and development of the private pension system. The pension funds managers heavily invested in financial markets instruments. The primarily choices are stocks, bonds, bills and international financial markets instruments. Being voluntarily, effective financing, and professional fund management are the most important mainstays of the private pension system. In this study, portfolio performances of Turkish Gov't bonds and bills (FX) pension funds are analyzed with ELECTRE method, which is one of the multicriteria decision making methods, for the period 2010-2012. For that purpose, performance measurement methods, which are accepted in the literature widely, are calculated separately for each fund. Then, performance values are turned into a point that shows general portfolio performance by using ELECTRE method. According to the results, the performance ranking of funds carried out.

KEYWORDS
Portfolio Performance Measurement, Pension Fund, Multicriteria Decision Making Methods, ELECTRE.

JEL CLASSIFICATION
G11, G20, H55

1. INTRODUCTION

Changes in financial instruments included in the portfolio composition of pension funds managed by professional managers have shown a direct impact on the returns of pension funds. This situation can create a significant impact on the investment's potential return. For this reason, whether pension funds have been managed successfully must be determined. This situation is understood by evaluating the performance of the funds.

In this paper, the performance of Turkish Gov't bonds and bills (FX) pension funds is evaluated by using ELECTRE method, which is one of the multicriteria decision making methods (MCDM). Generally, pension or mutual funds are evaluated according to their risk and return. At this point, traditional performance measurement techniques of funds are used such as Sharpe ratio, Treynor index, Information ratio, Fama's performance measure and Jensen's performance measure (Jensen's alpha). Although several multicriteria methods may be used in portfolio performance measurement, ELECTRE method is opted in this study. Because, ELECTRE method deals with all of these fund performance measurement techniques and provides more reasonable performance measurement. In addition to that, ELECTRE method is capable of handling qualitative criteria and it is easily updated, taking into account the dynamic nature of the decision environment as well as the changing preferences of the decision-maker.

2. LITERATURE REVIEW

The historical roots of portfolio performance evaluation date to the work of Nobel laureate Harry Markowitz (1952). Markowitz and subsequent researchers, such as Jack Treynor and Nobel laureate William Sharpe, established the field of modern portfolio theory the analysis of rational portfolio choices based on the efficient use of risk. Modern portfolio theory revolutionized investment management. Modern portfolio theory helped spread the knowledge and use of quantitative methods in portfolio management. Today, quantitative and qualitative concepts complement each other in investment management practice (Maginn et al., 2007).

The empirical literature upon the evaluation measurements of the performance of portfolios referred to Treynor index (1965), Sharpe ratio (1966), Jensen's performance measure (1968), Treynor-Mazuy model (1966), Henriksson-Metron model (1981), the CAPM, and several optimization models, etc. Even though these performance measurements, adjusted to risk, have been widely used in the assessment of portfolio performance, researchers have needed new methods that deal with all of these funds performance measurement techniques and provide a more reasonable performance measurement. Multicriteria decision making methods provide the requisite methodology framework in handling the problem of portfolio selection and management through a realistic and an integrated approach (Pendaraki and Zopounidis, 2003). Many researchers have used multicriteria decision making methods on different dates to evaluate portfolio performance.

Martel and et al. (1988), applied an alternative approach, namely the ELECTRE methods, to portfolio comparisons. Hurson and Zopounidis (1997) proposed the use of different multicriteria decision methods for management of stocks' portfolios. The ELECTRE method and the MINORA (Multicriteria INteractive Ordinal Regression Analysis) system were used to sort and rank respectively a sample of stocks.

Pendaraki and Zopounidis (2003) used PROMETHEE II (Preference Ranking Organisation Method for Enrichment Evaluations) method to solve the ranking problem of the performance of mutual funds, originated from the field of the multicriteria decision method. Chang and et al. (2010) aimed to evaluate the performance of mutual funds under the broad framework of multicriteria decision analysis approach.

Sielska (2010) used three multicriteria outranking methods (PROMETHEE, WSA and TOPSIS) to construct rankings of investment funds to assess their performance. Babalos and et al. (2011) proposed an alternative mutual funds performance evaluation measure in the context of multicriteria decision making. The evaluation of the performance of funds in their study is based on a multicriteria approach implemented within the SMAA-2 (Stochastic Multicriteria Acceptability Analysis) framework. Stankevičienė and Bernatavičienė (2012) aimed to test the multicriteria evaluation method as a complex system of evaluation of the efficiency of pension fund performance.

3. DATA AND RESEARCH METHODOLOGY

3.1. Funds Included in the Study and Analysis Period. This study, it is aimed at evaluating performance of Turkish Gov't bonds and bills (FX) pension funds in the period January 2010-December 2012 by using daily returns of the funds. The daily returns of these ten pension funds are obtained from Capital Markets Board of Turkey (CMB) official website (CMB, 2013). Funds names and codes which are used in the research are given in Table 1.

