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Investor Overreaction in the BIST Sustainability Index: An Empirical Analysis from 2014-2022

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Abstract: Recent emphasis on environmental stewardship by stakeholders has escalated demands for disclosures on social and environmental impacts from environmentally detrimental companies, underscoring the significance of sustainable reporting. This trend has catalyzed the emergence of sustainability indices in financial markets, highlighting corporate commitment to sustainable practices. The inclusion of firms in these indices is often perceived positively by investors, potentially influencing expectations of stock price surges. Hence, the examination of whether this inclusion prompts investor overreaction becomes pertinent. This study aims to ascertain the existence of investor overreaction to companies listed in the BIST Sustainability Index. The research encompasses companies incorporated into the Borsa Istanbul sustainability index from 2014 to 2022. Adopting the methodology of De Bondt & Thaler (1985), this analysis investigates the prevalence of overreaction. The findings reveal that the overreaction hypothesis holds true for a one-year duration post-inclusion in the index. This indicates that investors exhibit overreaction by purchasing stocks during the initial year of a company's inclusion, yielding returns surpassing market averages. Conversely, holding these stocks for three and five years results in inadequate investor reactions and fails to secure above-market returns. This suggests that the impact of index inclusion on investor behavior is transient, diminishing in the third and fifth years. The study contributes to the discourse on behavioral finance by elucidating the nuanced effects of sustainability indices on financial market dynamics and investor behavior.

Keywords: Sustainability index; Financial markets; Overreaction hypothesis; Behavioral finance

1. Introduction

While developments such as the discovery of new machines, the use of steam engines, and iron production were effective at the start of Industry 1.0, these developments led to an increase in the goods produced, an orientation towards new markets, and increased exports. The change in energy sources and raw materials used, the changes in technology, and the use of communication tools such as the telephone, radio, and typewriter are referred to as Industry 2.0. The spread of automation with the effect of technology coincides with the Industry 3.0 period. Developments in communication, communication, and technology have enabled automation in production, and the software sector has developed and machines have changed. Globalization has gradually increased, and there is no longer any distance between people. The concept of Industry 4.0, which was first mentioned at the Hannover Fair in 2011, includes advanced technology (blockchains, the Internet of Things, artificial intelligence, etc.).

The increase in industrialization and technological developments that started with Industry 2.0 and continued after Industry 4.0 have led to an increase in direct or indirect damage to the environment. This situation has been effective in addressing the issue of minimizing the damage to the environment globally. In order to reduce environmental damage, the concept of sustainability has come to the forefront, and studies have been carried out to raise awareness. Especially in recent years, stakeholders expect companies that have a share in environmental damage to report their social and environmental activities, apart from their financial activities. These developments have led to the emergence of the concept of sustainability reporting.

The issue of sustainability, which has environmental, social, and economic dimensions, is increasingly occupying the agenda of senior executives. Today, a new world order is emerging in which corporate interests do

not conflict with social interests and social and environmental issues become the responsibility of companies in addition to an economic and profit-oriented perspective. Corporate sustainability has gone far beyond corporate social responsibility and has become very important for companies (PWC, 2011). As a result of developments in corporate sustainability and changes in the management approach, companies have started to publish sustainability reports, and sustainability indices have been created in the markets. The demand for the preparation of sustainability reports by the stakeholders of the business, including legal regulators, credit institutions, civil organizations, securities exchanges, and business customers, is one of the important factors for businesses to prepare such reports. In addition, business managers have also become aware that they can benefit from sustainability reports (Beyazyol & Gökçen, 2023). Companies have internal reasons for sustainability reporting that are often related to improving the company's performance. Reporting processes help both to generate additional information that was not available before and to improve the quality of existing information. Attention to sustainability can lead to innovation, new market opportunities, and long-term sustainable growth. Sustainability reporting can improve a company's understanding of sustainability-related risks, improve the management of risks, and make it easier to meet changing social expectations. Sustainability reporting can raise awareness of sustainability issues within the company, which can help to make better decisions and improve the long-term future outlook. Sustainability reports can also be used as a cost-saving tool to reduce costs. This is because sustainability reports encourage the company to use natural resources more effectively, improve process efficiency, and utilize recoverable resources (Yükçü & Kaplanoğlu, 2016). These benefits may lead to an increase in the shareholder value of the companies and direct investors to invest in them.

Sustainability indices, on the other hand, are defined as a measure to evaluate the environmental, social, and economic performance of enterprises in a systematic, transparent, and complete manner (Gündüz, 2018) and are created as a tool to help institutional investors evaluate capital in a more sustainable manner (Çıtak & Ersoy, 2016). In recent years, stock exchanges, especially in developing countries, have started to use sustainability-related practices of listed companies in order to inform their existing investors and to appeal more to global institutional investors (Çıtak & Ersoy, 2016). In recent years, stock exchanges, especially in developing countries, have developed regulations and created sustainability indices for public disclosure of sustainability-related practices of listed firms in order to inform their existing investors and appeal more to global institutional investors.

