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Research Article

Evaluation of the Financial Performance of Sustainability Funds in Turkey Using CRITIC and TOPSIS Methods

Türkiye'deki Sürdürülebilirlik Fonlarının Finansal Performanslarının CRITIC ve TOPSIS Yöntemleri ile Değerlendirilmesi

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Abstract

Heightened environmental consciousness has spurred demand for sustainability-oriented financial instruments globally. This study investigates the performance of sustainability mutual funds traded on Turkey's Electronic Fund Trading Platform (TEFAS) from 2022 to 2024, benchmarked against the BIST100 index. Performance is evaluated using the Sharpe ratio, Value at Risk (VaR_{90}), and Maximum Drawdown (MDD) metrics, selected for their robust capacity to measure risk-adjusted returns, loss risk, and portfolio stability. The TOPSIS multi-criteria decision-making method ranks the funds, with criteria weights derived from the objective CRITIC method, which accounts for inter-criteria correlations. The aggregated performance of the funds is compared to the BIST100 to assess overall trends. Findings indicate that sustainability funds generally exhibit higher risk-adjusted returns, though not statistically significant, and significantly reduced loss risk and enhanced stability compared to the BIST100. Despite these advantages, the BIST100 outperforms the aggregated sustainability funds in overall TOPSIS rankings. TOPSIS rankings reveal heterogeneity in fund performance, with some funds demonstrating exceptional results and others underperforming. The findings underscore the risk-mitigation potential of environmental, social, and governance (ESG)-focused investments in Turkey, supported by growing sustainability awareness. The study advocates for standardized ESG frameworks, regulatory enhancements, and investor education to strengthen the adoption of sustainability funds, contributing to both academic discourse and practical investment strategies in emerging markets.

Keywords: *Sustainability Mutual Funds, CRITIC, TOPSIS, BIST100, Portfolio Performance Evaluation*

Öz

Artan çevresel farkındalık, sürdürülebilirlik odaklı finansal araçlara küresel talebi artırmıştır. Bu çalışmada, 2022-2024 yılları arasında Türkiye Elektronik Fon Alım Satım Platformu'nda (TEFAS) işlem gören sürdürülebilirlik yatırım fonlarının performansını, BIST100 endeksiyle karşılaştırarak analiz edilmiştir. Performans, risk ayarlı getirileri, kayıp riskini ve portföy istikrarını ölçen Sharpe oranı, Riske Maruz Değer (VaR_{90}) ve Maksimum Düşüş (MDD) metrikleriyle değerlendirilmiştir. Bu metrikler, finansal performansı kapsamlı bir şekilde analiz etme kapasiteleri nedeniyle seçilmiştir. Fonlar, TOPSIS çok kriterli karar verme yöntemiyle sıralanmış; kriter ağırlıkları, kriterler arası korelasyonları dikkate alan nesnel CRITIC yöntemiyle hesaplanmıştır. Fonların ortalama performansı da BIST100 ile karşılaştırılmıştır Bulgular, sürdürülebilirlik fonlarının genel olarak daha yüksek risk-getiri oranına sahip olduğunu, ancak bu farkın istatistiksel olarak anlamlı olmadığını göstermektedir. Bununla birlikte, sürdürülebilirlik fonları, BIST100'e kıyasla önemli ölçüde

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daha düşük kayıp riski ve daha yüksek istikrar sergilemektedir. Bu avantajlara rağmen, BIST100, genel TOPSIS sıralamasında sürdürülebilirlik fonlarının toplu performansını geride bırakmaktadır. TOPSIS sıralamaları, fon performanslarında heterojenlik olduğunu ortaya koymuş, bazı fonlar olağanüstü sonuçlar gösterirken diğerleri düşük performans sergilemiştir. Sonuçlar, Türkiye'de artan sürdürülebilirlik farkındalığıyla desteklenen çevresel, sosyal ve yönetişim (ESG) odaklı yatırımların risk azaltma potansiyelini vurgulamaktadır. Çalışma, standart ESG çerçeveleri, düzenleyici iyileştirmeler ve yatırımcı eğitimi ihtiyacını belirterek, gelişmekte olan piyasalarda akademik tartışmalara ve pratik yatırım stratejilerine katkı sunmaktadır.

Anahtar Kelimeler: *Sürdürülebilirlik Yatırım Fonları, CRITIC, TOPSIS, BIST100, Portföy Performans Değerlendirme*

1. Introduction

Modern portfolio theory (MPT), pioneered by Markowitz (1952), emphasizes that constructing portfolios with assets exhibiting low correlations can significantly reduce overall risk while optimizing returns. This principle requires investors to meticulously select securities with minimal correlation and vigilantly monitor both portfolio components and external market dynamics throughout the investment period to effectively manage risk exposure. Such a process demands substantial expertise in finance, statistics, and data analysis, as well as considerable time and resources dedicated to portfolio management, often rendering it inaccessible to individual investors without professional support.

To address these complexities, mutual funds have emerged as a cornerstone of modern financial markets, offering individual investors access to diversified investment vehicles managed by professional fund managers. In Turkey, mutual funds have gained substantial traction, facilitated by the Turkish Electronic Fund Trading Platform (TEFAS). As of December 2024, TEFAS lists a diverse array of mutual funds, including 209 free umbrella funds, 128 equity umbrella funds, 126 variable umbrella funds, 77 fund basket funds, 53 participation umbrella funds, 51 debt securities umbrella funds, 36 money market umbrella funds, 18 precious metals umbrella funds, and 8 mixed umbrella funds, with an average daily trading volume of 22.7 billion TRY (TEFAS, 2024). This vibrant mutual fund ecosystem underscores their critical role in Turkey's financial landscape, enabling investors to allocate capital across a wide range of money and capital market instruments, such as repos, deposits, bonds, precious metals, and equities, with returns or losses distributed proportionally to their investment (SPK, 2024).

In recent years, investor preferences have increasingly shifted toward sustainability, driven by growing awareness of environmental, social, and governance (ESG) factors. Companies that fail to adhere to robust sustainability practices are often perceived as higher-risk entities by lenders and investors, leading to elevated borrowing costs and cautious investment decisions by financial institutions. A growing body of academic research highlights the positive impact of ESG integration on financial performance, with studies such as Friede, Busch, and Bassen (2015) demonstrating that ESG-focused investments frequently deliver superior or at least comparable risk-adjusted returns relative to traditional investments. Consequently, leading global asset managers and funds have increasingly embedded ESG criteria into their investment frameworks, prioritizing companies with transparent and robust ESG disclosures (Busch, Bauer, and Orlitzky, 2016).

Sustainability mutual funds, which integrate ESG criteria into their investment strategies, aim to balance financial returns with societal and environmental benefits. Globally, these funds have surged in popularity due to their lower risk profiles and more stable returns compared to conventional funds (Renneboog, Ter Horst, and Zhang, 2008). In Turkey, while sustainability mutual funds are gaining momentum, their financial performance relative to broader market benchmarks, such as the BIST100 index, remains underexplored. The academic literature presents mixed findings on the performance of ESG-focused investments: while Friede, Busch, and Bassen (2015) suggest that sustainability investments typically yield positive or neutral financial outcomes, Climent and Soriano (2011) argue that such funds may underperform traditional funds in certain contexts. This divergence underscores the need for empirical studies tailored to specific markets, particularly in emerging economies like Turkey, where sustainability investing is still nascent.

