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Traces of sustainability in the stock market: A comparative analysis of Türkiye and European Union indices

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Abstract

"Sustainability" is a term that has gained magical connotations in recent years, impacting both the economic-financial sphere and all aspects of our lives. It is crucial to ensure development while making it sustainable. Companies have begun transforming themselves accordingly, while governments have implemented regulations to support them. The transformation and evolution of companies in this regard are now being evaluated through sustainability indices on stock exchanges. The European Union (EU) is a leading group of countries worldwide in sustainability, asserting significant influence. Turkey, through its customs union established with the EU in 1996, the initiation of membership negotiations in 2005, and its candidate status, is obligated and committed to aligning with EU policies in all respects. This study compares data from 2014 to 2024 on the sustainability statuses of European companies evaluated by the STOXX Sustainability 40 Index (SUBE) and the Dow Jones Sustainability Eurozone Index (DJSEUZ), with that of Turkish companies assessed by the Borsa Istanbul Sustainability Index (XUSRD). It is observed that the European indices move together, whereas the Borsa Istanbul Index, while similar for many years, has diverged from the European indices in recent years.

Keywords: DJSEUZ, EU, Türkiye, Stock market indices, SUBE, Sustainability, XUSRD.

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1. Introduction

In the past, companies operating within the framework of a free market economy focused solely on profit, often disregarding social, environmental, and ethical values. While this approach may have maximized profit for a period, today it

has given way to a more holistic understanding. It is now recognized that companies are expected to pursue profit and fulfill their social and environmental responsibilities. This shift has deeply influenced investor expectations.

Sustainability approaches should no longer be viewed as just part of a company's business strategy but as an integral part of its corporate culture. Integrating sustainability into a company's mission and values is crucial to ensuring that all employees embrace this concept. A sustainability-oriented corporate culture facilitates the consideration of environmental and social factors in daily operations and decision-making processes.

Companies that stray from sustainability goals jeopardize not only the environment but also society and the global community. Unsustainable business practices, along with rapidly spreading threats like financial crises, present considerable dangers to humanity. In terms of global priorities and corporate transformation, international bodies such as the World Bank, International Monetary Fund, World Federation of Exchanges, and Organization for Economic Co-operation and Development emphasize the importance of businesses being attentive to human and environmental concerns. These organizations advocate for sustainable business models and craft policies to support this mission.

In today's business world, sustainability is no longer optional but a necessity. The long-term success of companies will depend not only on profit but also on fulfilling their social and environmental responsibilities. Therefore, integrating sustainability strategies into corporate culture will significantly benefit the business community and society.

International financial institutions and stock exchanges not only guide companies in financial matters but also have responsibilities to direct them in sustainability, environmental, and social issues. They create awareness and initiate efforts in these areas. Moreover, exchanges develop various strategies and practices to effectively communicate companies' sustainability policies to investors. They encourage companies to report their environmental and social impacts transparently and share their sustainability performance. Additionally, financial instruments such as sustainable investment funds and green bonds offer investors financial returns aligned with sustainability principles.

Many stock exchanges around the world comply with the World Federation of Exchanges (WFE), the United Nations Global Compact, the Sustainable Stock Exchanges Initiative (SSE), and the UN Principles of Responsible Investment. They act together on sustainability by collaborating with initiatives such as Responsible Investment (UNPRI). These collaborations enable stock exchanges to develop common standards in the field of sustainability and disseminate these standards. Global collaborations and joint action efforts ensure the development and dissemination of common standards in the field of sustainability. In this way, capital markets and stock exchanges contribute to the formation of a business world that is not only profit-oriented but also acts with social and environmental responsibility awareness [1]. In the study, the relationship and level of share values of companies included in the EURO STOXX Sustainability 40 Index (SUBE), Dow Jones Sustainability Eurozone Index (DJSEUZ), and BIST Sustainability (XUSRD) indexes are examined. SUBE covers 40 stocks from eleven Eurozone countries: Spain, Portugal, Netherlands, Luxembourg, Italy, Ireland, Germany, France, Finland, Belgium, and Austria. The DJSEUZ index consists of sustainability-leading companies in the European Region determined by S&P Global through the Corporate Sustainability Assessment (CSA). The XUSRD index has been traded since 03.11.2014, and as of 15.05.2024, 81 companies are listed in the index.

Many stock exchanges worldwide collaborate with initiatives such as the World Federation of Exchanges (WFE), the UN Global Compact, the Sustainable Stock Exchanges Initiative (SSE), and the UN Principles for Responsible Investment (UNPRI) to advance sustainability collectively. These partnerships enable exchanges to develop common standards in sustainability and promote their widespread adoption. Global collaborations and joint efforts facilitate the development and dissemination of shared standards in sustainability, thereby contributing to the emergence of a business world that operates with a consciousness of not only profit but also social and environmental responsibility [1].

This study explores the relationships and correlations among the stock values of companies listed in the EURO STOXX Sustainability 40 Index (SUBE), the Dow Jones Sustainability Eurozone Index (DJSEUZ), and the Borsa Istanbul Sustainability Index (XUSRD). The SUBE index includes 40 stocks from eleven Eurozone countries: Spain, Luxembourg, the Netherlands, Austria, Ireland, Portugal, Germany, Italy, France, Finland, and Belgium. The DJSEUZ index features sustainability leaders in the European region, as identified by S&P Global's Corporate Sustainability Assessment (CSA). Established on November 3, 2014, the XUSRD index currently comprises 81 companies. These indices serve as benchmarks for assessing the sustainability performance of companies across different regions, reflecting the increasing integration of sustainability criteria into investment decisions and market operations globally.

Sustainability indices evaluate the performance of companies not only in financial terms but also in terms of their environmental and social responsibilities. These indices enable companies to assess the actions they take and the commitments they make regarding sustainability with concrete criteria. In this way, investors can make more informed decisions about sustainability, and sustainability awareness becomes widespread in capital markets. The study indicates that stock exchanges play an active role in the creation and dissemination of sustainability awareness in capital markets. Whether at the national or international level, stock exchanges lead both companies and investors in the sustainability process. This leadership is of great importance not only in reducing environmental risks but also in ensuring long-term economic stability [2]. For these reasons, in this study, the share values of the companies listed in the sustainable indices in the European region and the companies listed in the sustainable index in Borsa Istanbul were evaluated mutually between December 2014 and May 2024. The results of the study showed that while share values and investor preferences were similar in the SUBE and DJSEUZ indices, it was observed that the XUSRD index differed from other indices, especially in recent years.

The following sections of this study include the theoretical framework, literature review, applied method, findings, and conclusion.