Sustainability indices can be utilized to understand the impact of sustainable reporting on firms. When the literature is analyzed, it is seen that there are differences in the results of the studies examining the relationship between sustainability reports and financial performance. There are studies that find a negative relationship or no relationship between sustainability reports and firm performance. On the other hand, there are studies that have found a positive effect of sustainability reports on firm performance. Anam et al. (2011), based on the signaling theory, stated that increased transparency and disclosures in enterprises have a positive effect on performance. In the study, it was argued that increased disclosures by businesses lead to a decrease in the misevaluation of the share price, which in turn leads to higher company performance. Durucu (2023) found no significant difference in the financial ratios of manufacturing industry companies that publish and do not publish sustainability reports, while it was concluded that the average financial performance of companies that publish sustainability reports is higher. In this direction, the study recommends that companies should give importance to sustainability reporting. Almashhadani & Almashhadani (2023) reported that sustainability reporting has a significant impact on the financial performance (ROA and ROE) of 20 financial sector companies on the Bahrain Stock Exchange (BSX). In the study, it is stated that sustainability reporting by companies will be beneficial in strengthening financial performance. Felita & Faisal (2021) examined the impact of sustainability reporting on the performance of 85 firms in the banking sector on the Indonesian Stock Exchange for the period 2016-2019 and stated that sustainability reporting positively affects company performance and that sustainability reporting is one of the most important factors in understanding company success.

Based on the studies that conclude that sustainability reporting has a positive impact on firm performance, we can expect an increase in the stocks of companies included in the sustainability index. An increase in the stock price may cause investors to invest in firms included in the index. It is important to determine whether there is an overreaction when investors hold firms included in this index in their portfolios. Because if there is an overreaction, this may indicate that the investor can earn a return above the market return by investing in these stocks, while it may also indicate that the inclusion of firms in this index is welcomed positively by investors.

It is thought that examining whether being included in the sustainability index causes an overreaction in investors may be important for companies to be included in this index. In addition, there is no study in Turkey on whether inclusion in the sustainability index causes an overreaction. The purpose of this study is to determine whether investors overreact to companies included in the BIST Sustainability Index. The study consists of four sections. In the first part of the study, the sustainability report and sustainability index are discussed. The second section provides information on the overreaction hypothesis, while the third section presents the related literature. The fourth section presents the analysis and the results of the analysis.

2. Sustainability Reporting and Sustainability Index

The first known use of the word sustainability in Europe is found in the book of Hans Carl von Carlowitz in 1713. The concept of sustainability became more widely known after the Brundtland Report published by the United Nations World Commission on Environment and Development. The Brundtland Report defined sustainable development as "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs". The definition of sustainable development and the concept of sustainability became widespread after 1987 (Heinberg & Lerch, 2010). Sustainability shows the balance between the capacity of the ecosystem and resource consumption. Therefore, it is possible to define sustainability as the ability to meet economic demands without exceeding this balance and without reducing the environmental capacity of future generations (Gündüz, 2018). The concept of corporate sustainability, on the other hand, can be defined as "the effort to maintain the profitability of the company as a living entity by carrying out activities that will enable the protection and development of resources that can be used in the future while meeting today's needs by turning to social and environmental activities as well as economic profit in order to ensure the continuity of companies" (Altınay et al., 2017). The aim of corporate sustainability is to ensure balance and integrity between the environmental, social and economic dimensions of sustainability while fulfilling the environmental and social responsibilities of businesses towards the society in which they operate (Baumgartner & Ebner, 2010).

Companies develop their strategies around sustainability practices, which are of great importance in terms of resisting global competition. In fact, institutional structures such as non-governmental organizations, governments and media outlets try to put pressure on companies to develop sustainable strategies. In other words, companies are expected to stand out with socially beneficial projects through sustainable strategies. Therefore, it is now important to adapt sustainable strategies to corporate culture and relations with social stakeholders (Gündüz, 2018). The increasing importance of sustainable strategies in businesses has been effective in the use of non-financial sustainable reporting by businesses.

The first type of non-financial reporting can be considered as corporate social responsibility (CSR) reporting. Since the early 1970s, CSR has developed and spread rapidly. For example, with the amendment of the law in 1977, France made it compulsory for companies with more than 300 employees to prepare labor and employment reports in addition to financial reports (Parlakkaya et al., 2016). Since the 1980s, the negative consequences of industrialization started to emerge. Due to these negative consequences, the number of crises due to economic, social and climatic conditions has started to increase. As a result of these crises, consumers' awareness levels have increased and consumers have started to prefer environmentally sensitive businesses. This situation has caused businesses to publish environmental reports in order to demonstrate that they are environmentally sensitive and to gain competitive advantage. Environmental reporting has maintained its importance from the 1980s to the present day, as it is based on the sustainability of the activities of companies and leaving them the resources that will enable them to meet the needs of future generations. Since the 1990s, many countries have supported environmental management systems, which has led to different laws and practices between trade regions. In order to prevent this situation from negatively affecting international trade, environmental standards that can be applied all over the world have started to be developed. ISO 14001 environmental management standards were first published by the International Organization for Standardization (ISO) in 1996. Although ISO 14001 environmental standards are the most advanced standards used to improve the economic and environmental performance of businesses, they leave out some important issues in terms of sustainability. For example, the social impacts of businesses on society are not covered by the standards (Hatunoğlu & Kılıç, 2023). In order to overcome such deficiencies, John Elkington's Triple Balance Sheet System, which was first mentioned in his article "Towards the Sustainable Corporation: Win-Win-Win Business Strategies for Sustainable Development" published in the California Management Reviews in 1994, presented an approach that was the basis for the development of sustainable finance and corporate sustainability concepts (environmental, social and economic). This system developed by Elkington to measure America's corporate sustainability is a very valuable calculation method both for our world and living creatures and for the profitability of companies. With this method, Elkington included environmental and social dimensions in the corporate literature in addition to economic calculations such as traditional profit, return on investment and shareholder value (Ada, 2022). In the 2000s, it is seen that the reports published by businesses, which are called corporate social responsibility reports, form the basis of today's sustainability reports. (Beyazyol & Gökçen, 2023). The preparation and publication of these reports are generally voluntary. In addition, there are a few countries in the European Union that have special legislation requiring the publication of reports. Many developed countries use a standardized system for analyzing sustainability-related information to ensure that decision-makers have a solid basis for their strategic planning (Batista & Francisco, 2018).