This study evaluates the performance of 14 sustainability mutual funds traded in Turkey between 2022 and 2024, comparing their performance both among themselves and against the BIST100 index. Employing a robust analytical framework, the study assesses performance using the Sharpe ratio, Value-

at-Risk (VaR_{90}), and Maximum Drawdown (MDD) metrics, with criteria weights determined via the CRITIC method and fund rankings established using the TOPSIS method. The research addresses two key questions: (1) Which sustainability mutual funds in Turkey exhibit superior performance? (2) How does the aggregate performance of sustainability funds compare to the BIST100 index? To this end, the following hypotheses are tested:

- **H1:** Sustainability mutual funds exhibit higher risk-adjusted returns (Sharpe ratio) than the BIST100 index.
- **H2:** Sustainability mutual funds demonstrate lower loss risk (VaR_{90}) than the BIST100 index.
- **H3:** Sustainability mutual funds display greater stability (lower MDD) than the BIST100 index.

This study aims to make a significant contribution to the limited but growing literature on sustainability mutual funds in Turkey by employing multi-criteria decision-making methods (CRITIC and TOPSIS) to deliver an objective and comprehensive performance evaluation. By elucidating the financial merits of ESG-focused investments relative to the broader market, the findings provide actionable insights for investors and fund managers in Turkey's emerging market context. Moreover, the study bridges a critical research gap by offering empirical evidence on the performance of sustainability funds, thereby advancing the academic and practical understanding of sustainable investing in Turkey.

2. Literature Review

Sustainability mutual funds seek to harmonize financial returns with environmental and social benefits by embedding environmental, social, and governance (ESG) criteria into their investment frameworks. Scholarly literature highlights distinct risk-return profiles for sustainability funds compared to conventional funds. Renneboog, Ter Horst, and Zhang (2008) assert that sustainability funds typically exhibit lower risk profiles while delivering returns comparable to those of traditional funds. A comprehensive meta-analysis by Friede, Busch, and Bassen (2015), encompassing over 2,000 studies, concludes that ESG investments generally exert a positive or neutral effect on financial performance. Busch, Bauer, and Orlitzky (2016) further emphasize the positive contribution of ESG investments to long-term performance, an effect that intensifies with escalating environmental risks.

Performance evaluation of sustainability funds frequently employs traditional risk-adjusted metrics, such as the Sharpe ratio, Treynor ratio, and Value-at-Risk (VaR). Nofsinger and Varma (2014) highlight that sustainability funds demonstrate reduced volatility during economic downturns, underscoring the relevance of risk metrics like VaR in performance assessments. The influence of ESG criteria on long-term returns has become increasingly evident amid rising environmental risks (Climent and Soriano, 2011). Beyond risk mitigation, ESG investments offer ancillary benefits, such as enhanced portfolio diversification (Giese et al., 2019). Giese et al. (2019) demonstrate that ESG factors diminish portfolio risk, with sustainability funds often outperforming their counterparts in developed markets.

Market-specific studies provide further insights. Ielasi, Rossolini, and Limberti (2018) evaluated 106 ethical and 51 sustainability-themed funds traded in Europe from 1996 to 2015, utilizing the Fama-French three-factor model. Their analysis, based on Jensen's alpha, revealed that sustainability-themed funds experienced less pronounced performance declines compared to ethical funds, although no significant differences were observed in Beta coefficients, which reflect market risk. Saci, Jasimuddin, and Hasan (2022) compared socially responsible investment funds in the Chinese market with traditional funds from 2016 to 2019, employing the Mann Whitney U test. Their findings indicate no significant difference in returns, but socially responsible funds exhibited significantly lower risk. These results reinforce the proposition that sustainability funds confer advantages in risk reduction and long-term performance while maintaining return parity with traditional funds.

In the Turkish context, research on sustainability funds remains limited. Studies in Turkey often compare the Borsa Istanbul Sustainability Index (XUSRD) with the BIST-100 Index or analyze the performance of sustainable-themed funds against traditional ones. Özman (2022) analyzed data from 2014 to 2022 and found that the XUSRD did not outperform the BIST-100 during loss-making years and exhibited higher risk levels, suggesting it is not suitable as a risk-hedging tool in Turkey. Similarly, Ateş, Dağıdır Çakan, and Koç (2022) compared sustainability-themed funds with traditional funds in Turkey from

2019 to 2022, using metrics such as standard deviation, Sharpe ratio, Jensen's alpha, and Treynor ratio. Their findings suggest that sustainability-themed funds outperformed traditional counterparts. These studies underscore the need for further research to elucidate the potential of sustainability funds in Turkey. However, Gök and Özdemir (2017) concluded that the Sustainability Index does not provide financial incentives for investors.

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Multi-criteria decision-making (MCDM) methods are instrumental in addressing complex decision-making challenges by integrating multiple criteria. In the context of sustainability fund performance evaluation, MCDM methods facilitate comprehensive analysis by combining financial and ESG-focused criteria. Pendaraki, Zopounidis, and Doumpos (2005) applied UTADIS MCDM to evaluate mutual funds in Greece, demonstrating its efficacy in balancing multiple criteria. The CRITIC method is widely utilized for objectively determining criteria weights (Jahan and Edwards, 2015). Recent studies have increasingly adopted MCDM methods for sustainability investments. For instance, Bilbao-Terol et al. (2014) employed the Analytic Hierarchy Process (AHP) and TOPSIS to assess socially responsible mutual funds, highlighting the robustness of these methods in complex performance evaluations. These findings affirm the utility of MCDM methods as powerful tools for evaluating sustainability investment performance.

In conclusion, the literature underscores that sustainability funds offer significant advantages in risk reduction and long-term performance, while generally achieving returns comparable to traditional funds. Although research in Turkey is limited, existing studies provide a foundation for exploring the potential of sustainability funds and the efficacy of MCDM methods in performance evaluation. The application of CRITIC and TOPSIS methods to assess sustainability funds in Turkey offers a holistic approach, integrating financial and ESG-focused criteria to provide a robust evaluation framework.

3. Data and Methodology

This study evaluated the performance of sustainability mutual funds traded between 2022 and 2024 using the Sharpe ratio, VaR_{90}, and Maximum Drawdown (MDD) methods. The price data used in the calculations was obtained from the Turkish Electronic Fund Trading Platform (TEFAS) website (TEFAS, 2024). The 14 sustainability funds traded over the three-year period are presented in Table 1.

Table 1: Sustainability-Themed Funds Traded on TEFAS Between 2022 and 2024

Fund Code	Fund Name
AOY	AK Portföy Alternative Energy Foreign Equity Fund
ESG	Aktif Portföy ESG Sustainability Free Fund
GZH	Garanti Portföy Clean Energy Variable Fund
GZR	Garanti Portföy Sustainability Equity (TRY) Fund (Equity-Intensive Fund)
GZV	Garanti Portföy ESG Sustainability Fund Basket Fund
HMS	HSBC Portföy Sustainability Equity (TRY) Fund (Equity-Intensive Fund)
IHK	İş Portföy İş'te Kadın Equity (TRY) Fund (Equity-Intensive Fund)
IKP	İş Portföy Renewable Energy Mixed Fund
IPJ	İş Portföy Electric Vehicles Mixed Fund
KSR	Kuveyt Türk Portföy Sustainability Participation Fund

Fund Code	Fund Name
OLD	QNB Portföy Clean Energy and Water Fund Basket Fund
TJF	TEB Portföy Sustainability Fund Basket Fund
TMC	İş Portföy Tema Variable Fund
YJH	Yapı Kredi Portföy Clean Energy Variable Fund

To compare sustainability-themed funds with the BIST100 index as a market benchmark, the average daily prices of each fund were calculated, and a variable named ORT, representing the average of sustainability funds, was created and included in the dataset alongside the BIST100 index.

The analysis was conducted using a daily dataset. Returns were calculated using the logarithmic return formula:

$$r_t = \ln\left(\frac{P_t}{P_{t-1}}\right) \quad (1)$$

where r_t represents the logarithmic return at time t, and P_t denotes the price at time t. The dataset includes daily closing prices obtained from Borsa İstanbul (Borsa İstanbul 2020).