TABLE 1: PENSION FUNDS AND FUNDS' CODES

Fund Name	Code
Allianz Hayat ve Emeklilik A.Ş. Gov't Bond and Bills Income (FX) PMF*	AZD
Avivasa Emeklilik ve Hayat A.Ş. Gov't Bonds and Bills (FX) Income PMF	AVG
Avivasa Emeklilik ve Hayat A.Ş. Gov't Bonds and Bills Income Group PMF	AVB
Ergo Emeklilik ve Hayat A.Ş. Gov't Bonds and Bills (Euro) PMF	EIF
Ergo Emeklilik ve Hayat A.Ş. Gov't Bonds and Bills Income (USD) PMF	EIK
Garanti Emeklilik ve Hayat A.Ş. Gov't Bonds and Bills (Eurobond) PMF	GHG
Groupama Emeklilik A.Ş. Gov't Bonds and Bills (FX) Income PMF	BED
Groupama Emeklilik A.Ş. Gov't Bonds and Bills (FX) PMF	BKB
Vakıf Emeklilik A.Ş. Gov't Eurobond Income PMF	VET
Yapı Kredi Emeklilik A.Ş. Gov't Bonds and Bills (Euro) Income PMF	YGE

*PMF (Pension Mutual Fund)

3.2. Performance Evaluation Techniques. Performance evaluation of funds is an important issue for fund management and is an important part of the investment activities. Attracting and keeping investors depend on performance of a fund or a portfolio manager (Moy, 2002). In this paper, Sharpe ratio, Treynor index, Information ratio, Fama's measure and Jensen's measure are used in performance evaluation of funds. Performance evaluation techniques that are used in the analysis and their calculation methods are shown in Table 2.

TABLE 2: PERFORMANCE EVALUATION TECHNIQUES USED IN THE RESEARCH

Performance Evaluation Techniques	Model	Explanations on the Parameters
Sharpe Ratio	$(r_p - r_f) / \sigma_p$	r_p portfolio return, r_f risk free rate, σ_p portfolio risk (standard deviation of the portfolio returns).
Treynor Index	$(r_p - r_f) / \beta$	β portfolio beta (the measure of systematic risk)
Information Ratio	$E(r_p) - E(r_B) / \sigma(r_p - r_B)$ or $\delta_p / \sigma(e_p)$	r_B return on the benchmark portfolio, δ_p residual portfolio return, $\sigma(e_p)$ standard deviation of residual return.
Fama's Measure	$(r_p - r_f) - (\sigma_p / \sigma_B)(r_B - r_f)$	σ_B standard deviation of the benchmark returns.
Jensen's Measure	$r_{p,t} - r_{f,t} = \alpha_p + \beta_p (r_{B,t} - r_{f,t}) + e_{p,t}$	$r_{p,t}$ is the portfolio return in time period t, $r_{f,t}$ is the risk free return in time period t, $r_{m,t}$ is the return on the market portfolio in time period t, e is the error term, α_p (Jensen Alpha) and β_p both are parameters of the model.

3.3. Risk-free Rate, Benchmark and Calculation of Returns. Risk-free rate and comparison criteria (benchmark) are needed to measure the performance of the funds. In this study, Turkish Institutional Investment Managers' Association (KYD) O/N Net Repo Indice is used as the risk-free rate. Benchmark is made up of 10% KYD O/N Repo Indices Gross, 45% KYD Eurobond Indices USD-TL and 45% KYD Eurobond Indices EUR-TL. The data used in the calculation of the index returns are obtained from the KYD official web site (TKYD, 2013). Daily returns of the funds and indices included in the study are calculated using the following formula.

$R_i = \ln (R_t / R_{t-1})$

R_i = i fund / index daily logarithmic return,

R_t = i fund / index end of day price in period t,

R_{t-1}= i fund / index end of day price in period t-1.

3.4. ELECTRE Method. The acronym ELECTRE stands for: ELimination Et Choix Traduisant la REalité (Elimination and Choice Translating Reality). ELECTRE method was proposed by Benayoun, Roy and Sussman in 1966, and it was developed and improved by Roy in 1971. ELECTRE concentrates the analysis on the dominance relations among the alternatives. ELECTRE method includes seven-step process of a solution. Steps of the ELECTRE method are described below.

Step 1: Determining the Decision Matrix (A). Decision matrix is formed in the first step of the method. In this matrix, the rows indicate alternatives and columns indicate the value of criteria for each alternative.

$$A_{ij} = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix}$$

Here, m shows the number of alternatives and n shows the number of criteria values.

Step 2: Calculation of the Normalized Decision Matrix (X). This procedure transforms various units in the decision matrix into dimensionless comparable units by using the following Equation (1) (Dodangh et al., 2010).

$$x_{ij} = \frac{a_{ij}}{\sqrt{\sum_{i=1}^{m} a_{ij}^2}} \qquad i = 1, \ldots, m \qquad j = 1, \ldots, n \qquad (1)$$

Therefore, the normalized matrix X is defined as follows:

$$X_{ij} = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix}$$

Where m is the number of alternatives and n is the number of criteria, and *Xij* is the new and dimensionless preference measure of the i-th alternative in terms of the j-th criterion (Triantaphyllou et al., 1998).

Step 3: Calculation of the Weighted Normalized Decision Matrix (V). The column of the X matrix is then multiplied by its associated weights which were assigned to the criteria by the decision maker. Thus the weighted matrix depends on normalized matrix assigned to it is given by: $V_{ij} = w_j * x_{ij}$.

$$V_{ij} = \begin{bmatrix} w_1x_{11} & w_2x_{12} & \cdots & w_nx_{1n} \\ w_1x_{21} & w_2x_{22} & \cdots & w_nx_{2n} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ w_1x_{m1} & w_2x_{m2} & \cdots & w_nx_{mn} \end{bmatrix}$$

Where $0 \le w_1, w2,...,wn \le 1$ or $\sum_{j=1}^{n} w_j = 1$. The weights of the attributes are expressed by these constants.

Step 4: Determining the Concordance and Discordance Sets. The concordance set C_{pq} of two alternatives A_p and A_q (1, 2, ..., m and p $\neq$ q), is defined as the set of all criteria for which A_p is preferred to *Aq* . That is, the following is true:

$C_{(p,q)}$ = {j, such that: $V_{pj} \ge V_{qj}$ }, for j = 1, 2, 3, ..., n.