In recent years, mostly large companies, but also SMEs, have been informing their stakeholders more frequently about their social and environmental performance through published reports or websites. Sustainability reports are effective in gaining public acceptance of the company in general and the acceptance of specific management decisions and activities by the company's key stakeholders. Reporting on non-financial corporate activities can

demonstrate a willingness to communicate about and engage with societal issues and reflect the company's commitment to stakeholders (Herzig & Schaltegger, 2011). In a research report published by Santa Clara University and Barclays Global Investors in 2013, it was determined that the stocks of companies that acted socially responsible were strongly valued over a 15-year period, while the stocks of companies that were not sensitive to social issues in their activities showed lower performance in the same period. In a study conducted by London Business School between 1990 and 2010, comparing publicly traded companies according to their sustainability relationships, it was determined that companies that invested in sustainability in a 20-year perspective were valued much more than those that did not. In addition, it has been determined that companies with sustainability are in a separate category in the stock markets and investors can choose to invest in companies with high index values (Akın, 2014). Moskowitz (1972) found a positive relationship between corporate performance of banks and corporate social awareness policies in the Ghanaian banking sector. The author believes that corporate social responsibility policies can increase firm value as they are demanded and valued by investors. Berthelot et al. (2012), using a sample of Canadian companies traded on the Toronto Stock Exchange, found that investors pay attention to sustainability reports and positively evaluate firms that provide sustainability reporting. Burhan & Rahmanti (2012) investigated the relationship between sustainability reporting and firm performance of 32 firms listed on the Indonesian stock exchange in the period 2006-2009. As a result of the study, it was stated that sustainability reporting affects company performance.

The increasing importance of sustainability has affected the financial system and led to a number of innovations in stock exchanges. At this point, we come across sustainability indices. Sustainability indices are generally used as an indicator that represents the behavior of stock prices in certain markets in a given period, including making the performance of capital markets more effective, deepening markets and measuring general economic trends (Gündüz, 2018).

Sustainability indices date back to the 1990s (Çıtak & Ersoy, 2016). The sustainability index is defined as a system for measuring the financial indicators of businesses that prefer to protect the environment rather than making quick profits. The first sustainability index created in the world is the Domini 400 Social Index calculated by "KLD Research & Analytics", which was established in 1990 and conducts research for institutional investors. Developments that contributed to the acceleration of sustainability studies started with the establishment of the Dow Jones Index in 1999. Dow Jones Sustainability Indexes (global), FTSE4Good UK Index (UK), Domini 400 Social Index (USA), Morningstar Socially Responsible Investment Index (Japan), Johannesburg Stock Exchange (South Africa), Bovespa Corporate Sustainability Index (Brazil), Shanghai Stock Exchange (SSE) Social Responsibility Index (China), Global Challenges Index (Germany), DAXglobal® Sarasin Sustainability Switzerland Index (Switzerland) are examples of sustainability indices. The leading stock exchanges in sustainability indices are London, Nasdaq and Euronext (Altınay et al., 2017).

BIST Sustainability (XUSRD) and BIST Sustainability 25 (XSD25) indices, which include the shares of companies traded on Borsa Istanbul and whose corporate sustainability performances are at a high level, were created in order to increase the understanding, knowledge and practices on sustainability in Turkey and especially among Borsa Istanbul companies (Borsa İstanbul, 2013). In order to calculate the BIST Sustainability Index and to determine the companies to be included in the index, Borsa Istanbul companies are subjected to valuation according to international sustainability criteria only through "publicly available" information (Çıtak & Ersoy, 2016). Started in 2014, the BIST Sustainability Index included only companies in the BIST 30 index in the first year, while companies in the BIST 50 index were also subjected to valuation in 2015. As of 2016, the index was expanded to include volunteer BIST 100 companies in addition to BIST 50 index companies. The list of companies subject to valuation is revised every year in December and announced by Borsa Istanbul (Parlakkaya et al., 2019). In addition, the BIST Sustainability 25 Index started to be published as of November 21, 2022 (Borsa İstanbul, 2013).

3. Overreaction

De Bondt & Thaler (1985) explained the overreaction effect as "If stock prices systematically trade above or below their expected value, the reversal in prices (i.e., gaining stocks losing and losing stocks gaining) should be predictable on its own, without the use of any data (such as earnings)". Basically, they proposed two hypotheses: (1) if extreme price movements in stock prices occur, there will be a subsequent price movement in the opposite direction. (2) the more extreme the initial price movement in stock prices, the larger the stock price correction will be.