3.1. Performance Metrics

Initially, eight metrics were calculated for performance evaluation: Sharpe ratio, Sortino ratio, Treynor ratio, Beta, Jensen's Alpha, Omega ratio, VaR_{90}, and $CVaR_{90}$. However, a selection process was applied to determine the metrics to be used in the CRITIC and TOPSIS analyses. First, the Treynor ratio, Beta, and Jensen's Alpha were excluded because they could not be calculated for XU100, as these metrics require performance evaluation relative to a market index, and such values are undefined for XU100 itself. Subsequently, a correlation analysis was conducted among the metrics. The correlation matrix was calculated as follows:

Table 2: Performance Metrics Correlations

	Sharpe_Ratio	*Sortino_Ratio*	*Omega_Ratio*	*VaR_90*	*CVaR_90*	*MDD*
Sharpe_Ratio	1.0000					
Sortino_Ratio	0.9918	1.0000				
Omega_Ratio	0.9958	0.9910	1.0000			
VaR_90	0.5446	0.6052	0.5446	1.0000		
CVaR_90	0.3646	0.4386	0.3717	0.9738	1.0000	
MDD	0.5236	0.5856	0.5067	0.9515	0.9175	1.0000

The correlation analysis revealed:

- A very high correlation (0.9918–0.9958-0.9910) between the Sharpe ratio, Sortino ratio, and Omega ratio. Since these three metrics measure risk-adjusted returns and provide redundant information, only the Sharpe ratio was selected. The Sharpe ratio, one of the most widely used metrics in financial analysis, accounts for total risk.
- A high correlation (0.9915-0.9175-0.9738) between VaR_{90}, $CVaR_{90}$, and MDD. VaR_{90} offers a simpler approach to measuring tail risk, while $CVaR_{90}$ provides a more comprehensive risk assessment by measuring the average loss beyond this threshold. However, VaR_{90} was chosen for this study because it better reflects the differences among funds in the dataset.
- A moderate-to-high correlation between return metrics (Sharpe, Sortino, Omega) and risk metrics (VaR_{90}, $CVaR_{90}$, MDD), indicating a strong relationship between returns and risk.

Finally, the Maximum Drawdown (MDD) metric was included to measure the portfolio's stability and resilience. Although MDD shows a moderate-to-high correlation with other metrics, it was included in

the analysis because it provides a different perspective (worst-case loss). Ultimately, the following three metrics were selected for the CRITIC and TOPSIS analyses:

- **Sharpe Ratio:** Performance dimension (to be maximized).
- **VaR$_{90}$:** Loss risk dimension (to be minimized).
- **MDD:** Stability/resilience dimension (to be minimized).

These metrics comprehensively evaluate the financial performance and risk profile of sustainability funds by covering performance, loss risk, and stability dimensions.

3.1.1. Sharpe Ratio

The Sharpe ratio measures the excess return per unit of total risk (standard deviation) of a portfolio (Sharpe, 1966):

$$\text{Sharpe Ratio} = \frac{R_p - R_f}{\sigma_p} \quad (2)$$

where R_p is the expected return of the portfolio (daily average return), R_f is the risk-free rate, and σ_p is the standard deviation of portfolio returns. The risk-free rate was calculated as the average of the 1-year government bond interest rates published by the Central Bank of the Republic of Turkey (CBRT) for the 2022–2024 period. During this period, the annual average of 1-year government bond interest rates was 33.33%. Using the effective interest formula and assuming 365 days in a year, the daily risk-free rate was calculated as follows:

$$R_f = (1 + 0.3333)^{\frac{1}{365}} - 1$$

With this formula, the daily risk-free rate was found to be approximately 0.0795%.

3.1.2. VaR90 (Value at Risk)

VaR$_{90}$ measures the maximum potential loss of a portfolio at a 90% confidence level (Jorion, 2007). VaR$_{90}$ was calculated by taking the 90th percentile of the daily return distribution. Considering negative returns, the potential loss risk for each fund was determined.

3.1.3. Maximum Drawdown (MDD)

Maximum Drawdown (MDD) measures the largest loss (peak-to-trough decline) of a portfolio over a specific period:

$$\text{MDD} = \min\left(\frac{R_t - R_{\text{peak}}}{R_{\text{peak}}}\right) \quad (3)$$

where R_t is the cumulative return at a given time, and R_{peak} is the highest cumulative return up to that point. MDD measures the portfolio's stability and resilience during crisis periods. Lower (negative but smaller in absolute value) MDD values indicate more stable portfolios.

3.2. Determination of Criteria Weights Using the CRITIC Method

Criteria weights were determined using the CRITIC method. The CRITIC method provides objective weighting by considering both the variance within each criterion and its correlation with other criteria (Diakoulaki, Mavrotas, and Papayannakis, 1995). The CRITIC method involves the following steps: First, the Sharpe ratio, VaR$_{90}$, and MDD values for each fund were placed in a decision matrix:

$$X = [x_{ij}] \quad (i = 1,2,\dots,m; j = 1,2,\dots,n) \quad (4)$$

The decision matrix was normalized using the "Divide by Column Sum" normalization method to equalize the different scales of the criteria:

$$r_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} \quad (5)$$

The standard deviation (σ_j) for each criterion was calculated, and Pearson correlation coefficients (ρ_{jk}) between criteria were determined. The amount of information (C_j) for each criterion was calculated as follows:

$$C_j = \sigma_j \sum_{k=1}^{n} (1 - \rho_{jk}) \quad (6)$$

where σ_j is the standard deviation of the j-th criterion, ρ_{jk} is the correlation coefficient between the j-th and k-th criteria, and $1 - \rho_{jk}$ represents the conflict (independence) between criteria. Finally, the weight (w_j) for each criterion was calculated as:

$$w_j = \frac{C_j}{\sum_{k=1}^{n} C_k} \quad (7)$$

3.3. TOPSIS Method

The TOPSIS method ranks alternatives based on their closeness to the ideal solution (Hwang and Yoon 1981). The decision matrix was normalized using the "Shift" method for handling negative values and the "Divide by Column Sum" normalization type:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \quad (8)$$

The normalized matrix was multiplied by the weights determined using the CRITIC method:

$$v_{ij} = w_j \cdot r_{ij} \quad (9)$$

The ideal best (A^+) and ideal worst (A^-) solutions for each criterion were determined: for Sharpe, $A^+ = \max(v_{ij}), A^- = \min(v_{ij})$ (higher values are better); for VaR_{90}, $A^+ = \min(v_{ij}), A^- = \max(v_{ij})$ (lower values are better). The distances of each alternative to the ideal solution (S_i^+) and the negative ideal solution (S_i^-) were calculated:

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

The closeness score (C_i) for each alternative was calculated as:

$$C_i = \frac{S_i^-}{S_i^+ + S_i^-} \quad (11)$$

The C_i value ranges between 0 and 1, with values closer to 1 indicating better performance.

3.4. Analysis Process and Rationale for Method Selection

The analysis was conducted using the Python programming language. Data processing and performance metric calculations were performed using the Pandas and NumPy libraries, while graphical analyses were conducted using the Matplotlib and Seaborn libraries. The CRITIC and TOPSIS methods were implemented using custom Python functions. All calculations were performed on a daily dataset, and the results were statistically analyzed. The Sharpe ratio, VaR_{90}, and MDD metrics were selected because they provide different perspectives on performance, loss risk, and stability, respectively. For sustainability funds, these metrics offer a suitable framework for evaluating both financial performance and risk-averse capacity of ESG investments (Nofsinger and Varma, 2014).