The complementary subset is called the discordance set and it is described as follows:

$D_{(p,q)}$ = {j, such that: $V_{pj} < V_{qj}$ }, for j = 1, 2, 3, ..., n.

Step 5: Calculation of Concordance and Discordance Indexes. The relative power of each concordance set is measured by means of the concordance index. The concordance index C_{pq} represents the degree of confidence in the pair wise judgments of (A_p, A_q). The concordance index of $C_{(p,q)}$ is defined as:

$$C_{pq} = \sum_{j^*} w_{j^*} \qquad (2)$$

Where j^* are attributes which belong to concordance set $C_{(p,q)}$. On the other hand, the discordance index, measures the power of $D_{(p,q)}$. The discordance index of $D_{(p,q)}$, which indicates the degree of disagreement in (A_p, A_q), can be defined as:

$$D_{pq} = \frac{\max\left|V_{pj} - V_{qj}\right|, j \in D_{(p,q)}}{\delta} \qquad (3)$$

$$\delta = \sum_j \left|V_{pj} - V_{qj}\right|, j = 1,2,3,....,n$$

Where V_{pj} indicates the performance of alternative A_p in terms of criterion C_j, and .

Step 6: Outrank the Relationships. A higher concordance index C_{pq} and a lower discordance index D_{pq} means the dominance relationship of alternative A_p becomes stronger over alternative A_q. When the $C_{pq} \ge \overline{C}$ and $D_{pq} \le \overline{D}$, that represents A_p outranks A_q ($A_p \rightarrow A_q$). Here, $\overline{C}$ and $\overline{D}$ are the averages of C_{pq} and D_{pq} respectively.

Step 7: Calculation of Net Concordance and Discordance Indexes. The application of the method proceeds with the calculation of the net concordance and discordance indexes, where the net concordance index constitutes a measure of relative dominance of an alternative A_p over other alternatives when compared with a measure of dominance of other alternatives over the alternative A_p and a net discordance index provides a measure of relative weakness of alternative A_p over other alternatives when compared with a measure of weakness of other alternatives over alternative A_p (Charilas et al., 2009). The net concordance and discordance indexes are calculated by equations (4) and (5) as follows:

$$C_p = \sum_{\substack{k=1 \\ k \neq p}}^{m} C_{pk} - \sum_{\substack{k=1 \\ k \neq p}}^{m} C_{kp} \qquad (4)$$

$$D_p = \sum_{\substack{k=1 \\ k \neq p}}^{m} D_{pk} - \sum_{\substack{k=1 \\ k \neq p}}^{m} D_{kp} \qquad (5)$$

Obviously, an alternative A_p has a greater preference with a higher C_p and a lower D_p. Hence the final selection should satisfy the condition that its net concordance index should be at a maximum and its net discordance index at a minimum. If both these conditions are not satisfied, the alternative that scores the highest average rank can be selected as the final solution (Yoon and Hwang, 1995).

4. EMPIRICAL RESULTS

The performance evaluation methods**,** which are calculated for each fund in the analysis, are used for determining the fund performances for 2010, 2011 and 2012 years separately. Calculated performance evaluation methods are turned into one point that shows the general performance of the fund via ELECTRE method. Then, the funds are ranked and the performance measurement is completed.

Step 1: Determining the Decision Matrix (A). In the first stage of the research, 5 evaluation methods, which explain performance of funds, are determined and evaluation methods are calculated for each fund. In the test, usability of ELECTRE method of funds are included in the analysis; decision matrices are formed separately for the 2010, 2011 and 2012 years by using performance evaluation methods that are determined in the previous step. In decision matrices, decision points (funds) are placed in the lines and valuation factors (performance evaluation methods) which used in decision making are placed in the columns. There are 10 decision points and 5 valuation factors in this study (10x5). Accordingly, decision matrix of 2012 for the funds that are included in this study are shown in Table 3. As an example, data from the year 2012 are shown in the tables.

TABLE 3: 2012 DECISION MATRIX (A)

2012	Valuation Factors				
Fund Code	Sharpe Ratio	Treynor Index	Information Ratio	Fama's Measure	Jensen's Measure
AZD	0,092	0,034	0,041	0,006	-0,007
AVG	0,048	0,019	-0,017	-0,011	-0,022
AVB	0,078	0,025	0,012	0,001	-0,017
EIF	-0,043	-0,017	-0,169	-0,046	-0,079
EIK	-0,027	-0,009	-0,135	-0,035	-0,060
GHG	0,081	0,029	0,022	0,002	-0,013
BED	0,070	0,023	-0,008	-0,001	-0,010
BKB	0,046	0,018	-0,019	-0,012	0,014
VET	0,058	0,018	-0,026	-0,005	-0,029
YGE	0,022	0,009	-0,065	-0,021	-0,038

Step 2: Calculation of the Normalized Decision Matrix (X). The normalized decision matrix that is in Table 4 is constructed by using elements of A matrix in Table 3 and equation (1).