The overreaction hypothesis assumes that investors make systematic errors when reacting to information. As discussed in Daniel et al. (1998) overreaction can arise from biased behavior. One of the behaviors that cause overreaction in financial markets stems from the tendency of people to make predictions using what is known as representativeness rather than Bayes' rule (Fung & Lam, 2004). An important symptom of the representativeness heuristic, discussed in detail by Tversky and Kahneman, is that individuals think they see patterns in truly random sequences (Barberies et al., 2005). Investors, who tend to generalize what they have experienced, make decisions

according to the prejudices they form (Bayrak, 2012). One consequence of the representation heuristic is that individuals attach great importance to specific details, whether they are valuable or not, and overlook basic information (Turguttopbaş, 2008). Investors may be thinking quickly to perceive information that is actually random. They may also misperceive an asset's past performance as indicative of future performance. Such a bias causes investors' investment averages to decrease in their long-term investments (Bhattacharya, 2012). Individuals under the influence of the representativeness heuristic tend to overreact, thinking that former losers tend to be future winners. In other words, stock market overreaction suggests an excessive increase (decrease) in the stock price of a particular stock as a result of recent good (bad) news associated with the stock. Thus, when uncertain about the intrinsic value of a stock, investors will be very optimistic and/or very pessimistic about the value of the firm (Aguiar & Sales, 2010). This will lead to an overreaction that causes the company's stock price to be priced above/below its value. Investors in the market will notice the overreaction after a certain period of time and take corrective action, ensuring that the stocks in the market return to their required value.

Another investor behavior related to the Overreaction Hypothesis is the myobic loss aversion effect. "Myopic loss aversion", which is based on myopia (inability to see near and far), is one of the behavioral investor tendencies that create overreaction. It is claimed that an investor who is considered myopic does not evaluate events and information as they should when making long-term decisions, and as a result of this incorrect evaluation, stock prices deviate from fundamental values, causing an overreaction. According to the Overreaction Hypothesis, this situation resulting from myopic perspective causes prices to return to their fundamental values in a reverse direction over time (Sönmez, 2010).

Other investor behaviors associated with the Overreaction Hypothesis are overconfidence (Bayrak, 2012) and investor optimism/pessimism (Faikoğlu, 2012). Overconfidence is when individuals trust their own abilities and knowledge more than the abilities and knowledge of other individuals. An overconfident investor is not willing to change the existing information even in a situation where new information comes to them, and they maintain their existing position in a situation that requires trading (Bayrak, 2012). Another behavior that leads investors to overreaction is investor optimism/pessimism. It is thought that the discrepancy between the optimism/pessimism behavior experienced by investors may explain the low stock returns in the long term after the overreaction (Faikoğlu, 2012). After a series of good news announcements, investors become overly optimistic about future news announcements, causing an overreaction and causing stock prices to rise excessively. However, subsequent news leads to low returns, contrary to the investor's optimism. In this sense, it is claimed that transactions based on a series of good or bad old information can bring high returns (Döm, 2003).

Representativeness effect, myopic loss aversion effect, overconfidence tendency and investor optimism/pessimism effect behaviors each prevent the investor from evaluating new information rationally. As a result of these tendencies, the investor misinterprets the new information and causes the stock prices to deviate from the fundamental prices, while the investor who realizes his/her mistake over time and causes an overreaction will ensure that the stock prices return to their fundamental values (Sönmez, 2010).

In addition, investors' beliefs based on past stock performances may be effective in forming an expectation about future stock performance. Therefore, investors may reverse stock prices by realizing the wrong decision they have made based on their beliefs. If the overreaction hypothesis is correct, such a stock should show a strong reversal (negative return) in the future (George & Hwang, 2007).

Overreaction is associated with the irrational behavior of investors who overreact to developments based on good or bad news about the businesses traded in the market (Caporale et al., 2014). If there is an overreaction to very important news reflected in the market, this situation causes negative news about the business to cause the stock price in the market to be valued below its actual value, while positive news about the business causes the stock to be priced above its fundamental value. When this situation that causes mispricing in the market is realized after a certain period of time, investors take corrective measures (Maheshwari & Dhankar, 2014). These measures cause investors, who have their own justifications, to move the stock prices in the market from top to bottom (bottom-up) (Das & Krıshnakumar, 2015). In this case, an investor can earn a return above the market return thanks to the trading strategies he/she applies by using this information (Tetik & Özen, 2016).

Under the overreaction hypothesis, the announcement of sustainability index inclusion or delisting events can lead to three possible scenarios: (i) positive investor reactions to index inclusion and negative investor reactions to index delisting; (ii) negative investor reactions to index inclusion and positive investor reactions to index delisting; and (iii) no investor reaction to index inclusion or delisting (Adamska & Dąbrowski, 2021). Consolandi et al. (2009), covering the period 2002-2006, investigated the market reaction to the inclusion and exclusion of European companies in the Dow Jones Sustainability Stoxx Index (DJSSI). As a result of the research conducted with the event study method, it is stated that while positive abnormal returns are observed in firm returns after inclusion in the sustainability performance, cumulative abnormal returns decrease shortly after the announcement of delisting from the index. The study also finds that the positive reaction to index inclusion is stronger than the negative reaction to index delisting. Wai Kong Cheung (2011) finds no strong evidence that index inclusion or exclusion announcements have a significant impact on stock returns and risk, but reports a significant but temporary increase (decrease) in the returns of included (excluded) stocks on the day of the change. Škare & Golja

(2012) compared the financial and sustainable performance of 45 companies included in the Dow Jones World Sustainability Index and 45 companies not included in the Sustainability Index. As a result of the research, it was found that the companies included in the Sustainability Index performed better than the companies not included in the Sustainability Index for the specified periods. Ramchander et al. (2012) stated that the announcement of inclusion in the Domini Social 400 index created a positive reaction in the firm's stock price. Based on these results, a positive increase in the stock prices of firms included in the index can be expected. Therefore, it may be important to determine whether inclusion in the sustainability index causes an overreaction among investors.