The CRITIC method objectively determines criteria weights, avoiding subjective judgments and providing balanced weighting by considering correlations between criteria (Diakoulaki, Mavrotas, and Papayannakis, 1995). TOPSIS, on the other hand, ranks alternatives based on their closeness to the ideal solution and distance from the negative ideal solution, enabling the simultaneous evaluation of multiple criteria, making it suitable for financial performance analysis (Pendaraki, Zopounidis, and Doumpos, 2005). Therefore, CRITIC and TOPSIS methods were chosen for this study to address the multi-criteria decision-making problem.

4. Findings

Table 3 presents the Sharpe ratio, VaR_{90}, and MDD values for each sustainability fund. This table also used as decision matrix. Table 4 provides a statistical summary of the metrics.

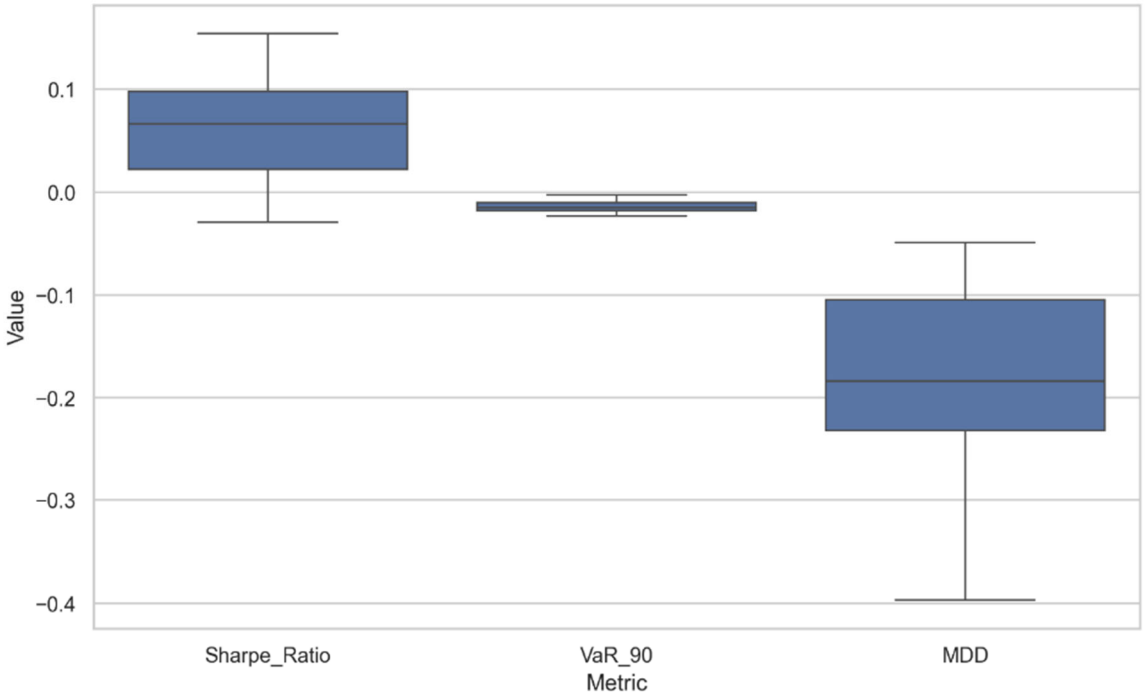
Table 3: Performance Metrics

Fund/Index	Sharpe Ratio	VaR_{90}	MDD
AOY	-0.0293	-0.0234	-0.3966
ESG	0.1049	-0.0029	-0.0490
GZH	0.0070	-0.0180	-0.2354
GZR	0.0953	-0.0169	-0.2133
GZV	0.0600	-0.0097	-0.1050
HMS	0.1080	-0.0181	-0.2304
IHK	0.1270	-0.0173	-0.2542
IKP	0.0378	-0.0112	-0.1557
IPJ	0.0244	-0.0144	-0.1600
KSR	0.0877	-0.0080	-0.0879
OLD	0.0154	-0.0159	-0.1938
TJF	0.0303	-0.0122	-0.1734
TMC	0.1541	-0.0039	-0.0510
YJH	0.0022	-0.0182	-0.2116
ORT	0.0761	-0.0102	-0.1030
XU100	0.0724	-0.0186	-0.2461

Table 4: Statistical Summary of Metrics

Metric	Mean	Standard Deviation	Minimum	Maximum
Sharpe Ratio	0.0610	0.0487	-0.0293	0.1541
VaR90	-0.0138	0.0057	-0.0234	-0.0029
MDD	-0.1794	0.0925	-0.3966	-0.0490

The average Sharpe ratio of sustainability funds is 0.0610, the average VaR_{90} is -0.0138, and the average MDD is -0.1794. The Sharpe ratio exhibits the highest standard deviation (0.0487), indicating greater variance in risk-adjusted returns among funds. VaR_{90} shows a narrower distribution (standard deviation: 0.0057), suggesting that the loss risk of sustainability funds is less variable. MDD indicates significant differences in stability among funds (standard deviation: 0.0925). Figure 1 visualizes the distribution and outliers of the metrics.



This box plot shows the distribution and outliers of the Sharpe ratio, VaR_{90}, and MDD. The Sharpe ratio has the widest distribution. VaR_{90} shows a narrower distribution. MDD includes outliers such as AOY (-0.3966).

Figure 1: Distribution of Metrics

4.1. CRITIC Weights

The CRITIC method was implemented following a structured procedure to ensure robust and reliable weight calculations. The decision matrix, comprising 16 alternatives evaluated across the three criteria, contains zero values (e.g., for the alternative AOY), which requires preprocessing to ensure all values are positive, as mandated by the method. The preprocessing step involves applying a *shift* transformation, where the minimum value of the matrix is subtracted, and a constant (1) is added to all entries. Adjusted decision matrix is presented in Table 5.

Table 5: Adjusted Decision Matrix

	Sharpe_Ratio	**VaR_90**	**MDD**
AOY	1.367333	1.373270	1
ESG	1.501494	1.393687	1.347599
GZH	1.403593	1.378603	1.161211
GZR	1.491884	1.379699	1.183345
GZV	1.456592	1.386905	1.291668
HMS	1.504667	1.378505	1.166184
IHK	1.523655	1.379364	1.142436
IKP	1.434469	1.385432	1.240889
IPJ	1.421029	1.382205	1.236656
KSR	1.484285	1.388671	1.308756
OLD	1.412062	1.380736	1.202812

	Sharpe_Ratio	VaR_90	MDD
TJF	1.426977	1.384469	1.223280
TMC	1.550707	1.392686	1.345589
YJH	1.398874	1.378475	1.185039
ORT	1.472767	1.386421	1.293624
XU100	1.468997	1.378048	1.150563

Following preprocessing, the decision matrix is normalized using the Min-Max normalization technique, scaling all values to the [0, 1] interval. This normalization ensures comparability across criteria with different scales. The standard deviation of each criterion in the normalized matrix is then calculated to quantify its contrast intensity, reflecting the variability in the criterion's values across alternatives. Next, a correlation matrix is constructed to assess the interrelationships between criteria. The conflict measure for each criterion is determined by summing the complements of the correlation coefficients (i.e., $1 - r_{jk}$), where r_{jk} represents the Pearson correlation coefficient between criteria j and k. A higher conflict measure indicates that a criterion provides unique information, increasing its importance.

Table 6: Normalized Decision Matrix for CRITIC Method

	Sharpe_Ratio	VaR_90	MDD
AOY	0	0	0
ESG	0.731625	1	1
GZH	0.197740	0.261226	0.463785
GZR	0.679217	0.314904	0.527461
GZV	0.486762	0.667823	0.839095
HMS	0.748931	0.256429	0.478092
IHK	0.852477	0.298469	0.409771
IKP	0.366118	0.595658	0.693010
IPJ	0.292822	0.437622	0.680830
KSR	0.637777	0.754316	0.888254
OLD	0.243924	0.365666	0.583466
TJF	0.325258	0.548513	0.642349
TMC	1.000000	0.950961	0.994218
YJH	0.172003	0.254931	0.532336
ORT	0.574969	0.644114	0.844723
XU100	0.554408	0.234044	0.433151

The information content of each criterion, denoted as C_j, is computed as the product of its standard deviation and conflict measure. Finally, the weights are obtained by normalizing these information content values so that their sum equals one:

$$w_j = \frac{C_j}{\sum_{k=1}^{n} C_k}, \tag{12}$$

where w_j is the weight of criterion j, and C_j is its information content. The implementation includes error checks to ensure that no negative weights are produced, which could indicate inconsistencies in the data or normalization process.