2. Sustainability in the European Union and Türkiye

The European Union strives to align its industrial, environmental, climate, and energy policies to create an optimal business environment for sustainable growth, job creation, and innovation. To achieve this, the EU has established an ambitious agenda aimed at transforming its economy into a circular economy. This approach seeks to maintain the value of products and materials for as long as possible, yielding significant economic benefits. Additionally, it supports European industry in transitioning to a climate-neutral economy and ensures that products are energy-efficient through eco-design legislation, thereby enhancing overall efficiency.

The EU is implementing various measures to facilitate the shift to a more circular economy. These measures encompass the entire lifecycle from production and consumption to waste management and the secondary raw material market. In a circular economy, the aim is to preserve the value of products and materials for as long as possible while minimizing waste and resource usage. This approach is believed to foster innovation, growth, and job creation. On March 11, 2020, the EU Commission adopted a new circular economy action plan as part of its new industrial strategy [3].

46% of global greenhouse gas emissions that cause climate change and 72% of electricity sector greenhouse gas emissions are caused by coal use. As the negative effects of climate change begin to be observed more severely and international efforts to limit climate change intensify, the role of coal in the energy system has begun to be questioned. With the Paris Climate Agreement, many countries have accelerated their climate change mitigation policies and set targets to completely phase out coal energy. In parallel with the calls for urgent emission limitation, many countries have set this target for 2030 or earlier. Due to reasons such as the negative externalities of coal energy, cost reductions observed in areas such as renewable energy and energy storage, and the increasing need for flexibility in energy markets, coal use is decreasing on a global scale, and this trend is expected to accelerate in the coming years.

The Border Carbon Regulation Mechanism, set to be implemented in 2026 as part of the European Green Deal, offers an economic incentive for countries trading with the European Union to abandon their coal policies. Turkey, which has supported coal energy policies in recent decades, has seen a significant increase in coal-fired electricity production and greenhouse gas emissions. The country's current energy plans still aim to open new reserve areas and increase domestic coal-based electricity production. However, these plans appear unfeasible for both environmental and economic reasons.

European industry is transitioning to a climate-neutral economy, marking a shift in the energy, manufacturing, transport, and construction sectors. For this purpose, the "Sustainable Industry Low Carbon (SILC) initiative towards a climate-neutral economy" was created.

In Turkey, the "First Step on the Path to a Carbon Neutral Turkey: Exiting Coal in 2030" report was published in 2011[4]. This report aims to contribute to the creation of a road map for Turkey to exit coal by 2030. For this purpose, three scenarios covering the period between 2021 and 2035 were created, and in light of this modelling study, the possibilities of Turkey's transition from coal in 2030 and its possible consequences were examined. Modelling results include outputs such as general system costs, total investment requirements, resource-based installed power and production development and carbon emission amounts.

Another important issue within the scope of sustainability is product initiative, eco-design, and energy labeling. Eco-design and energy labeling legislation are effective tools in increasing the energy efficiency of products. They help eliminate the lowest performing products from the market, contributing significantly to the EU's 2020 energy efficiency target. Energy savings associated with eco-design and energy labeling regulations are estimated to be around 800 terawatt hours (TWh) per year by 2020. Eco-design also supports industrial competitiveness and innovation by promoting better environmental performance of products in the domestic market.

In line with the green deal objectives, EU product policy needs to help keep resource consumption and environmental impacts from product production and use within planetary limits. To do this, a sustainable product policy initiative is being developed and a legal framework is being created to ensure that all products produced or placed on the EU market comply with technical standards for sustainability.

Sectoral initiatives on ecological design and energy labeling; the Circular Plastic Alliance, the EU's textile strategy, and a sustainable environmental strategy. The Circular Plastics Alliance brings together stakeholders from industry, academia, and public authorities, covering all plastic value chains in the EU, to increase the recycled plastics market in the EU to 10 million tonnes by 2025 (+150% compared to 2016). The EU's textile strategy strengthens the competitiveness and innovation of the sector and enhances the EU market for textile reuse.

A sustainable environmental strategy is a comprehensive approach towards a climate-neutral, smart, and resilient built environment for all EU citizens. This strategy consists of the following headings: circularity principles and life cycle approaches, climate, energy and resource efficiency, construction and demolition waste management, accessibility, digitalization, and skills.

Studies are initiated to support evidence-based policymaking in this field, and events are organized to bring stakeholders together and disseminate information; examining the impact of climate and energy policies on EU competitiveness from an industry perspective, a study on regulatory obstacles to the circular economy, research on competitiveness and resource efficiency of EU companies, a study on increasing the reuse of products, a study on sharing industrial by-products (industrial symbiosis), a study on EU eco-competitiveness of the industry, and work on levers to unlock the clean industry.

To maintain the international competitiveness of European industries while upholding strict environmental standards, it is important to work towards a level playing field through international policy dialogues. These dialogues share Europe's sustainable and low-carbon solutions with other countries and offer the opportunity to promote European technologies in key export markets. The Commission is an active member of the G7 Resource Efficiency Alliance [5].

3. Sustainable Finance in the EU and Türkiye

Sustainable finance is about making sustainability considerations an integral part of financial policy and decision-making to redirect and scale public and private investments towards meeting sustainability goals. The transition to a sustainable and fair economy requires significant investments. Sustainable finance makes it easier to direct capital to sustainable activities and projects. This means taking environmental, social, and governance considerations into account when making investment decisions.

Green finance is a part of sustainable finance that takes into account environmental objectives, such as whether investments will protect biodiversity, water and marine resources, prevent pollution, strengthen the circular economy, or support climate change mitigation and adaptation.

Sustainable finance is a broader concept that includes not only green investments but also social aspects such as human rights, labor relations, and investment in communities, as well as governance-related issues such as management structures, employee relations, and executive compensation.

Sustainable finance will help the EU achieve its European Green Deal targets and the EU's international commitments on sustainability. The European Green Deal investment plan mobilizes investments of at least one trillion euros over ten years. The aim is to create the right environment – or 'enabling framework' – to facilitate and encourage the public and private investments required for the transition to a climate-neutral, green, and inclusive economy.

Sustainable finance entails the process of taking environmental, social and governance (ESG) considerations into account when making investment decisions in the financial sector, leading to longer-term investments in sustainable economic activity.

The EU sustainable finance framework includes the following building blocks: Corporate disclosure of climate-related information, EU labels for criteria (climate, ESG), and ESG disclosures of criteria, Sustainability-related disclosure in the financial services sector (SDFR), European green bond standard, Taxonomy, and corporate sustainability reporting. Corporate Sustainability Reporting on 5 January 2023, the directive has entered into force. This new directive modernizes and strengthens the rules on social and environmental information that companies must report [6]. Companies of a certain size operating in the EU are required to integrate the duty of care into their company policies, identify the social and environmental impacts of their activities, and prevent and reduce potential negative impacts. It aims to eliminate negative impacts and impose the obligation to report them.