4. Literature

Rossi (2009) used a sample of 241 non-financial Brazilian companies from 2005 to 2007 and analyzed whether corporate social responsibility has an impact on firm value. It is stated that companies that form the Bovespa Corporate Sustainability Index (ISE) are traded at a higher price compared to other publicly traded companies.

Artiach et al. (2010) find that firms that are included in the Dow Jones Global Sustainability Index and have a high degree of corporate sustainability performance are more profitable than firms that are not included in the index.

Çıtak & Ersoy (2016) investigated the investor reaction to the firms included in the BIST Sustainability Index through stock return ratios and Market Value/Book Value Ratio. As a result of the mean tests, no significant difference was found between the average rates of return of firms included in the sustainability index and the average rates of return of firms not included in the sustainability index. However, the Market Value/Book Value Ratio of the firms included in the sustainability index was higher than the other group of firms. As a result of the Event Study, the fact that the average cumulative abnormal return in the 0 + 3 range is statistically significantly positive indicates that investors showed demand for the related stocks in the short term after the announcement.

Altınay et al. (2017) statistically analyzed the change in the stock values of 4 banks traded in the BIST Sustainability Index and operating in the banking sector before and after their inclusion in the sustainability index. Although the average stock values of the banks were higher before the index than after the index, no statistically significant difference was found.

The aim of Gündüz (2018)'s study is to examine whether there is a change in the stock values of the firms included in the BIST Sustainability Index after they are included in the index. Within the scope of the study, the financial data of 42 firms traded in the index between 2014 and 2016 were used. As a result of the research, it is stated that inclusion in the sustainability index has no effect on the stock values of the companies and that the index has not yet made the expected contribution to the companies in terms of economic benefit.

Parlakkaya et al. (2019) examined the effects of the inclusion of companies in the BIST Sustainability Index on company stock returns between 2014-2016. In the study using the event study method, it is stated that inclusion in the BIST Sustainability Index has no effect on stock returns.

In Özmen et al. (2020)'s study, the financial performances of 15 companies included in the index in the first period of the BIST Sustainability Index were measured in the post-index period. After the measurement made with the TOPSIS method, it was stated that while there was no increase in the financial performance of the banks included in the index, there was an increase in the financial performance of companies other than banks.

Adamska & Dąbrowski (2021) examined 815 events in the markets of Brazil, Japan, Poland, South Africa, the USA and the UK between 2009 and 2017 using the event study method. In the study, investors' reactions to the announcements regarding the inclusion and exclusion of institutional environments and the risk levels created by companies in the sustainability indices of companies were investigated. As a result of the research, it was stated that investors in markets with riskier corporate environments responded more strongly to company participation than in markets with lower risk corporate environments.

5. Methodology

The purpose of this study is to investigate whether the overreaction hypothesis exists in the companies included in the BIST Sustainability Index between 2014 and 2022. The companies included in the sustainability index are published in December every year, and the number of companies and company names may change every year due to new companies being included in the index and companies being removed from the index. For this reason, the companies to be examined in the research were re-determined every year according to published company information. Companies that are included in the Sustainability Index, which has been published since 2014, and whose data are fully accessible, were selected as a sample, taking into account the lists that are renewed every year. In the research, stock information of 64 businesses whose data did not have any problems was used. Within the scope of analysis; Monthly closing price data of stocks and monthly BIST-100 index value were used. Closing prices of companies and the index were obtained from investing.com.tr.

The study utilizes the methodology of De Bondt & Thaler (1985) to construct one-year portfolio formation and test periods. The first portfolio formation period starts in December 2013 and ends in November 2023. Based on

this information, the first portfolio formation period to create a one-year portfolio started in 2014 and ended in 2015. For a 12-month period, the individual performance of stocks was measured. The results of these measurements were ranked in descending order, and a winner portfolio was formed from the stocks ranked in the top ten to five, and a losing portfolio was formed from the stocks ranked in the bottom five. In the next period, between 2015 and 2016, the returns of the winner and losing portfolios were calculated to test whether there was an inverse movement. This test was repeated for eight periods. The processes performed for one-year portfolios were repeated for our other periods, first for three-year portfolios and then for five-year portfolios, in order to measure the long-term effect.