TABLE 4: THE NORMALIZED DECISION MATRIX (X)

2012	Valuation Factors				
Fund Code	Sharpe Ratio	Treynor Index	Information Ratio	Fama's Measure	Jensen's Measure
AZD	0,479	0,500	0,175	0,099	-0,064
AVG	0,250	0,284	-0,071	-0,167	-0,186
AVB	0,407	0,371	0,050	0,017	-0,149
EIF	-0,227	-0,252	-0,723	-0,716	-0,682
EIK	-0,141	-0,138	-0,576	-0,549	-0,517
GHG	0,422	0,426	0,095	0,035	-0,112
BED	0,366	0,331	-0,035	-0,022	-0,090
BKB	0,239	0,269	-0,081	-0,181	0,122
VET	0,300	0,266	-0,111	-0,083	-0,250
YGE	0,113	0,126	-0,279	-0,326	-0,328

Step 3: Calculation of the Weighted Normalized Decision Matrix (V). In the third step, weighted normalized values are calculated by weighted degree of evaluation factors multiplied by normalized values computed in the previous step.

The Weighted Normalized Decision Matrix in Table 5 is formed by giving equal weights (w_1 = 0,20, w_2 = 0,20, w_3 = 0,20, w_4 = 0,20, w_5 = 0,20) to the each valuation factor in the study. Accordingly, the weights of the evaluation factors in 2012 are calculated below:

TABLE 5: 2012 THE WEIGHTED NORMALIZED DECISION MATRIX (V)

2012	Valuation Factors				
Fund Code	Sharpe Ratio	Treynor Index	Information Ratio	Fama's Measure	Jensen's Measure
AZD	0,096	0,100	0,035	0,020	-0,013
AVG	0,050	0,057	-0,014	-0,033	-0,037
AVB	0,081	0,074	0,010	0,003	-0,030
EIF	-0,045	-0,050	-0,145	-0,143	-0,136
EIK	-0,028	-0,028	-0,115	-0,110	-0,103
GHG	0,084	0,085	0,019	0,007	-0,022
BED	0,073	0,066	-0,007	-0,004	-0,018
BKB	0,048	0,054	-0,016	-0,036	0,024
VET	0,060	0,053	-0,022	-0,017	-0,050
YGE	0,023	0,025	-0,056	-0,065	-0,066

Step 4: Determining the Concordance and Discordance Sets. The concordance (C) and discordance (D) clusters are established for each pair-wise comparison of alternatives. The concordance (C) and discordance (D) clusters of all funds are shown in Table 6.

TABLE 6: THE CONCORDANCE (C) AND DISCORDANCE (D) CLUSTERS

Concordance Clusters			Discordance Clusters	
C (AZD,AVG)	(1,2,3,4,5)		D (AZD,AVG)	-
C (AZD,AVB)	(1,2,3,4,5)		D (AZD,AVB)	-
C (AZD,EIF)	(1,2,3,4,5)		D (AZD,EIF)	-
C (AZD,EIK)	(1,2,3,4,5)		D (AZD,EIK)	-
C (AZD,GHG)	(1,2,3,4,5)		D (AZD,GHG)	-
C (AZD,BED)	(1,2,3,4,5)		D (AZD,BED)	-
C (AZD,BKB)	(1,2,3,4)		D (AZD,BKB)	(5)
C (AZD,VET)	(1,2,3,4,5)		D (AZD,VET)	-
C (AZD,YGE)	(1,2,3,4,5)		D (AZD,YGE)	-
C (AVG,AZD)	-		D (AVG,AZD)	(1,2,3,4,5)
C (AVG,AVB)	-		D (AVG,AVB)	(1,2,3,4,5)
C (AVG,EIF)	(1,2,3,4,5)		D (AVG,EIF)	-
C (AVG,EIK)	(1,2,3,4,5)		D (AVG,EIK)	-
C (AVG,GHG)	-		D (AVG,GHG)	(1,2,3,4,5)
C (AVG,BED)	-		D (AVG,BED)	(1,2,3,4,5)
C (AVG,BKB)	(1,2,3,4)		D (AVG,BKB)	(5)
C (AVG,VET)	(2,3,5)		D (AVG,VET)	(1,4)
C (AVG,YGE)	(1,2,3,4,5)		D (AVG,YGE)	-
C (AVB,AZD)	-		D (AVB,AZD)	(1,2,3,4,5)
C (AVB,AVG)	(1,2,3,4,5)		D (AVB,AVG)	-
C (AVB,EIF)	(1,2,3,4,5)		D (AVB,EIF)	-