In this context, the European Sustainability Reporting Standards (ESRS) were adopted by the European Commission on July 31, 2023, to be used by all companies subject to the Corporate Sustainability Reporting Directive. In the statement made by the Commission, the standards cover all environmental, social, and governance issues, including climate change, biodiversity, and human rights. They are intended to provide investors with information to understand the sustainability impact of the companies in which they invest. It is reported that discussions with the International Sustainability Standards Board (ISSB) and the Global Reporting Initiative (GRI) have also been taken into account to prevent double reporting, and the reporting requirements will be gradually implemented for different companies over time.

In Turkey, with the sixth paragraph added to the 88th article of the Turkish Commercial Code No. 6102 by the amendment published in the Official Gazette No. 31856 dated June 4, 2022, the authority to determine and publish the Turkish Sustainability Standards has been granted to the Public Oversight Authority, and up-to-date information about the studies can be found on the institution's website. Access is possible [7].

4. Literature Review

Sustainability indices have a history of nearly thirty years. The first sustainability index, the Domini 400 Social Index, started to be calculated in 1990 by KLD Research & Analytics, which produces indices. However, it did not receive the expected interest from investors at that time. Sustainability indices created by Dow Jones in 1999 and FTSE in 2001, unlike the first index, attracted intense interest from investors and companies [8]. With the last quarter of the 20th century and the early 21st century, studies in the literature on sustainable indices have concentrated.

In this section, literature studies are examined under three main headings. While the first part examines sustainability studies, the second includes studies examining the relationship between sustainability and stock markets, and the last part includes studies on SUBE, DJSEUZ, and XUSRD indices.

5. Sustainability Literature Studies

Although sustainability studies are relatively new, Bosselmann [9] stated that the idea of sustainability was first introduced by Hanley [10]. The first formal definition of sustainability was made by Brundtland [11]. Sustainability: It is to ensure development without reducing the opportunities of future generations to meet their needs. Daly [12] predicted that economic development and environmental issues would be the most important conceptual problems in the future.

Future studies include Ryszawska [13]. The author determined the purpose of his study as emphasizing the role of sustainable finance in the transition to sustainability. In his study, Lehner [14] divided sustainable finance and investments into sections and focused on areas ranging from sociological foundations to critical approaches to markets. He defined sustainability analysis and measurement methods as risk prevention by specifying business models. In the last part of the study, case studies examining various perspectives on sustainable banking are included. Schoenmaker [15] underlined that providing resources for sustainable projects and achieving sustainable development goals go through the financial system. In their study, Schoenmaker and Schramade [16] explained how sustainable finance principles can mobilize the financial sector and discussed using finance as a tool to achieve the goal of a sustainable world. Schumacher et al. [17] reviewed the

applications used in sustainable finance and emphasized the importance of green bonds for the development of sustainable investment markets in Japan. The study also included climate change scenarios.

Olokoyo et al. [18] in their study investigated the impact of macroeconomic indicators on capital market performance in Nigeria. For this purpose, they applied the Vector Error Correction Model analysis using Johansen cointegration. They found a weak link in the long-term relationship between stock market sustainability performance and macroeconomic fundamentals. Hanley [10] examined the policy need for sustainability indicators in his study. He emphasized that there is no single measurement to measure sustainability, but the a need for a comprehensive approach. Popescu et al. [19] based their research on the premise that for the transition to a low-carbon and more inclusive economy, funds are directed to priority sectors and there is a need for reliable sustainability assessment methods. In the study, they prepared a seven-criteria matrix developed based on the gaps they found by examining the reports of international organizations. In conclusion, they determined that the investments have various shortcomings that fail to capture the sustainability impact in real life. Jackson and Victor [20] created a macroeconomic simulation model for Canada in their study. They complemented the model with a sustainable prosperity scenario for the future of the Canadian economy that includes a carbon reduction scenario by 2067 and additional measures to improve environmental, social and financial conditions.

Cunha et al. [21] emphasize in their study that sustainable finance and investments are the key to promoting sustainable globalisation. Sustainable companies; They described themselves as committed to financial performance and sustainability. Jeronen [22] studied economic sustainability. She emphasized that it means continuity in business life, productivity, economic growth and the ability to maintain profitability by using the company's assets efficiently. Thiele [23] researched the concept and practices of sustainability in her study and also suggested sustainability solutions. In this article, Pavlichenko et al. [24] present a case study to develop environmental assessment methodologies. In this study, Altassan and Ahmad [25] evaluated the relationship between green human resources practices and environmental responsibility through gender and experience factors. In the article, Alhazemi [26] examined ESG (Environmental, Social and Governance) performance metrics in the context of sustainable leadership, stakeholder participation and institutional characteristics. Salhab et al. [27] analyzed the contribution of green marketing strategies to sustainable development goals and consumer behavior in Jordan. In the article, Nguyen et al. [28] investigated the effects of green marketing on competitive advantage and business performance in tourism enterprises in Vietnam.

6. Literature Studies on Sustainability and Stock Market Relations

Examples of studies related to sustainability and stock markets are given in Table 1.

Table 1.
Examples of studies related to sustainability and stock markets

Author	Subject	Data Set Period	Method	Result
Sivalingam [29]	Kuala Lumpur Stock Exchange and sustainability.	Kuala Lumpur 1973-2004	Efficient Market Hypothesis	Unsustainable small and medium-sized company performance is low.
Cahaya, et al. [30]	Sustainability at the Jakarta Stock Exchange.	Jakarta 2004	Regression analysis	Social disclosures bring transparency and profitability to companies.
Royal and O'Donnell [31]	Borsada işlem gören firmalardaki maddi olmayan varlıkların değerlemesi.	Sidney ve Hong Kong 1999-2001	Nitel araştırma teknikler	Şirketlerin sürdürülebilir ekonomiye katkıda bulunacak şekilde yeniden tasarlanması gerekmektedir.
Panait and Lupu [32]	Bucharest Stock Exchange and sustainability.	Bucharest 2007–2009	Contagion	Sustainability provides stability.
Burhan and Rahmanti [33]	The impact of sustainability reporting on company performance.	Indonesia 2006-2009.	Mathematical Analysis	Sustainability reporting positively affects company performance.
Oberndorfer, et al. [34]	Stock market and sustainability.	Germany 1999-2002	Event study	During the period examined, companies were negatively affected by their inclusion in the sustainable stock index.
Kong, et al. [35]	Environmental policy and stock market performance.	China 2010-2012	Event study	It has been found that environmental policy increases the market value of companies.
Boitan [36]	Performance evaluation of sustainable stock market indices.	Europe, Japan, US 2010 - 2019	Principal components analysis.	Sustainable indices are an alternative method of risk diversification and hedging.
Ionita and Dinu [37]	The impact of intangible assets on sustainable growth and firm value.	Bucharest Stock Exchange 2016–2019	Linear regression	Being sustainable has a positive impact on the performance of companies listed on the Romanian stock exchange.