In the study, abnormal returns (AR_{it}) and cumulative abnormal returns (CAR_i) are calculated using the monthly closing prices of stocks. Here, the stock return (R_{it}) and the market index return (R_{mt}) are denoted by the stock return in period t (Can & Dizdarlar, 2021).

$$AR_{it} = R_{it} - R_{mt} \tag{1}$$

$$CAR_i = \sum_t^0 AR_{it} \tag{2}$$

They are listed from largest to smallest, taking into account the cumulative abnormal returns during the formation period. Afterwards, the winner portfolio (W) was created from the top 5 stocks and the losing portfolio (L) was created from the last 5 stocks. The performance of the portfolios created during the test period was examined with the help of the formula below (Can & Dizdarlar, 2021).

$$CAR_{p,z,t} = \sum_t [\left(\frac{1}{N}\right) \sum_{i=1}^{N} AR_{it} \tag{3}$$

where, p indicates the winner and loser portfolios, z indicates the portfolio creation periods, and N indicates the number of stocks in the portfolio.

In the last part of the analysis, the joint impact of the portfolios will be measured. Average cumulative abnormal return calculation (ACAR) was used to measure the joint effect of the portfolios. ACARs of the winner and losing portfolios during the formation and test periods were calculated with the help of the formula below.

$$ACAR_{p,t} = \frac{\sum_{z=1}^{Z} CAR_{p,z,t}}{Z} \tag{4}$$

According to the results of this analysis, if the ACARs of the winner portfolio are less than zero ($ACAR_{w,t} < 0$) and the ACARs of the loser portfolio are greater than zero ($ACAR_{l,t} > 0$) it will be concluded that the overreaction hypothesis is valid. If the difference between the ACARs of the loser portfolio and the ACARs of the winner is greater than zero (($ACAR_{l,t} - ACAR_{w,t}$)>0), the overreaction hypothesis is valid for the specified period (Can & Dizdarlar, 2021).

Finally, it was examined whether there was a significant change in the ACARs of the winner and losing portfolios during the test and formation periods. A dependent sample t-test was used to determine whether there was a significant change. The t-test was conducted with the SPSS 23 program.

6. Results

The findings obtained in the study using the winner and loser portfolio model of De Bondt & Thaler (1985) are presented in the tables below.

Table 1 shows the cumulative abnormal returns and average cumulative abnormal returns in the eight-period formation and test periods of the winner portfolio consisting of the top five companies in the sustainability index and the losing portfolio of the bottom five companies as a result of the ranking.

The one-year CAR of the winner portfolio during the formation period is 0.055 per month. The ACAR of the winner portfolio during the test period was found to be 0.009. When we look at the ACARs for the loser portfolio, the average monthly return is -0.029 in the formation period, while it is 0.017 in the test period.

Table 2 includes the cumulative abnormal returns and average cumulative abnormal returns of the winner and loser portfolios for the test period, as well as the cumulative abnormal return differences and average cumulative abnormal return differences of the winner and losing portfolios.

Table 1. One-year CARs and ACARs (%) of winner and losing portfolios in the BIST Sustainability Index

		Losing Portfolio (L)				Winner Portfolio (W)			
		Formation Period		Test Period		Formation Period		Test Period	
Formation	**Test**	**CAR**	**ACAR**	**CAR**	**ACAR**	**CAR**	**ACAR**	**CAR**	**ACAR**
2014-2015	2015-2016	0.2067	-0.0172	0.0379	0.0032	0.5812	0.0484	0.0740	0.0062
2015-2016	2016-2017	-0.2015	-0.0168	0.0248	0.0021	0.6246	0.0521	0.1009	0.0084
2016-2017	2017-2018	-0.2947	-0.0246	0.3122	0.0260	0.5990	0.0499	0.0107	0.0009
2017-2018	2018-2019	-0.2947	-0.0246	0.3122	0.0260	0.5990	0.0499	0.0482	0.0040
2018-2019	2019-2020	-0.4322	-0.0360	-0.0061	-0.0005	0.6998	0.0583	0.0760	0.0063
2019-2020	2020-2021	-0.5060	-0.0422	0.5154	0.0430	0.6165	0.0514	0.2474	0.0206
2020-2021	2021-2022	-0.3011	-0.0251	0.0234	0.0020	0.8593	0.0716	0.4950	0.0412
2021-2022	2022-2023	-0.6280	-0.0523	0.5005	0.0417	0.7454	0.0621	-0.1539	0.0128
	ACAR	-0.3581	**-0.0298**	0.2150	**0.0179**	0.6656	**0.0555**	0.1123	**0.0094**

Table 2. CARs and ACARs (%) of the portfolios with the most gains and losses in the BIST Sustainability Index during a year

	Losing Portfolio (L)		Winner Portfolio (W)		Losing-Winner Portfolio (L-W)	
Test	**CAR**	**ACAR**	**CAR**	**ACAR**	**CARL-CARW**	**ACARL-ACARW**
2015-2016	0.0379	0.0032	0.0740	0.0062	-0.0361	-0.0030
2016-2017	0.0248	0.0021	0.1009	0.0084	-0.0761	-0.0063
2017-2018	0.3122	0.0260	0.0107	0.0009	0.3016	0.0251
2018-2019	0.3122	0.0260	0.0482	0.0040	0.2641	0.0220
2019-2020	-0.0061	-0.0005	0.0760	0.0063	-0.0821	-0.0068
2020-2021	0.5154	0.0430	0.2474	0.0206	0.2681	0.0223
2021-2022	0.0234	0.0020	0.4950	0.0412	-0.4716	-0.0393
2022-2023	0.5005	0.0417	-0.1539	-0.0128	0.6544	0.0545
ACAR	0.2150	**0.0179**	0.1123	**0.0094**	0.1028	**0.0086**

The average abnormal return that an investor will obtain if he invests in a losing portfolio consisting of the stocks that lose the most during one-year portfolio formation periods is 0.017. In addition, if the investor invests in the winner portfolio, the monthly average abnormal return he will receive is 0.009. When we examine the total difference in the ACARs of the loser and winner portfolios, we see that the difference is 0.008. The fact that the differences are positive shows that the condition sought in the overreaction hypothesis ($(ACAR_{l,t}\text{-}ACAR_{w,t}) > 0$) is met, and indicates that the overreaction hypothesis is valid in the BIST Sustainability Index in the 2014-2022 period.