Concordance Clusters			Discordance Clusters	
C (AVB,EIK)	(1,2,3,4,5)		D (AVB,EIK)	-
C (AVB,GHG)	-		D (AVB,GHG)	(1,2,3,4,5)
C (AVB,BED)	(1,2,3,4)		D (AVB,BED)	(5)
C (AVB,BKB)	(1,2,3,4)		D (AVB,BKB)	(5)
C (AVB,VET)	(1,2,3,4,5)		D (AVB,VET)	-
C (AVB,YGE)	(1,2,3,4,5)		D (AVB,YGE)	-
C (EIF,AZD)	-		D (EIF,AZD)	(1,2,3,4,5)
C (EIF,AVG)	-		D (EIF,AVG)	(1,2,3,4,5)
C (EIF,AVB)	-		D (EIF,AVB)	(1,2,3,4,5)
C (EIF,EIK)	-		D (EIF,EIK)	(1,2,3,4,5)
C (EIF,GHG)	-		D (EIF,GHG)	(1,2,3,4,5)
C (EIF,BED)	-		D (EIF,BED)	(1,2,3,4,5)
C (EIF,BKB)	-		D (EIF,BKB)	(1,2,3,4,5)
C (EIF,VET)	-		D (EIF,VET)	(1,2,3,4,5)
C (EIF,YGE)	-		D (EIF,YGE)	(1,2,3,4,5)
C (EIK,AZD)	-		D (EIK,AZD)	(1,2,3,4,5)
C (EIK,AVG)	-		D (EIK,AVG)	(1,2,3,4,5)
C (EIK,AVB)	-		D (EIK,AVB)	(1,2,3,4,5)
C (EIK,EIF)	(1,2,3,4,5)		D (EIK,EIF)	-
C (EIK,GHG)	-		D (EIK,GHG)	(1,2,3,4,5)
C (EIK,BED)	-		D (EIK,BED)	(1,2,3,4,5)
C (EIK,BKB)	-		D (EIK,BKB)	(1,2,3,4,5)
C (EIK,VET)	-		D (EIK,VET)	(1,2,3,4,5)
C (EIK,YGE)	-		D (EIK,YGE)	(1,2,3,4,5)
C (GHG,AZD)	-		D (GHG,AZD)	(1,2,3,4,5)
C (GHG,AVG)	(1,2,3,4,5)		D (GHG,AVG)	-
C (GHG,AVB)	(1,2,3,4,5)		D (GHG,AVB)	-
C (GHG,EIF)	(1,2,3,4,5)		D (GHG,EIF)	-
C (GHG,EIK)	(1,2,3,4,5)		D (GHG,EIK)	-
C (GHG,BED)	(1,2,3,4)		D (GHG,BED)	(5)
C (GHG,BKB)	(1,2,3,4)		D (GHG,BKB)	(5)
C (GHG,VET)	(1,2,3,4,5)		D (GHG,VET)	-
C (GHG,YGE)	(1,2,3,4,5)		D (GHG,YGE)	-
C (BED,AZD)	-		D (BED,AZD)	(1,2,3,4,5)
C (BED,AVG)	(1,2,3,4,5)		D (BED,AVG)	-
C (BED,AVB)	(5)		D (BED,AVB)	(1,2,3,4)
C (BED,EIF)	(1,2,3,4,5)		D (BED,EIF)	-
C (BED,EIK)	(1,2,3,4,5)		D (BED,EIK)	-
C (BED,GHG)	(5)		D (BED,GHG)	(1,2,3,4)
C (BED,BKB)	(1,2,3,4)		D (BED,BKB)	(5)
C (BED,VET)	(1,2,3,4,5)		D (BED,VET)	-
C (BED,YGE)	(1,2,3,4,5)		D (BED,YGE)	-
C (BKB,AZD)	(5)		D (BKB,AZD)	(1,2,3,4)
C (BKB,AVG)	(5)		D (BKB,AVG)	(1,2,3,4)
C (BKB,AVB)	(5)		D (BKB,AVB)	(1,2,3,4)
C (BKB,EIF)	(1,2,3,4,5)		D (BKB,EIF)	-
C (BKB,EIK)	(1,2,3,4,5)		D (BKB,EIK)	-
C (BKB,GHG)	(5)		D (BKB,GHG)	(1,2,3,4)
C (BKB,BED)	(5)		D (BKB,BED)	(1,2,3,4)
C (BKB,VET)	(2,3,5)		D (BKB,VET)	(1,4)
C (BKB,YGE)	(1,2,3,4,5)		D (BKB,YGE)	-
C (VET,AZD)	-		D (VET,AZD)	(1,2,3,4,5)
C (VET,AVG)	(1,4)		D (VET,AVG)	(2,3,5)
C (VET,AVB)	-		D (VET,AVB)	(1,2,3,4,5)
C (VET,EIF)	(1,2,3,4,5)		D (VET,EIF)	-
C (VET,EIK)	(1,2,3,4,5)		D (VET,EIK)	-
C (VET,GHG)	-		D (VET,GHG)	(1,2,3,4,5)
C (VET,BED)	-		D (VET,BED)	(1,2,3,4,5)
C (VET,BKB)	(1,4)		D (VET,BKB)	(2,3,5)
C (VET,YGE)	(1,2,3,4,5)		D (VET,YGE)	-
C (YGE,AZD)	-		D (YGE,AZD)	(1,2,3,4,5)
C (YGE,AVG)	-		D (YGE,AVG)	(1,2,3,4,5)
C (YGE,AVB)	-		D (YGE,AVB)	(1,2,3,4,5)
C (YGE,EIF)	(1,2,3,4,5)		D (YGE,EIF)	-
C (YGE,EIK)	(1,2,3,4,5)		D (YGE,EIK)	-
C (YGE,GHG)	-		D (YGE,GHG)	(1,2,3,4,5)
C (YGE,BED)	-		D (YGE,BED)	(1,2,3,4,5)
C (YGE,BKB)	-		D (YGE,BKB)	(1,2,3,4,5)
C (YGE,VET)	-		D (YGE,VET)	(1,2,3,4,5)

Step 5: Calculation of Concordance and Discordance Indexes. In the fifth step, the concordance and discordance indexes are calculated by using concordance and discordance clusters. The concordance (C) and discordance (D) indexes of all funds are shown (second and fifth columns) in Table 7.

Step 6: Outrank the Relationships. Primarily, C and D indices' average value $\left(\overline{C}=0{,}50 \text{ and } \overline{D}=0{,}50\right)$ are calculated for a comparison of dominance. Then, the analyze processes are carried out in accordance with the rule of $C_{pq} \geq \overline{C}$ and $D_{pq} \leq \overline{D}$, that represents A_p outranks A_q ($A_p \rightarrow A_q$).