Keskin and Günay [38]	Value analysis of companies included in the BIST Sustainability Index.	Türkiye 2014-2021	Quantile Regression	A significant relationship was determined between market added value and asset profitability ratios and price-earnings ratios.
Keskin and Türkoğlu [39]	Performance evaluation of sustainable banks.	Türkiye 2020-2022	Wedba	The performance ranking of the banks traded in the sustainable index has been made.
Slimane [40]	Stock markets and sustainability goals.	85 Country Stock Exchanges 2017	Qualitative analysis	All of the exchanges examined contribute to the Sustainable Development Goals.
Musah [41]	AB üye ülkelerinde borsa gelişimi ve çevre kalitesi.	17 EU member countries 1995-2014	Cointegration tests	Borsalar ile ekolojik kirlilik arasında nedensellik ilişkisi bulunamamıştır.

7. Literature Studies on SUBE, DJSEUZ and XUSRD Indices

Table 2 includes examples of studies conducted in the literature on SUBE, DJSEUZ and XUSRD indices.

Table 2.
Examples of studies on SUBE, DJSEUZ and XUSRD indices.

Author	Subject	Data Set Period	Method	Result
Cerin and Dobers [42]	Dow Jones Sustainability.	The Dow Jones Sustainability Group Index 1995-2000	Rational assessment method Consistent method	Companies included in the Dow Jones Sustainability Index have high performance and transparency.
López, et al. [43]	Dow Jones Sustainability Index performance measure.	Dow Jones Global Index Dow Jones Sustainability Index 1998–2004	Regression analysis Non-parametric test	There are differences in performance between the two indices.
Christofi, et al. [44]	Dow Jones Sustainability Index.	Dow Jones Sustainability Index (2006-2007)	Analogy Technique	Dow Jones Sürdürülebilirlik Endeksleri uzun dönemde toplam kalite ve performansları artmaktadır.
Sariannidis, et al. [45]	Comparison of macroeconomic data and sustainability index.	USA 2000-2008	Autoregressive Conditional Variability (GARCH)	Oil price exchange rate volatility negatively affects Dow Jones Sustainability index returns.
Sariannidis, et al. [45]	Macroeconomic variables, Dow Jones Sustainability and Dow Jones Impact on Wilshire 5000 indices.	Dow Jones Sustainability Dow Jones Wilshire 5000 indexes 2000 - 2008	GARCH	Macroeconomics The change in yields negatively affects the US stock market, and this situation affects the Dow Jones. It is reflected in the Sustainability Index with a delay of 1 month.
Drimbetas, et al. [46]	Effects of macroeconomic factors on the sustainability index.	USA 2000-2008	GARCH	Dow Jones and US Large-Scale Enterprise (DJUSL) indices react differently.
Adamczyk [47]	Value management of companies listed in sustainability indices.	Dow Jones Sustainability, index FTSE4Good index RESPECT Index (2006–2011)	Analogy Technique	Sustainability indices suffer fewer losses when markets are falling. Compliance with sustainable development principles has a positive impact on the value of listed companies.

Daszyńska-Żygadło, et al. [48]	The effect of inclusion in the sustainability index on investor preference.	Dow Jones STOXX Sustainability Index, STOXX Europe 600, RESPECT Index (2005–2012)	Matematiksel analiz	Being listed in the sustainable index has a positive impact on financial performance. On the other hand Poor environmental or social performance has negative financial consequences.
Aytekin and Erol [49]	Financial performance evaluation in BIST Sustainable Index.	BIST 2014- 2015	Aras Method (Additive Ratio Assessment)	Being included in the sustainable index alone is a sufficient indicator of financial performance.
Lupu, et al. [50]	Comparative assessment of the risks of sustainable and unsustainable companies in the European region.	EURO STOXX sustainability index and Companies in the STOXX Europe 600 (2010-2020)	Value at Risk (VaR)	Sustainable companies have lower risks.
Brătianu [51]	Risk management in sustainable companies.	Euro STOXX Sustainability Index, STOXX Europe 600 (2010-2020)	Fuzzy Mathematical Models	Companies included in the Euro STOXX Sustainability Index have a lower risk level than others.
Tiltay, et al. [52]	Sustainable development goals	BIST Sürdürülebilir Endeks 2018–2020	Exploratory Research	Companies included in the sustainable index aim to reduce inequalities, quality education, healthy and quality life and gender equality.
Morea, et al. [53]	Stoxx 50 and Euro Stoxx 50 ESG Index comparison.	Stoxx 50 and Euro Stoxx 50-ESG. (2012-2021)	Portfolio analysis Back Test Analysis	Her ne kadar ESG puanları tek başına daha yüksek performansı ifade etse de ESG profillerinin hisse senedi üzerinde olumlu bir etkisi vardır.
Almansour, et al. [54]	S&P and Dow Jones sustainable Indices.&P ve Dow Jones'un sürdürülebilir Endeksleri.	S&P and Dow Jones (DJ) sustainability indices (2012 -2021)	TVP-VAR model	There is a high degree of correlation between the S&P and DJ sustainable indices.
Cagli, et al. [55]	Sustainable stocks and green bonds.	Dow Jones Sustainability, Eurocurrency, Asia Pacific, Europe, USA, S&P Green Bond Crude oil prices etc.. (2014- 2021)	Renyi's transfer entropy method	There are two-way transmissions between oil price volatility and sustainability indices. Moreover, there are also information flows between cryptocurrency uncertainty and sustainability indices.

What distinguishes this study from the literature is that the share value prices of sustainable companies in the European region have not been evaluated in conjunction with sustainable companies traded in Türkiye.

8. Method and Findings

Eviews [56] and SPSS 21.0 software were used in the analysis of data between the 2014-2024 period of the BIST Sustainability Index, where the sustainability status of companies in Europe, STOXX Sustainability 40 Index and Dow Jones

Sustainability Eurozone Index and the sustainability status of companies in Turkey are evaluated. Data are collected from:https://www.investing.com website [57].

9. Findings on Sustainability Indices

Table 3 includes descriptive statistics of the weekly closing values of the sustainability indices on the BIST, DOW JONES and STOXX stock exchanges between December 2014 and May 2024.

Table 3.
Descriptive statistics of sustainability indices

Variables	Average	SS	Distortion	Kurtosis	Correlation (r)		
BIST Sustainability Index	2611.51	2862.32	2.161	6.640	1	0.131**	0.707
Dow Jones Sustainability Index	152.54	21.75	0.324	2.221		1	0.001
Stoxx Sustainability Index	1571.30	238.96	0.435	2.297			1

According to Table 3, it has been determined that the sustainability index data does not show a normal distribution, and Spearman's rho correlation results and graphical representation are included. According to Table 3, there is a positive and significant relationship between the BIST 100 sustainability index and the Dow Jones sustainability index (r =0.131, p<0.01); A positive and significant relationship (r =0.707; p<0.05) was determined between the BIST 100 sustainability index and the Stoxx sustainability index. It was determined that there is no significant relationship (p>0.05) between the Dow Jones Sustainability Index and the Stoxx Sustainability Index.
Figure 1 shows the course of weekly closing data between 2014 and 2024.