Table 3 shows the cumulative abnormal returns and average cumulative abnormal returns in the six-period formation and test periods of the winner portfolio consisting of the top five companies in the sustainability index and the losing portfolio of the bottom five companies as a result of the ranking.

Table 3. Three-year CARs and ACARs (%) of winner and losing portfolios in the BIST Sustainability Index

		Losing Portfolio (L)				Winner Portfolio (W)			
		Formation Period		Test Period		Formation Period		Test Period	
Formation	**Test**	**CAR**	**ACAR**	**CAR**	**ACAR**	**CAR**	**ACAR**	**CAR**	**ACAR**
2014-2017	2015-2018	-0.3940	-0.0109	-0.3621	-0.0101	1.2812	0.0356	0.9216	0.0256
2015-2018	2016-2019	-0.5790	-0.0161	-0.3022	-0.0084	1.2530	0.0348	0.8487	0.0236
2016-2019	2017-2020	-0.4789	-0.0133	-0.0566	-0.0098	1.2888	0.0358	2.1633	0.0601
2017-2020	2018-2021	-0.4219	-0.0117	-0.3537	-0.0098	1.5826	0.0440	2.9810	0.0828
2018-2021	2019-2022	-0.7727	-0.0215	-0.3288	-0.0091	1.9733	0.0548	1.4209	0.0395
2019-2022	2020-2023	-0.6553	-0.0182	-0.4115	-0.0114	2.0843	0.0579	1.4229	0.0395
	ACAR	-0.5503	**-0.0153**	-0.3025	**-0.0098**	1.5772	**0.0438**	1.6264	**0.0452**

The three-year CAR of the winner portfolio during the formation period is 0.0043 per month. The ACAR of the winning portfolio during the test period was found to be 0.045. When we look at the ACARs for the loser portfolio, the average monthly return is -0.015 in the formation period, while it is -0.009 in the test period.

Table 4 includes the cumulative abnormal returns and average cumulative abnormal returns of the winner and loser portfolios for the test period, as well as the cumulative abnormal return differences and average cumulative abnormal return differences of the winner and loser portfolios.

The average abnormal return that an investor will obtain if he invests in a losing portfolio consisting of the stocks that lose the most during three-year portfolio formation periods is -0.009. In addition, if the investor invests in the winner portfolio, the monthly average abnormal return he will receive is 0.045. When we examine the total

difference in the ACARs of the loser and winner portfolios, we see that the difference is -0.054. The fact that the differences are negative shows that the condition sought in the overreaction hypothesis (($ACAR_{l,t}$ $-ACAR_{w,t}$) > 0) is met, and indicates that the overreaction hypothesis is not valid in the BIST Sustainability Index in the 2014-2022 period.

Table 4. CARs and ACARs (%) of the portfolios with the most gains and losses in the BIST Sustainability Index during three years

	Losing Portfolio (L)		Winner Portfolio (W)		Losing-Winner Portfolio (L-W)	
Test	**CAR**	**ACAR**	**CAR**	**ACAR**	**CARL-CARW**	**ACARL-ACARW**
2015-2018	-0.3621	-0.0101	0.9216	0.0256	-1.2837	-0.0357
2016-2019	-0.3022	-0.0084	0.8487	0.0236	-1.1509	-0.0320
2017-2020	-0.0566	-0.0098	2.1633	0.0601	-2.2199	-0.0699
2018-2021	-0.3537	-0.0098	2.9810	0.0828	-3.3347	-0.0926
2019-2022	-0.3288	-0.0091	1.4209	0.0395	-1.7497	-0.0486
2020-2023	-0.4115	-0.0114	1.4229	0.0395	-1.8344	-0.0510
ACAR	-0.3025	**-0.0098**	1.6264	**0.0452**	-1.9289	**-0.0550**

Table 5 shows the cumulative abnormal returns and average cumulative abnormal returns in the four-period formation and test periods of the winner portfolio consisting of the top five companies in the sustainability index and the losing portfolio of the bottom five companies as a result of the ranking.

Table 5. Five-year CARs and ACARs (%) of winner and loser portfolios in the BIST Sustainability Index

		Losing Portfolio (L)				Winner Portfolio (W)			
		Formation Period		Test Period		Formation Period		Test Period	
Formation	**Test**	**CAR**	**ACAR**	**CAR**	**ACAR**	**CAR**	**ACAR**	**CAR**	**ACAR**
2014-2019	2015-2020	-0.287	-0.005	-0.176	-0.003	1.453	0.024	1.235	0.021
2015-2020	2016-2021	-0.468	-0.008	-0.608	-0.010	1.549	0.026	1.184	0.020
2016-2021	2017-2022	-0.768	-0.013	-0.485	-0.008	1.830	0.031	1.302	0.022
2017-2022	2018-2023	-0.620	-0.010	-0.428	-0.007	1.992	0.033	1.711	0.029
	ACAR	-0.536	**-0.009**	-0.424	**-0.007**	1.706	**0.028**	1.358	**0.023**

The five-year CAR of the winner portfolio during the formation period is 0.028 per month. The ACAR of the winner portfolio during the test period was found to be 0.022. When we look at the ACAR for the loser portfolio, the average monthly return is -0.008 in the formation period, while it is -0,007 in the test period.