TABLE 7: OUTRANK THE RELATIONSHIPS

C_{pq}		$C_{pq} \geq \overline{C}$	D_{pq}		$D_{pq} \leq \overline{D}$	$A_p \rightarrow A_q$
$C_{(AZD,AVG)}$	1,00	Yes	$D_{(AZD,AVG)}$	0,00	Yes	AZD→AVG
$C_{(AZD,AVB)}$	1,00	Yes	$D_{(AZD,AVB)}$	0,00	Yes	AZD→AVB
$C_{(AZD,EIF)}$	1,00	Yes	$D_{(AZD,EIF)}$	0,00	Yes	AZD→EIF
$C_{(AZD,EIK)}$	1,00	Yes	$D_{(AZD,EIK)}$	0,00	Yes	AZD→EIK
$C_{(AZD,GHG)}$	1,00	Yes	$D_{(AZD,GHG)}$	0,00	Yes	AZD→GHG
$C_{(AZD,BED)}$	1,00	Yes	$D_{(AZD,BED)}$	0,00	Yes	AZD→BED
$C_{(AZD,BKB)}$	0,80	Yes	$D_{(AZD,BKB)}$	0,16	Yes	AZD→BKB
$C_{(AZD,VET)}$	1,00	Yes	$D_{(AZD,VET)}$	0,00	Yes	AZD→VET
$C_{(AZD,YGE)}$	1,00	Yes	$D_{(AZD,YGE)}$	0,00	Yes	AZD→YGE
$C_{(AVG,AZD)}$	0,00	No	$D_{(AVG,AZD)}$	1,00	No	No
$C_{(AVG,AVB)}$	0,00	No	$D_{(AVG,AVB)}$	1,00	No	No
$C_{(AVG,EIF)}$	1,00	Yes	$D_{(AVG,EIF)}$	0,00	Yes	AVG→EIF
$C_{(AVG,EIK)}$	1,00	Yes	$D_{(AVG,EIK)}$	0,00	Yes	AVG→EIK
$C_{(AVG,GHG)}$	0,00	No	$D_{(AVG,GHG)}$	1,00	No	No
$C_{(AVG,BED)}$	0,00	No	$D_{(AVG,BED)}$	1,00	No	No
$C_{(AVG,BKB)}$	0,80	Yes	$D_{(AVG,BKB)}$	0,86	No	No
$C_{(AVG,VET)}$	0,60	Yes	$D_{(AVG,VET)}$	0,52	No	No
$C_{(AVG,YGE)}$	1,00	Yes	$D_{(AVG,YGE)}$	0,00	Yes	AVG→YGE
$C_{(AVB,AZD)}$	0,00	No	$D_{(AVB,AZD)}$	1,00	No	No
$C_{(AVB,AVG)}$	1,00	Yes	$D_{(AVB,AVG)}$	0,00	Yes	AVB→AVG
$C_{(AVB,EIF)}$	1,00	Yes	$D_{(AVB,EIF)}$	0,00	Yes	AVB→EIF
$C_{(AVB,EIK)}$	1,00	Yes	$D_{(AVB,EIK)}$	0,00	Yes	AVB→EIK
$C_{(AVB,GHG)}$	0,00	No	$D_{(AVB,GHG)}$	1,00	No	No
$C_{(AVB,BED)}$	0,80	Yes	$D_{(AVB,BED)}$	0,22	Yes	AVB→BED
$C_{(AVB,BKB)}$	0,80	Yes	$D_{(AVB,BKB)}$	0,31	Yes	AVB→BKB
$C_{(AVB,VET)}$	1,00	Yes	$D_{(AVB,VET)}$	0,00	Yes	AVB→VET
$C_{(AVB,YGE)}$	1,00	Yes	$D_{(AVB,YGE)}$	0,00	Yes	AVB→YGE
$C_{(EIF,AZD)}$	0,00	No	$D_{(EIF,AZD)}$	1,00	No	No
$C_{(EIF,AVG)}$	0,00	No	$D_{(EIF,AVG)}$	1,00	No	No
$C_{(EIF,AVB)}$	0,00	No	$D_{(EIF,AVB)}$	1,00	No	No
$C_{(EIF,EIK)}$	0,00	No	$D_{(EIF,EIK)}$	1,00	No	No
$C_{(EIF,GHG)}$	0,00	No	$D_{(EIF,GHG)}$	1,00	No	No
$C_{(EIF,BED)}$	0,00	No	$D_{(EIF,BED)}$	1,00	No	No
$C_{(EIF,BKB)}$	0,00	No	$D_{(EIF,BKB)}$	1,00	No	No
$C_{(EIF,VET)}$	0,00	No	$D_{(EIF,VET)}$	1,00	No	No
$C_{(EIF,YGE)}$	0,00	No	$D_{(EIF,YGE)}$	1,00	No	No
$C_{(EIK,AZD)}$	0,00	No	$D_{(EIK,AZD)}$	1,00	No	No
$C_{(EIK,AVG)}$	0,00	No	$D_{(EIK,AVG)}$	1,00	No	No
$C_{(EIK,AVB)}$	0,00	No	$D_{(EIK,AVB)}$	1,00	No	No
$C_{(EIK,EIF)}$	1,00	Yes	$D_{(EIK,EIF)}$	0,00	Yes	EIK→EIF
$C_{(EIK,GHG)}$	0,00	No	$D_{(EIK,GHG)}$	1,00	No	No
$C_{(EIK,BED)}$	0,00	No	$D_{(EIK,BED)}$	1,00	No	No
$C_{(EIK,BKB)}$	0,00	No	$D_{(EIK,BKB)}$	1,00	No	No
$C_{(EIK,VET)}$	0,00	No	$D_{(EIK,VET)}$	1,00	No	No
$C_{(EIK,YGE)}$	0,00	No	$D_{(EIK,YGE)}$	1,00	No	No
$C_{(GHG,AZD)}$	0,00	No	$D_{(GHG,AZD)}$	1,00	No	No
$C_{(GHG,AVG)}$	1,00	Yes	$D_{(GHG,AVG)}$	0,00	Yes	GHG→AVG
$C_{(GHG,AVB)}$	1,00	Yes	$D_{(GHG,AVB)}$	0,00	Yes	GHG→AVB
$C_{(GHG,EIF)}$	1,00	Yes	$D_{(GHG,EIF)}$	0,00	Yes	GHG→EIF
$C_{(GHG,EIK)}$	1,00	Yes	$D_{(GHG,EIK)}$	0,00	Yes	GHG→EIK
$C_{(GHG,BED)}$	0,80	Yes	$D_{(GHG,BED)}$	0,06	Yes	GHG→BED
$C_{(GHG,BKB)}$	0,80	Yes	$D_{(GHG,BKB)}$	0,24	Yes	GHG→BKB
$C_{(GHG,VET)}$	1,00	Yes	$D_{(GHG,VET)}$	0,00	Yes	GHG→VET
$C_{(GHG,YGE)}$	1,00	Yes	$D_{(GHG,YGE)}$	0,00	Yes	GHG→YGE
$C_{(BED,AZD)}$	0,00	No	$D_{(BED,AZD)}$	1,00	No	No
$C_{(BED,AVG)}$	1,00	Yes	$D_{(BED,AVG)}$	0,00	Yes	BED→AVG
$C_{(BED,AVB)}$	0,20	No	$D_{(BED,AVB)}$	0,78	No	No
$C_{(BED,EIF)}$	1,00	Yes	$D_{(BED,EIF)}$	0,00	Yes	BED→EIF
$C_{(BED,EIK)}$	1,00	Yes	$D_{(BED,EIK)}$	0,00	Yes	BED→EIK
$C_{(BED,GHG)}$	0,20	No	$D_{(BED,GHG)}$	0,94	No	No
$C_{(BED,BKB)}$	0,80	Yes	$D_{(BED,BKB)}$	0,35	Yes	BED→BKB
$C_{(BED,VET)}$	1,00	Yes	$D_{(BED,VET)}$	0,00	Yes	BED→VET
$C_{(BED,YGE)}$	1,00	Yes	$D_{(BED,YGE)}$	0,00	Yes	BED→YGE
$C_{(BKB,AZD)}$	0,20	No	$D_{(BKB,AZD)}$	0,84	No	No
$C_{(BKB,AVG)}$	0,20	No	$D_{(BKB,AVG)}$	0,14	Yes	No