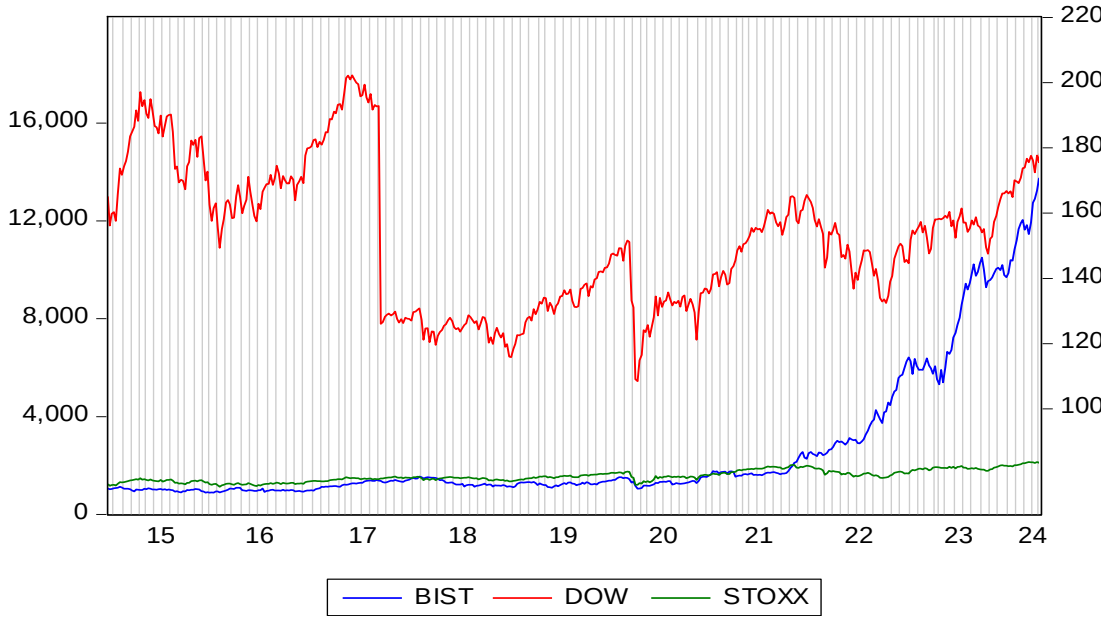


Figure 1.
The course of weekly closing values of sustainability indices (2014-2024).

When the weekly closings of the sustainability indices are examined, it is seen that there was a negative break for all three indices in the week of 28.02.2020. In the week in question, the BIST sustainability index increased by 9.87% compared to the previous week's close; There is a decrease of 11.91% in the Dow Jones sustainability index and 11.60% in the Stoxx sustainability index. A similar break was repeated at the close of 13.03.2020 and 12.43% in the BIST sustainability index; There was a negative break at 16.83% in the Dow Jones sustainability index and 19.25% in the Stoxx sustainability index. It is seen that there was a break in the Dow Jones sustainability index at the level of -34.67% at the closing of 15.09.2017, unlike other indices.

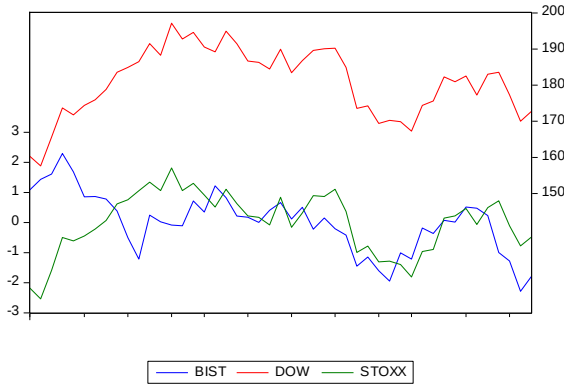
To better observe the bilateral relations between the indices, correlations were obtained separately for each year and are shown in Table 4.

Table 4.
Relationship between sustainability indices on a yearly basis.

		DJ SE	STX SE
BIST Sustainability Index	2015	0.099	0.088
	2016	0.192	0.221
	2017	-0.480*	0.751**
	2018	0.249	0.282*
	2019	0.469**	0.454**
	2020	0.789**	0.853**
	2021	0.439**	0.373**
	2022	-0.393**	-0.309**
	2023	0.224	0.163
	2024	0.820**	0.839**
Dow Jones Sustainability Index	2015		0.959**
	2016		0.930**
	2017		-0.474**
	2018		0.908**
	2019		0.993**
	2020		0.972**
	2021		0.988**
	2022		0.968**
	2023		0.896**
	2024		0.983**

When the weekly course of the indices in Table 4 and Figure 2 is examined on a yearly basis, it is seen that BIST and Dow Jones sustainability indices have moved together since 2017 and this relationship is negative in 2018 and 2022 and positive in other years; It is seen that BIST and Stoxx sustainability indices have similarly moved together since 2017, and this relationship is negative in 2022 and positive in other years.

It is seen that Dow Jones and Stoxx sustainability indices move together every year and this relationship is negative in 2017 and positive in other years.



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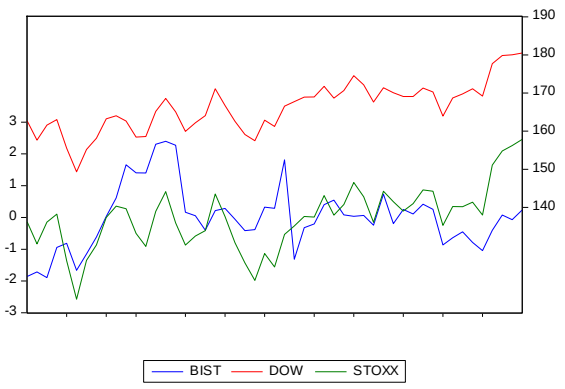

2016

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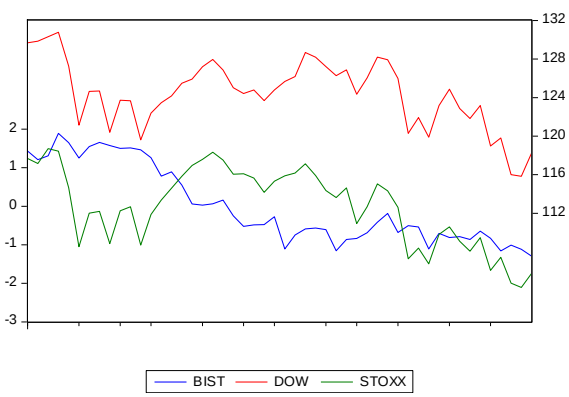