The weights determined by the CRITIC method are as follows: 0.4845 for the Sharpe ratio, 0.2628 for VaR_{90}, and 0.2527 for MDD. The highest weight for Sharpe ratio indicates that this metric better reflects the differences among funds in the dataset and contains more information.

4.2. Evaluation of Sustainability Funds Among Themselves Using TOPSIS Method

The TOPSIS method involves a systematic procedure to rank alternatives by calculating their relative closeness to the ideal solution. The implementation, as integrated into the decision-making application, ensures robust handling of the decision matrix and produces a ranked list of sustainability funds based on their performance scores. The steps of the TOPSIS method, as applied in this study, are described below.

First, for the decision matrix, consisting of 16 sustainability funds evaluated across the three criteria, Table 5 is used to ensures consistency between the weight calculation by CRITIC and the TOPSIS ranking, in order to handle negative values properly. Thus, the decision matrix was normalized using the "Shift" method for handling negative values and the "Divide by Column Sum" normalization type, normalized decision matrix for TOPSIS method is presented in Table 7.

Table 7: Normalized Decision Matrix for TOPSIS Method

	Sharpe_Ratio	VaR_90	MDD
AOY	0.234406	0.248248	0.204827
ESG	0.257406	0.251939	0.276024
GZH	0.240623	0.249213	0.237847
GZR	0.255758	0.249411	0.242381
GZV	0.249708	0.250713	0.264568
HMS	0.257950	0.249195	0.238866
IHK	0.261205	0.249350	0.234002
IKP	0.245916	0.250447	0.254167
IPJ	0.243612	0.249864	0.253300
KSR	0.254456	0.251033	0.268068
OLD	0.242074	0.249598	0.246368
TJF	0.244631	0.250273	0.250560
TMC	0.265843	0.251758	0.275613
YJH	0.239813	0.249189	0.242728
ORT	0.252481	0.250626	0.264969
XU100	0.251835	0.249112	0.235666

Next, the normalized matrix is weighted by multiplying each element by the corresponding criterion weight w_j, obtained from the CRITIC method:

Table 8: Weighted Normalized Decision Matrix

	Sharpe_Ratio	VaR_90	MDD
AOY	0.113574	0.065244	0.051752
ESG	0.124718	0.066214	0.069741
GZH	0.116586	0.065497	0.060095

	Sharpe_Ratio	VaR_90	MDD
GZR	0.123920	0.065549	0.061241
GZV	0.120989	0.065891	0.066847
HMS	0.124982	0.065492	0.060353
IHK	0.126559	0.065533	0.059124
IKP	0.119151	0.065821	0.064219
IPJ	0.118035	0.065668	0.064000
KSR	0.123289	0.065975	0.067731
OLD	0.117290	0.065598	0.062248
TJF	0.118529	0.065776	0.063308
TMC	0.128806	0.066166	0.069637
YJH	0.116194	0.065491	0.061329
ORT	0.122332	0.065868	0.066948
XU100	0.122019	0.065471	0.059544

The ideal best (A^*) and ideal worst (A^-) solutions are then identified for each criterion based on its type (benefit or cost). For benefit criteria, such as Sharpe Ratio, the ideal best is the maximum value, and the ideal worst is the minimum value in the weighted normalized matrix. For cost criteria, such as VaR 90% and MDD, the reverse applies. In this study, all three criteria are treated as benefit criteria, as higher values of Sharpe Ratio and lower absolute values of VaR 90% and MDD (after preprocessing in Section 3.2) indicate better performance. Thus, the ideal best and worst solutions are found as follows:

Table 9: Positive and Negative Ideal Solutions

	Positive Ideal Solution	Negative Ideal Solution
Sharpe_Ratio	0.128806	0.113574
VaR_90	0.065244	0.066214
MDD	0.051752	0.069741

The Euclidean distances of each alternative from the ideal best (S_i^*) and ideal worst (S_i^-) solutions and the relative closeness score (C_i) for each alternative is computed as follows:

Table 10: Distances to Ideal Solutions and Closeness Coefficients

	Distance to Positive Ideal Solution	Distance to Negative Ideal Solution	Closeness Coefficient
AOY	0.015232	0.018015	0.541863
ESG	0.018473	0.011144	0.376265
GZH	0.014798	0.010131	0.406381
GZR	0.010677	0.013406	0.556664
GZV	0.017011	0.007966	0.318923
HMS	0.009416	0.014792	0.611044
IHK	0.007712	0.016787	0.685218
IKP	0.015779	0.007858	0.332450

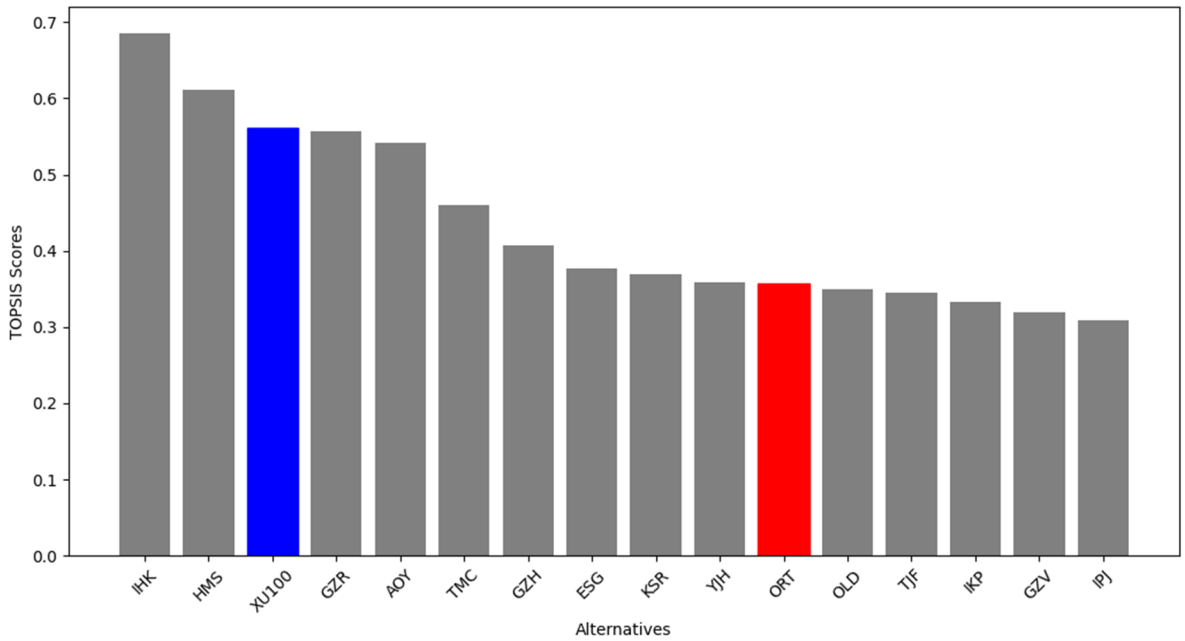
IPJ	0.016316	0.007291	0.308846
KSR	0.016920	0.009923	0.369664
OLD	0.015586	0.008386	0.349834
TJF	0.015474	0.008132	0.344495
TMC	0.017909	0.015232	0.459615
YJH	0.015837	0.008841	0.358248
ORT	0.016529	0.009199	0.357542
XU100	0.010336	0.013261	0.561972

The closeness scores and rankings calculated using the TOPSIS method are presented in Table 11.