C_{pq}		$C_{pq} \geq \overline{C}$	D_{pq}		$D_{pq} \leq \overline{D}$	$A_p \rightarrow A_q$
$C_{(BKB,AVB)}$	0,20	No	$D_{(BKB,AVB)}$	0,69	No	No
$C_{(BKB,EIF)}$	1,00	Yes	$D_{(BKB,EIF)}$	0,00	Yes	BKB→EIF
$C_{(BKB,EIK)}$	1,00	Yes	$D_{(BKB,EIK)}$	0,00	Yes	BKB→EIK
$C_{(BKB,GHG)}$	0,20	No	$D_{(BKB,GHG)}$	0,76	No	No
$C_{(BKB,BED)}$	0,20	No	$D_{(BKB,BED)}$	0,65	No	No
$C_{(BKB,VET)}$	0,60	Yes	$D_{(BKB,VET)}$	0,28	Yes	BKB→VET
$C_{(BKB,YGE)}$	1,00	Yes	$D_{(BKB,YGE)}$	0,00	Yes	BKB→YGE
$C_{(VET,AZD)}$	0,00	No	$D_{(VET,AZD)}$	1,00	No	No
$C_{(VET,AVG)}$	0,40	No	$D_{(VET,AVG)}$	0,48	Yes	No
$C_{(VET,AVB)}$	0,00	No	$D_{(VET,AVB)}$	1,00	No	No
$C_{(VET,EIF)}$	1,00	Yes	$D_{(VET,EIF)}$	0,00	Yes	VET→EIF
$C_{(VET,EIK)}$	1,00	Yes	$D_{(VET,EIK)}$	0,00	Yes	VET→EIK
$C_{(VET,GHG)}$	0,00	No	$D_{(VET,GHG)}$	1,00	No	No
$C_{(VET,BED)}$	0,00	No	$D_{(VET,BED)}$	1,00	No	No
$C_{(VET,BKB)}$	0,40	No	$D_{(VET,BKB)}$	0,72	No	No
$C_{(VET,YGE)}$	1,00	Yes	$D_{(VET,YGE)}$	0,00	Yes	VET→YGE
$C_{(YGE,AZD)}$	0,00	No	$D_{(YGE,AZD)}$	1,00	No	No
$C_{(YGE,AVG)}$	0,00	No	$D_{(YGE,AVG)}$	1,00	No	No
$C_{(YGE,AVB)}$	0,00	No	$D_{(YGE,AVB)}$	1,00	No	No
$C_{(YGE,EIF)}$	1,00	Yes	$D_{(YGE,EIF)}$	0,00	Yes	YGE→EIF
$C_{(YGE,EIK)}$	1,00	Yes	$D_{(YGE,EIK)}$	0,00	Yes	YGE→EIK
$C_{(YGE,GHG)}$	0,00	No	$D_{(YGE,GHG)}$	1,00	No	No
$C_{(YGE,BED)}$	0,00	No	$D_{(YGE,BED)}$	1,00	No	No
$C_{(YGE,BKB)}$	0,00	No	$D_{(YGE,BKB)}$	1,00	No	No
$C_{(YGE,VET)}$	0,00	No	$D_{(YGE,VET)}$	1,00	No	No