2018

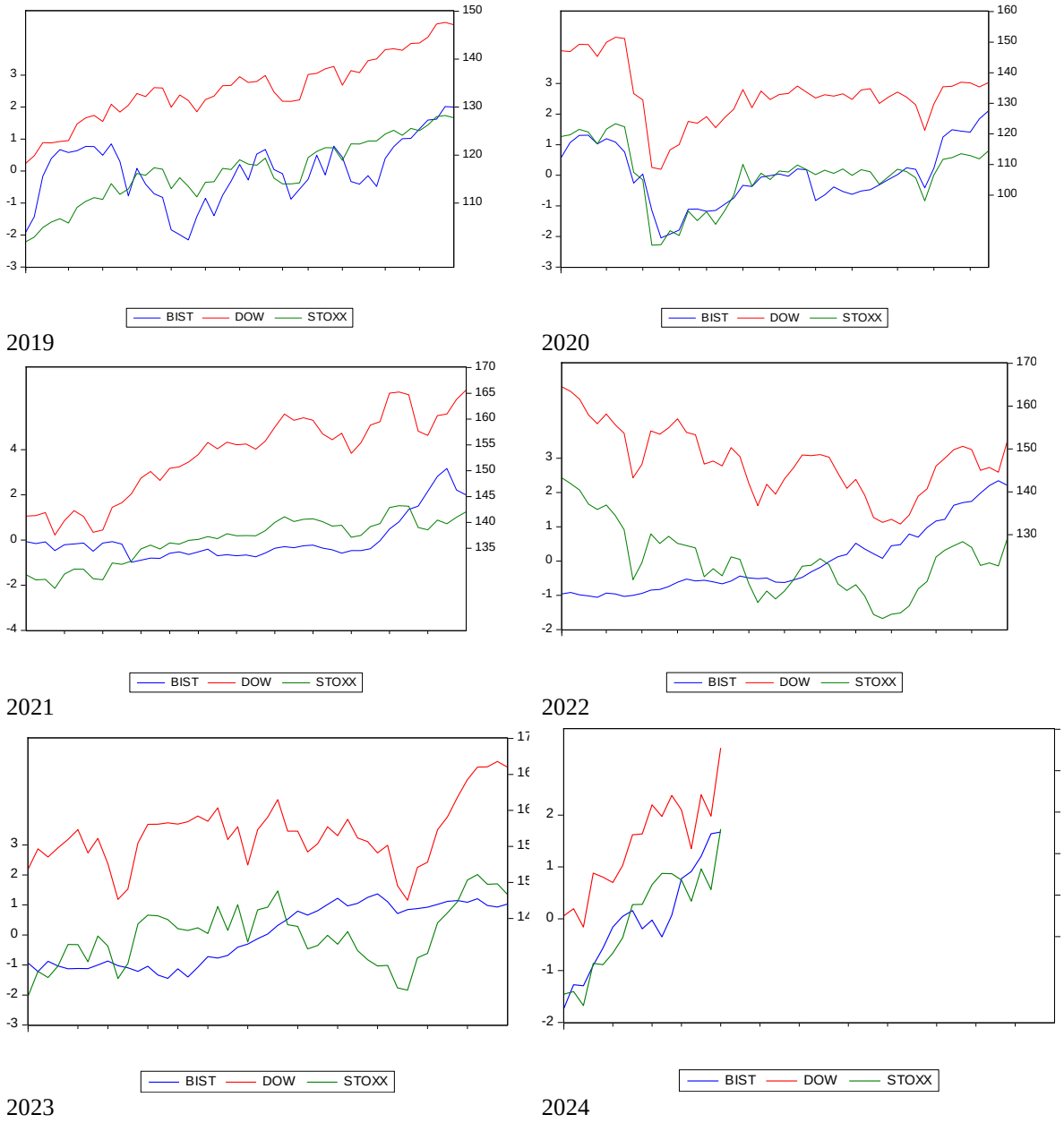


Figure 2.
The year-by-year course of weekly closing values of sustainability indices.

The findings in Tables and Figures 1-2 were calculated based on original data, and the results obtained with weekly closing change rates are shown in Table 5.

Table 5.
Sustainability indices closing rates compared to the previous week and the relationship between the indices.

Variable	Skewness	Kurtosis	Correlation (r)		
BIST Sustainability Index	-0.216	1.326	1	0.312**	0.296**
Dow Jones Sustainability Index	-4.866	54.787		1	0.935**
Stoxx Sustainability Index	-1.073	7.797			1

According to Table 5, it has been determined that the weekly closing changes of the sustainability indices do not show a normal distribution, and Spearman's rho correlation results and graphical representation are included. According to Table 5, there is a positive and significant relationship between the BIST 100 sustainability index and Dow Jones sustainability index ($r=0.312$, $p<0.01$); A positive and significant relationship ($r=0.296$; $p<0.05$) was determined between the BIST 100 sustainability index and the Stoxx sustainability index. A positive and significant relationship ($r=0.935$; $p<0.05$) was determined between the Dow Jones sustainability index and the Stoxx sustainability index.
Figure 3 shows the weekly closing change rates between 2014 and 2024.