Table 11: TOPSIS Closeness Scores and Ranking

Alternative	Score	Rank
IHK	0.6852	1
HMS	0.6110	2
XU100	0.5620	3
GZR	0.5567	4
AOY	0.5419	5
TMC	0.4596	6
GZH	0.4064	7
ESG	0.3763	8
KSR	0.3697	9
YJH	0.3582	10
ORT	0.3575	11
OLD	0.3498	12
TJF	0.3445	13
IKP	0.3325	14
GZV	0.3189	15
IPJ	0.3088	16

IHK achieved the highest closeness score (0.6852), making it the best performing sustainability fund. IHK stands out with a high Sharpe ratio (0.1270), low VaR_{90} (-0.0173), and relatively low MDD (-0.2542). HMS ranks second with a score of 0.6110, offering a suitable option for risk-averse investors with a high Sharpe ratio (0.1080) and low MDD (-0.2304). XU100 ranks third with a score of 0.5620, demonstrating stable performance with a moderate Sharpe ratio (0.0724) and low MDD (-0.2461). IPJ, with the lowest score (0.3088), exhibited the worst performance. Figure 2 visualizes the ranking of TOPSIS scores.



This bar chart displays the TOPSIS closeness scores in a ranked order. IHK (0.6852) and HMS (0.6110) have the highest scores, while IPJ (0.3088) received the lowest score.

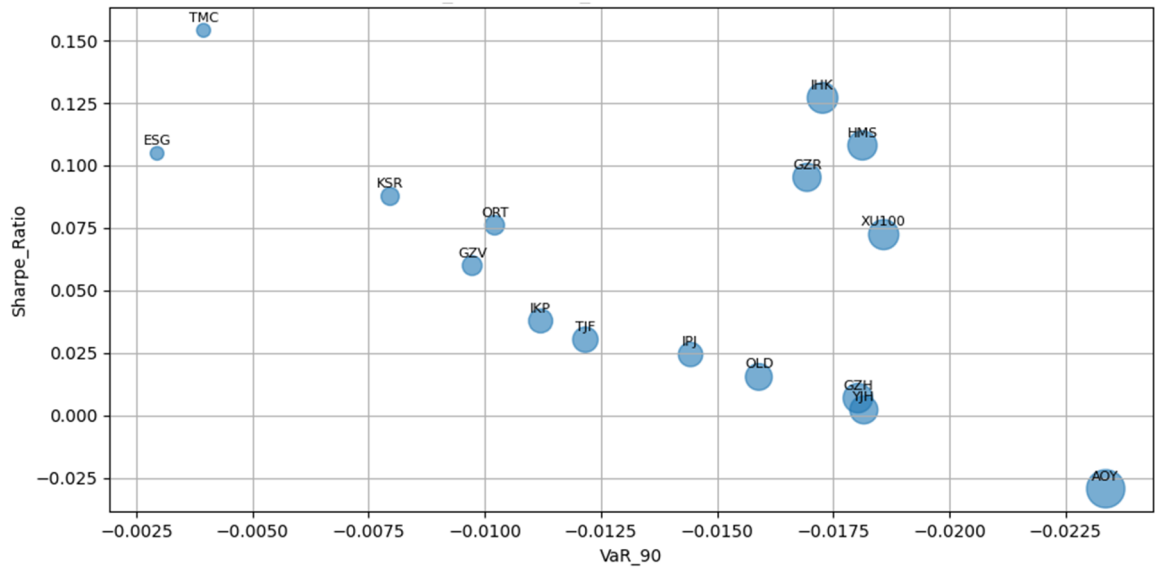
Figure 2: Ranking of TOPSIS Scores

4.3. Comparison of Sustainability Funds with BIST100 (H1, H2, and H3 Tests)

ORT represents the average of all sustainability funds. When compared to the BIST100 (XU100), the following results were obtained: ORT's Sharpe Ratio (0.0761) is higher than that of the BIST100 (0.0724). In terms of VaR_{90}, ORT (-0.0102) has a lower value than the BIST100 (-0.0186). For MDD, ORT (-0.1030) also has a lower value than the BIST100 (-0.2461). To assess whether these differences are statistically significant, a one-sample Wilcoxon signed-rank test was applied between the metric values of the 14 sustainability funds and the values of XU100. The test results are as follows:

- **H1:** The median Sharpe Ratio of sustainability funds is not higher than that of the BIST100 (0.0724) ($p = 0.658 > 0.05$). Therefore, the H1 hypothesis is not statistically supported.
- **H2:** The median VaR_{90} of sustainability funds is lower than that of the BIST100 (-0.0186) ($p = 0.0021 < 0.05$). Therefore, the H2 hypothesis is statistically supported.
- **H3**: The median MDD of sustainability funds is lower than that of the BIST100 (-0.2461) ($p = 0.0078 < 0.05$). Therefore, the H3 hypothesis is statistically supported.

Nevertheless, based on TOPSIS scores, XU100 (0.5620, 3rd rank) has a higher score than ORT (0.3575, 11th rank), indicating that BIST100 index generally outperform sustainability funds in the overall ranking. Figure 3 visualizes the risk-return profile of sustainability funds.



This scatter plot displays Sharpe Ratio (return) vs. VaR90 (risk), with VaR90 decreasing from left to right (lower values like -0.0029 for ESG and -0.0039 for TMC indicate better risk profiles, while -0.0234 for AOY reflects higher risk). Circle size represents MDD, where larger circles (smaller values like -0.0490 for ESG and -0.0510 for TMC, vs. -0.3966 for AOY) signify better stability, as lower MDD and VaR90 values are desirable in portfolio performance. ORT (Sharpe: 0.0761, VaR90: -0.0102, MDD: -0.1030) shows a more favorable risk-return profile than BIST100 (Sharpe: 0.0724, VaR90: -0.0186, MDD: -0.2461), with performance varying across funds.

Figure 3: Risk-Return Profile of Sustainability Funds (Sharpe Ratio vs. VaR_{90})

The lack of statistical significance in the Wilcoxon test results (p = 0.658 for Sharpe) indicates that the differences between the median performance metrics of the 14 sustainability funds and the BIST100 are not strong enough to rule out random chance, likely due to a small sample size, small effect sizes, or high variability among funds.

5. Conclusion and Evaluation

This study evaluates the performance of 14 sustainability-focused mutual funds traded in Turkey from 2022 to 2024, comparing their performance both inter se and against the BIST100 index, employing the CRITIC and TOPSIS methodologies. The analysis reveals that sustainability funds generally exhibited superior risk-adjusted returns, reduced downside risk, and enhanced stability compared to the BIST100 index. However, these differences did not achieve statistical significance. Results from the Wilcoxon signed-rank test indicate that the hypothesis H1 (risk-adjusted returns) was not statistically significant while H2 (downside risk), and H3 (stability) were statistically supported.

Based on TOPSIS rankings, the BIST100 index achieved a score of 0.5620, securing the third position, outperforming the sustainability fund ORT which scored 0.3575 and ranked eleventh. Notably, funds such as IHK and HMS demonstrated exceptional performance, characterized by high risk-adjusted returns, low downside risk, and robust stability. IHK emerged as the top performer with a TOPSIS score of 0.6852, followed closely by HMS with a score of 0.6110. Conversely, the IPJ fund underperformed significantly, recording a TOPSIS score of 0.3088, placing it at the bottom of the rankings.