According to the information in Table 7, 43 dominance relationships of alternatives are observed in 90 comparisons of dominance. Accordingly, fund AZD has superiority over fund AVG, AVB, EIF, EIK, GHG, BED, BKB, VET and YGE, fund AVG has superiority over fund EIF, EIK and YGE, fund AVB has superiority over fund AVG, EIF, EIK, BED, BKB, VET and YGE, fund EIK has superiority over fund EIF, fund GHG has superiority over fund AVG, AVB, EIF, EIK, BED, BKB, VET and YGE, fund BED has superiority over fund AVG, EIF, EIK, BKB, VET and YGE, fund BKB has superiority over fund EIF, EIK, VET and YGE, fund VET has superiority over fund EIF, EIK and YGE, fund YGE has superiority over fund EIF and EIK.

Step 7: Calculation of Net Concordance and Discordance Indexes. Net concordance and discordance indexes are calculated to determine which alternative is more dominant than the other. The calculated net concordance indexes (Cp) are sorted by descending order and net disconcordance indexes (Dp) are sorted by ascending order. Accordingly, the generated ranking is shown in Table 8.

TABLE 8: CP AND DP VALUES AND RANKINGS (2012)

Fund Code	C_p Value	Rankings	D_p Value	Rankings
AZD	8,600	1	-8,688	1
AVG	-0,200	6	1,769	7
AVB	4,200	3	-3,930	3
EIF	-9,000	10	9,000	10
EIK	-7,000	9	7,000	9
GHG	6,200	2	-6,396	2
BED	3,400	4	-2,864	4
BKB	0,200	5	-2,277	5
VET	-1,400	7	1,386	6
YGE	-5,000	8	5,000	8

Table 9 includes 2010-2012 analysis period values of C_p and D_p and performance rankings of the funds that are made according to these values.

TABLE 9: C_P AND D_P VALUES AND

Fund Code	2010				2011				2012			
	C	Rankings	D	Rankings	C	Rankings	D	Rankings	C	Rankings	D	Rankings
AZD	6,000	**2**	-6,000	**2**	2,200	**4**	-2,155	**4**	8,600	**1**	-8,688	**1**
AVG	-0,400	**6**	1,518	**7**	5,000	**2**	-5,676	**2**	-0,200	**6**	1,769	**7**
AVB	1,400	**5**	-0,246	**5**	8,600	**1**	-8,988	**1**	4,200	**3**	-3,930	**3**
EIF	-8,200	**10**	7,929	**9**	-5,000	**9**	3,454	**7**	-9,000	**10**	9,000	**10**
EIK	2,200	**4**	-2,695	**4**	-0,600	**6**	0,432	**6**	-7,000	**9**	7,000	**9**
GHG	9,000	**1**	-8,000	**1**	5,000	**3**	-4,816	**3**	6,200	**2**	-6,396	**2**
BED	-3,800	**8**	3,956	**8**	-7,800	**10**	8,796	**10**	3,400	**4**	-2,864	**4**
BKB	-2,200	**7**	1,200	**6**	-3,400	**7**	4,198	**8**	0,200	**5**	-2,277	**5**
VET	3,800	**3**	-4,733	**3**	0,600	**5**	-0,794	**5**	-1,400	**7**	1,386	**6**
YGE	-7,800	**9**	8,071	**10**	-4,600	**8**	5,549	**9**	-5,000	**8**	5,000	**8**

PERFORMANCE RANKINGS OF THE FUNDS

According to Table 9, AZD and GHG coded funds achieved the first two places in the year 2010, but these funds reduced their performance in 2011. In 2012, both funds received the first places with a performance increase. AVG and AVB coded funds take part in mid-table in 2010, but in 2011, they showed a rapid rise and took the first two places. However, these funds could not maintain their current situation in 2012, and fell down to the middle ranks.

EIF and YGE coded funds took the last places in all the analysis period and showed low performance when compared to other funds. EIK and VET coded funds took place near the first row in the year 2010. However, these funds showed a poor performance in 2011 and 2012. Therefore, they took place in the last rows. BED and BKB coded funds achieved better ranking value by showing performance improvement in 2012 than in 2010 and 2011.

5. CONCLUSION

In this study, Turkish Gov't bonds and bills (FX) pension funds' portfolio performance are determined by using their daily data for the period 2010-2012. In the first part of the analysis, in order to determine the performance of the funds performance measurement methods, which are accepted in the literature widely, are calculated separately for each fund. In the second part of the analysis, the calculated performance values are used as input of ELECTRE method. According to the results, the performance ranking of funds carried out.

As a result of the study, according to the calculated Cp and Dp values of funds in the analysis period, the performance of funds is found variable. In the analysis period, AZD and GHG coded funds generally took place in the higher ranks and its high level performance position did not change so much. This situation highlights AZD and GHG coded funds. In addition, the performance of EIF and YGE coded funds is found to be generally low during the analysis period.

The results of this study provide information to the portfolio managers and existing or potential investors about the portfolio performance status of Turkish Gov't bonds and bills (FX) pension funds in the Turkish Private Pension System. Even though the success of the fund depends directly on the performance of the fund manager, this study compares the performance of the funds within a given period rather than that of the fund managers. Since the calculations are based on historical data, the results cannot be regarded as indicators for the following year's performance and it neither reflects the change of management nor measures the skills of managers.

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