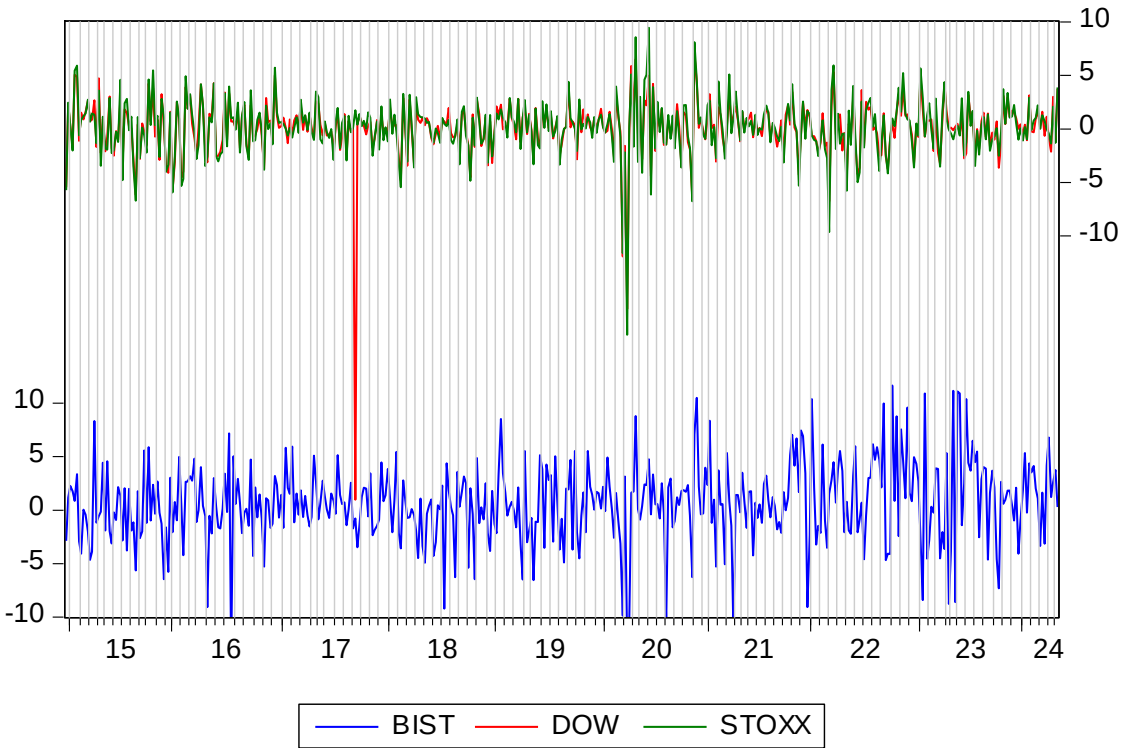


Figure 3.
Weekly closing change rates of sustainability indices (2014-2024).

When the weekly closing changes of the sustainability indices in Figure 3 are examined, it is seen that many negative and positive changes occur together for all three indices, and when evaluated with the correlation results, the similarity between the BIST sustainability index and the Dow Jones and Stoxx sustainability indices is at a medium level and is greater than the similarity in Figure 2. There appears to be a similarity. It can be seen that the similarity between the Dow Jones and Stoxx sustainability indices in Figure 3 is almost exactly the same as in the correlation table.

In order to better observe the bilateral relations between the indices, the correlation between the weekly change rates was obtained for each year and shown in Table 6.

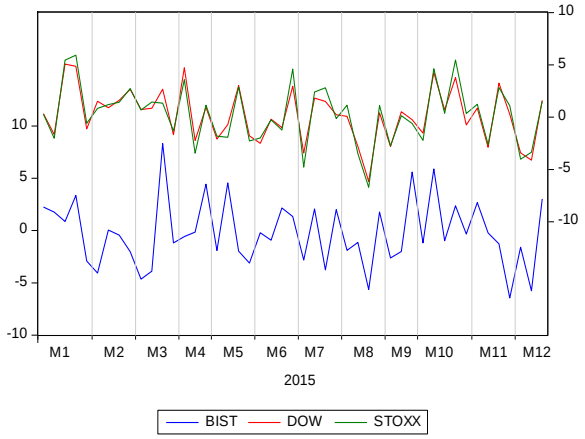
Table 6.
Relationship between weekly change rates of sustainability indices on a yearly basis.

		DJ SE	STX SE
BIST Sustainability Index	2015	0.355*	0.307*
	2016	0.570**	0.604**
	2017	0.056	0.023
	2018	0.303*	0.273*
	2019	0.293*	0.337*
	2020	0.561**	0.541**
	2021	0.337*	0.331*
	2022	0.388**	0.366**
	2023	-0.059	-0.086
	2024	0.054	-0.061
Dow Jones Sustainability Index	2015		0.968**
	2016		0.976**
	2017		0.787**
	2018		0.950**
	2019		0.929**
	2020		0.944**
	2021		0.932**
	2022		0.914**
	2023		0.945**
	2024		0.895**

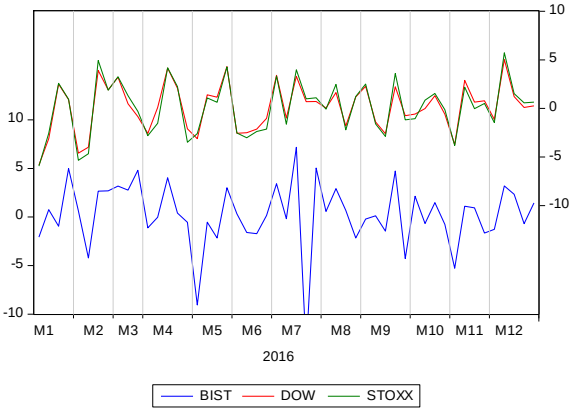
When the weekly closing changes of the indices in Table 6 and Figure 4 are examined on a yearly basis, we see that BIST and Dow Jones sustainability indices moved together from 2015 to 2022 (except 2017), this relationship was positive every year, and the similarity disappeared in 2023 and 2024. can be seen. It is seen that BIST and Stoxx sustainability indices

moved together from 2015 (except 2017) to 2022; this relationship was positive every year, and the similarity disappeared in 2023 and 2024.

It is seen that Dow Jones and Stoxx sustainability indices move together every year, and this relationship is positive and very strong (r > 0.75).



2015



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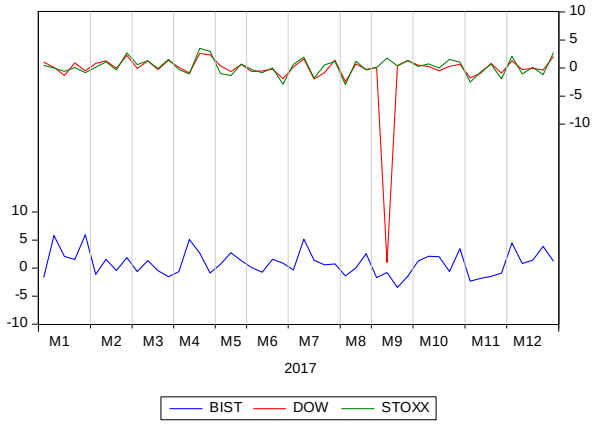

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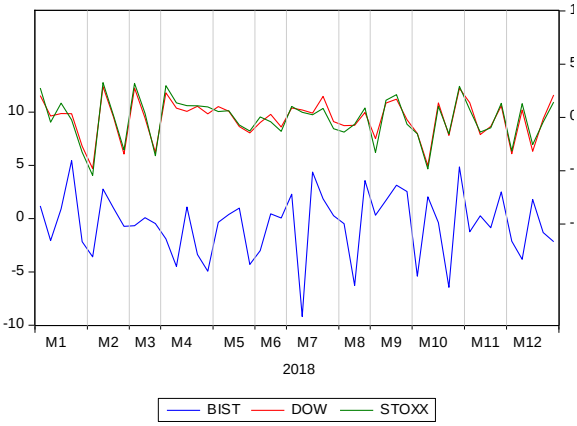