The findings align with prior literature affirming the risk-mitigating potential of sustainability-focused investments (Renneboog, Ter Horst, and Zhang, 2008; Friede, Busch, and Bassen, 2015). Moreover, results are parallel to the findings when compared to studies specific to the Turkish market. For instance, Ortas et al. (2021) observed that Turkish sustainability funds exhibit lower volatility than the BIST100 but generally underperform in terms of returns. Also, this study finds that BIST100 surpassed the sustainability funds across risk-adjusted returns, downside risk, and stability, with downside risk and

stability showing statistical significance. These differences may be attributed to the short-term dataset (daily data spanning 2022–2024) and the specific metrics employed. Additionally, an improvement in the risk-adjusted returns of Turkish sustainability funds was observed in the post-pandemic period, reinforcing the findings of this study.

The results are consonant with modern portfolio theory (Markowitz, 1952), which posits that ESG-focused investments can enhance risk-averse portfolio characteristics. The analysis, based on a three-year daily dataset, suggests that extending the temporal scope of the dataset could yield more robust insights into the long-term performance of sustainability funds. A methodological limitation arises from the Wilcoxon test, which compared the metric values of 14 funds against a single value for the BIST100, potentially reducing statistical power due to the limited sample size. Future research could address this by treating BIST100 metric values as a distribution, enabling a more comprehensive comparison. To advance the analysis, future studies could incorporate alternative metrics, such as Fama-French factors or ESG scores, and utilize longer-term datasets. Additionally, qualitative approaches, such as interviews with portfolio managers, could elucidate the influence of ESG criteria on fund performance.

This study underscores the financial viability of ESG-focused investments for Turkish investors. Funds like IHK and HMS present compelling options for risk-averse investors, offering benefits in portfolio diversification. However, the implementation of ESG criteria and portfolio management strategies warrants scrutiny, particularly for underperforming funds like IPJ. Performance disparities among sustainability funds may stem from the absence of a standardized ESG framework in Turkey.

To address these challenges, it is recommended that regulatory authorities establish policies to standardize ESG implementation, complemented by educational initiatives and awareness campaigns to bolster sustainability literacy. Financial incentives, such as tax benefits, could further stimulate the growth of sustainability funds. Fund managers are encouraged to refine portfolio management strategies, prioritize risk mitigation, and enhance transparency in reporting ESG integration to foster investor confidence and elevate the attractiveness of sustainability funds.

The present study is constrained by several limitations. First, because of the short history of the sustainability funds in Turkey, the analysis relies on a short-term dataset comprising daily data from 2022 to 2024, which may not fully capture the long-term performance trends of sustainability-focused mutual funds, potentially limiting the generalizability of the findings. Second, the Wilcoxon signed-rank test compared the metric values of 14 funds against a single value for the BIST100 index, which may have reduced statistical power due to the limited sample size. Third, the study employs only the CRITIC and TOPSIS methodologies, excluding alternative metrics such as Fama-French factors or ESG scores, which could provide additional insights. Finally, the study focuses solely on quantitative data, omitting qualitative approaches such as interviews with portfolio managers, which could offer deeper insights into the impact of ESG criteria on fund performance. Future research could address these limitations by utilizing longer-term datasets, incorporating alternative metrics, and integrating qualitative methods.

This study contributes to the academic discourse by elucidating the financial potential of sustainability investments in Turkey and offers practical implications for investors and policymakers. The superior performance of sustainability funds relative to the BIST100 index signals a promising trajectory for ESG-focused investments within the Turkish financial market.

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Araştırma Makalesi

Evaluation of the Financial Performance of Sustainability Funds in Turkey Using CRITIC and TOPSIS Methods

Türkiye'deki Sürdürülebilirlik Fonlarının Finansal Performanslarının CRITIC ve TOPSIS Yöntemleri ile Değerlendirilmesi

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Genişletilmiş Özet

Günümüzde artan çevre bilinci ve sürdürülebilirlik kavramlarına yönelik ilgi, sürdürülebilir temalı finansal varlıklara olan talebi artırmıştır. Bu çalışma, Türkiye'de işlem gören sürdürülebilirlik yatırım fonlarının performansını değerlendirmeyi amaçlamaktadır. Bu kapsamda, Türkiye Elektronik Fon Alım Satım Platformu'nda (TEFAS) işlem gören sürdürülebilirlik temalı fonlar ile karşılaştırma amacıyla piyasa portföyü olarak BIST100 endeksinin performansı, Sharpe oranı, VaR_{90} (%90 Güven Aralığında Riske Maruz Değer) ve Maksimum Düşüş (MDD) metrikleriyle ölçülmüştür. Fonların performans sıralaması, TOPSIS (İdeal Çözüme Yakınlık Tercih Sıralama Tekniği) çok kriterli karar verme yöntemiyle yapılmış; kriter ağırlıkları ise nesnel bir yöntem olan CRITIC (Kriterler Arası Korelasyon ile Kriter Önem Derecesi) ile belirlenmiştir. Bulgular, BIST100'ün risk ayarlı getiriler, kayıp riski ve istikrar açısından sürdürülebilirlik fonlarını geride bıraktığını göstermektedir. Bu bağlamda, kayıp riski ve istikrar metriklerindeki bu üstünlük istatistiksel olarak anlamlı bulunmuştur. TOPSIS sıralamalarına göre ise sürdürülebilirlik fonları genel olarak BIST100'den daha iyi performans göstermemiştir; bazı fonlar belirgin bir üstünlük sergilerken, pek çoğu daha düşük performansla sıralanmıştır.

Modern portföy teorisine göre, düşük korelasyonlu varlıklarla çeşitlendirme yapan yatırımcılar, portföy riskini azaltabilir. Düşük riskli bir portföy oluşturmayı hedefleyen bir yatırımcı, düşük korelasyonlu menkul kıymetleri belirlemeli ve portföyü yatırım süresi boyunca izlemelidir. Ancak bu süreç, finans, istatistik ve veri analizi gibi alanlarda uzmanlık ve zaman gerektirir. Bu zorlukları aşmak için yatırım fonları geliştirilmiştir. Yatırım fonları, bireylerin birikimlerini repo, mevduat, tahvil, değerli metaller ve hisse senetleri gibi araçlara profesyonel fon yöneticileri aracılığıyla yatırmasını sağlar; kazançlar ve kayıplar yatırım oranında dağıtılır. Aralık 2024 itibarıyla TEFAS'ta 209 serbest, 128 hisse senedi, 126 değişken, 77 fon sepeti, 53 katılım, 51 borçlanma araçları, 36 para piyasası, 18 değerli metaller ve 8 karma şemsiye fon işlem görmektedir. Ortalama günlük işlem hacmi 22,7 milyar TRY olan yatırım fonları, finansal piyasalarda önemli bir yer edinmiştir.

Yatırımcılar, firma seçimlerinde giderek daha fazla sürdürülebilirlik faktörlerini göz önünde bulundurmaktadır. Sürdürülebilirlik ilkelerine yeterince önem vermeyen şirketler, kreditörler ve yatırımcılar tarafından riskli görülmekte, bu da onları finanse eden kurumların risklerini artırmaktadır. Bu nedenle finansman kuruluşları, fon sağlayacakları ya da yatırım yapacakları şirketleri dikkatle seçmektedir. Akademik çalışmalar, çevresel, sosyal ve yönetişim (ESG) faktörlerini dikkate alan yatırımların finansal performansa olumlu katkıda bulunduğunu göstermektedir. Küresel varlık yönetim şirketleri, ESG faktörlerini yatırım kararlarında temel bir kriter olarak kullanacaklarını ve gerekli ESG raporlamasını yapmayan şirketlere yatırım yapmaktan kaçınacaklarını belirtmiştir.