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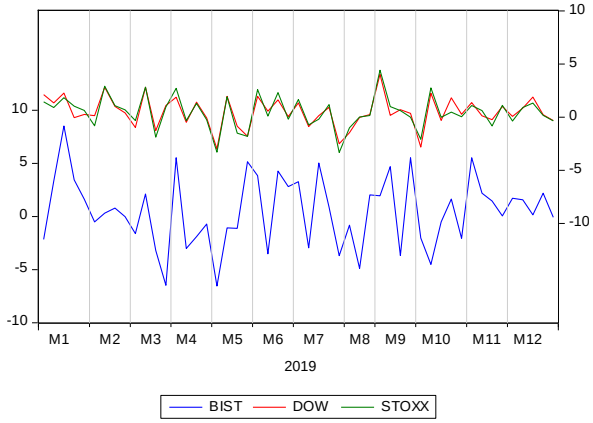

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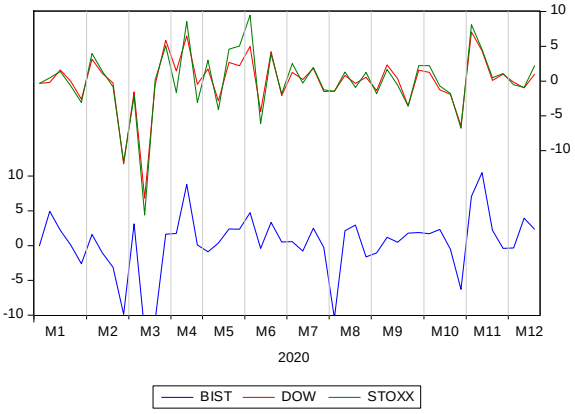

2020

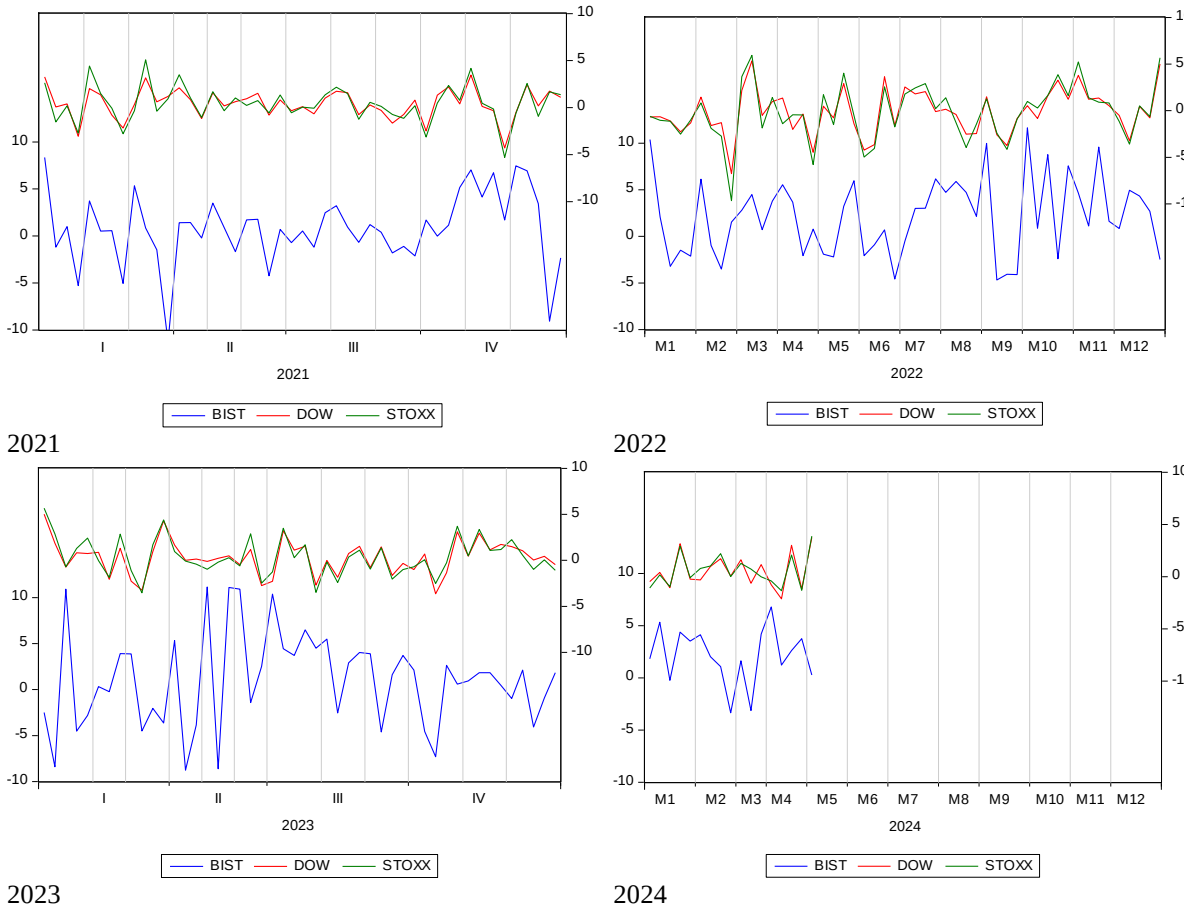

Figure 4.
Weekly closing change rates of sustainability indices (on a yearly basis).

10. Conclusion

Sustainability has gained great importance in the world economy in recent years. The steps taken in this regard have also been indicators of development. Taking environmental impacts into account in production can only be achieved through development. The European Union is leading the world in this regard, and many important steps have been taken.

Since Turkey is a candidate country for the EU, has established a customs union on industrial products and processed agricultural products since 1996, and has initiated harmonization efforts in many areas by starting membership negotiations in 2005, it is necessary to take the necessary steps to consider EU criteria in industrial production and ensure sustainability. These steps are also a requirement of the course of events in the world, and the sustainability of development must be ensured. Important steps have been taken in this sense in Turkey, and companies have begun to transform themselves. The state also makes the necessary legal regulations. Türkiye conducts nearly half of its foreign trade with the EU. This situation necessitates minimal compliance, even if one is not a member.

The sustainability status of companies is evaluated by sustainability indexes in the stock exchanges. In this study, SUBE and DJSEUZ indexes, which evaluate the sustainability of companies in Europe, were compared with the data of the BIST Sustainability Index in Turkey between December 2014 and May 2024. It has been observed that all three indices have moved in parallel for many years, but the BIST Sustainability Index has diverged from the other two indices in recent years. This study, Almansour et al. [54], similar to their work, López et al. [43], appears to have yielded different results.

As a result of the study, it is evaluated that the difference in the BIST Sustainability Index with the other two sustainable indexes may be due to the economic policies implemented in Turkey in recent years, or companies may have had to ignore sustainability due to economic difficulties.

It is considered that among the studies that can be conducted in the future, the study can be tested with other indices and different methods in Europe.

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