Sürdürülebilirlik yatırım fonları, ESG kriterlerini yatırım kararlarına entegre ederek finansal getiri ile

toplumsal fayda sağlamayı hedefler. Küresel olarak, bu fonlar düşük risk ve istikrarlı getirileriyle popülerlik kazanmıştır. Türkiye'de sürdürülebilirlik odaklı fonlar ilgi görmektedir ancak sürdürülebilirlik odaklı fonların performansları ve piyasaya göre avantajları üzerine çalışmalar sınırlı sayıdadır. Literatür, ESG odaklı yatırımların riskten kaçınma kapasitesi ve uzun vadeli getiri potansiyeli hakkında çelişkili bulgular sunmaktadır. Bazı çalışmalar, ESG yatırımlarının finansal performansa olumlu veya nötr katkı sağladığını belirtirken, diğerleri sürdürülebilirlik fonlarının geleneksel fonlara göre daha düşük getiri sunduğunu savunur. Türkiye gibi gelişmekte olan piyasalarda, sürdürülebilirlik farkındalığının sınırlı olması, bu yatırımların performansını etkileyebilir.

Bu çalışma, 2022-2024 yılları arasında Türkiye'de işlem gören 14 sürdürülebilirlik fonunun performansını, kendi aralarında ve BIST100 endeksiyle karşılaştırmayı amaçlamaktadır. Performans, Sharpe oranı, VaR_{90} ve MDD metrikleriyle değerlendirilmiş; kriter ağırlıkları CRITIC yöntemiyle belirlenmiş ve TOPSIS yöntemiyle sıralama yapılmıştır. Çalışma, şu soruları yanıtlamayı hedefler: Türkiye'deki sürdürülebilirlik fonlarından hangileri en iyi performansı gösterir? Bu fonların genel performansı BIST100 ile karşılaştırıldığında nasıldır? Bu sorular için aşağıdaki hipotezler test edilmiştir:

- **H1**: Sürdürülebilirlik fonlarının risk ayarlı getirileri (Sharpe oranı), BIST100'ünkinden yüksektir.
- **H2:** Sürdürülebilirlik fonlarının kayıp riski (VaR_{90}), BIST100'ünkinden düşüktür.
- **H3:** Sürdürülebilirlik fonlarının istikrarı (MDD), BIST100'ünkinden yüksektir (düşük MDD, daha iyi istikrar).

Çalışmada, 2022-2024 yılları arasında TEFAS'ta işlem gören sürdürülebilirlik fonlarının performansı, günlük veri seti kullanılarak değerlendirilmiştir. Getiriler logaritmik olarak hesaplanmıştır. Başlangıçta sekiz metrik (Sharpe, Sortino, Treynor, Beta, Jensen Alfası, Omega, VaR_{90}, $CVaR_{90}$) hesaplanmış, ancak korelasyon analizi sonrası Sharpe oranı, VaR_{90} ve MDD yöntemleri seçilmiştir. Bu metrikler, performans, kayıp riski ve istikrarı kapsamlı bir şekilde ölçer.

CRITIC yöntemiyle belirlenen ağırlıklar Sharpe oranı için 0,4845, VaR_{90} için 0,2628 ve MDD için 0,2527 olarak hesaplanmıştır. Sharpe oranı için en yüksek ağırlık, bu metriğin veri kümesindeki fonlar arasındaki farklılıkları daha iyi yansıttığını ve daha fazla bilgi içerdiğini göstermektedir. TOPSIS sıralamasında, IHK fonu 0,6852 skoruyla birinci, HMS fonu 0,6110 skoruyla ikinci, BIST100 endeksi de 0,5620 skoruyla üçüncü olmuştur. IPJ, 0,3088 skoruyla en düşük performansı göstermiştir. Sürdürülebilirlik fonlarının ortalaması (ORT) 0,3574 skoruyla on birinci sıradadır.

Sürdürülebilirlik fonlarının ortalaması olan ORT'nin risk-getiri performansını BIST100 (XU100) ile karşılaştıran analizde, ORT'nin Sharpe Oranı (0.0761) BIST100'den (0.0724) daha yüksek bulunurken, VaR_{90} (-0.0102) ve Maksimum Düşüş (MDD) (-0.1030) değerleri BIST100'e kıyasla sırasıyla daha düşük risk seviyelerini işaret etmektedir (VaR_{90}: -0.0186, MDD: -0.2461). Bu farklılıkların istatistiksel anlamlılığını değerlendirmek amacıyla 14 sürdürülebilirlik fonunun metrik değerleri ile XU100 değerleri arasında tek örneklemli Wilcoxon işaretli sıra testi uygulanmıştır. Test sonuçlarına göre, sürdürülebilirlik fonlarının medyan VaR_{90} ($p = 0.0021$) ve MDD ($p = 0.0078$) değerlerinin BIST100'den istatistiksel olarak anlamlı şekilde daha düşük olduğu tespit edilmiştir; bu da fonların daha düşük risk taşıdığı hipotezlerini desteklemektedir. Ancak, medyan Sharpe Oranı için istatistiksel anlamlı bir fark bulunamamıştır ($p = 0.658$), bu durum küçük örneklem büyüklüğü, düşük etki büyüklüğü veya fonlar arasındaki yüksek değişkenlikten kaynaklanabilir. Öte yandan, TOPSIS skorlarına göre BIST100 (0.5620, 3. sıra) ORT'den (0.3575, 11. sıra) daha yüksek bir skor elde ederek genel sıralamada sürdürülebilirlik fonlarını geride bırakmıştır.

Bu çalışma, 2022-2024 yılları arasında Türkiye'de işlem gören sürdürülebilirlik odaklı yatırım fonlarının performansını BIST100 endeksi ile karşılaştırmış ve analizde CRITIC-TOPSIS yöntemlerini kullanmıştır. Elde edilen bulgular, sürdürülebilirlik fonlarının risk ayarlı getiriler, kayıp riski ve istikrar açısından BIST100 endeksine kıyasla daha olumlu bir performans sergilediğini ortaya koymuş, ancak bu farklılıklar istatistiksel olarak anlamlı bulunmamıştır. IHK ve HMS gibi fonlar yüksek performans gösterirken, IPJ fonu daha düşük bir performans sergilemiştir. Bulgular, sürdürülebilirlik fonlarının riskten kaçınma kapasitesinin yüksek olduğunu desteklemekle birlikte, Türkiye'de çevresel, sosyal ve yönetişim (ESG) farkındalığının sınırlı olması ve standart bir ESG çerçevesinin eksikliği, performans farklılıklarının temel nedenleri arasında yer alabilir.

Analiz, üç yıllık günlük verilere dayanmaktadır. Daha uzun vadeli verilerle yapılacak çalışmalar, performans dinamiklerini daha kapsamlı bir şekilde aydınlatabilir. Gelecek araştırmalar, Fama-French faktör modelleri gibi farklı performans ölçüm metriklerini ve portföy yöneticileriyle yapılan görüşmeler gibi niteliksel analiz yöntemlerini içerebilir. ESG odaklı yatırımların Türk yatırımcılar için finansal getiri potansiyeli taşıdığı gözlenmiştir. Özellikle IHK ve HMS fonları, riskten kaçınan yatırımcılar için cazip bir seçenek olarak öne çıkmaktadır. Bununla birlikte, fon seçimi sürecinde ESG uygulama düzeyi ve portföy yönetim stratejilerinin dikkatlice değerlendirilmesi gerektiği vurgulanmalıdır. Düzenleyici otoriteler, ESG standartlarının oluşturulması, farkındalık artırıcı kampanyalar düzenlenmesi ve teşvik mekanizmalarının geliştirilmesi yönünde adımlar atmalıdır. Fon yöneticileri ise risk yönetimi süreçlerine odaklanmalı ve ESG uygulamalarını şeffaf bir şekilde raporlamalıdır. Bu çalışma, Türkiye'de sürdürülebilirlik odaklı yatırımların potansiyelini ortaya koyarak hem akademik literatüre hem de finansal piyasalara pratik katkılar sunmaktadır.