Table 6 includes the cumulative abnormal returns and average cumulative abnormal returns of the winner and loser portfolios for the test period, as well as the cumulative abnormal return differences and average cumulative abnormal return differences of the winner and loser portfolios.

Table 6. CARs and ACARs (%) of the portfolios with the most gains and losses in the BIST Sustainability Index during five years

	Losing Portfolio (L)		Winner Portfolio (W)		Losing-Winner Portfolio (L-W)	
Test	**CAR**	**ACAR**	**CAR**	**ACAR**	**CARL-CARW**	**ACARL-ACARW**
2015-2020	-0.1760	-0.0029	1.2346	0.0206	-1.4106	-0.0235
2016-2021	-0.6077	-0.0101	1.1839	0.0197	-1.7915	-0.0299
2017-2022	-0.4852	-0.0081	1.3022	0.0217	-1.7875	-0.0298
2018-2023	-0.4279	-0.0071	1.7108	0.0285	-2.1387	-0.0356
ACAR	-0.4242	**-0.0071**	1.3579	**0.0226**	-1.7821	**-0.0297**

The average abnormal return that an investor will obtain if he invests in a losing portfolio consisting of the stocks that lose the most during five-year portfolio formation periods is -0.007. In addition, if the investor invests in the winner portfolio, the monthly average abnormal return he will receive is 0.022. When we examine the total difference in the ACARs of the loser and winner portfolios, we see that the difference is -0.029. The fact that the differences are negative shows that the condition sought in the overreaction hypothesis (($ACAR_{l,t}$ $-ACAR_{w,t}$) > 0) is met, and indicates that the overreaction hypothesis is not valid in the BIST Sustainability Index in the 2014-2022 period.

Table 7 shows the t-Test results for the formation and test periods. According to the t-test results made with the ACAR values of the formation and test periods of the winner and losing portfolios, the significance level value for the losing portfolio is p = 0.020, while t = -4.7270 for the one-year period, and the significance level value is p = 0.025, while t = -3.1550 for the three-year period. The significance level value is p = 0.308, while t = -0.00186 for

the five-year period. In the winner portfolio, the significance level value was found to be p = 0.000 and t = 9.2920 for the one-year period, for the three-year period t = -0.1390, and the significance level value was found to be p = 0.895, for the five-year period t = 5.1870, and the significance level value was found to be p = 0.014. According to these results, the difference in returns between the winner and losing portfolios in the formation and test periods for a one-year period is significant at the 1% significance level. While the losing portfolio return difference was significant in the three-year portfolio period, only the winner portfolio return difference was found to be significant in the five-year portfolio period. It has been observed that the highest gain is in the one-year winner portfolio. However, according to these results, it was concluded that the overreaction hypothesis was only valid for a one-year period.

Table 7. t-Test results

		Mean	t	Sig
One Year	**L Formation-L Test**	-0.048	-4.727	**0.020**
	W Formation- W Test	0.066	9.292	**0.000**
Three Year	**L Formation-L Test**	-0.006	-3.155	**0.025**
	W Formation- W Test	-0.001	-0.139	0.895
Five Year	**L Formation-L Test**	-0.002	-1.226	0.308
	W Formation- W Test	0.006	5.187	**0.014**

7. Discussion

As a result of the analysis, results similar to the studies of Consolandi et al. (2009) and Rossi (2009) were obtained. However, when the studies on the BIST Sustainability Index are evaluated, it was concluded in the studies of Gündüz (2018), Parlakkaya et al. (2019), Altınay et al. (2017) that being included in the Sustainability index has no effect on the company's stock returns. With this study, it was concluded that by creating a portfolio consisting of companies included in the sustainability index, a return above the BIST 100 Index can be achieved if the portfolio is held for one year. This difference may have been caused by investors' generally inadequate daily reactions. Investors will be able to obtain a return above the market by holding their shares for a period of one year. This can be expressed as investors positively evaluating companies' inclusion in the sustainability index.

8. Conclusions

The sustainability index is an index that allows us to obtain information through financial markets about how much companies care about sustainability and how they reflect this to the institution. Therefore, an increase in the stock prices of companies included in the Sustainability Index can be expected. Additionally, inclusion in the sustainability index may be perceived as positive news by investors, causing an overreaction.

In this study, it was examined whether investors overreacted to the companies included in the BIST Sustainability Index between 2014 and 2022. The validity of the overreaction hypothesis was investigated for both one year and three and five years. As a result of the research, it was determined that there was an overreaction for a one-year period. However, no overreaction was observed for the three and five-year periods. According to this result, while investors react to companies being included in the Sustainability Index for one year, their reactions are not sufficient for three and five years. Based on this result, it can be stated that Sustainability reports are evaluated positively by investors. These results are only valid for the BIST Sustainability Index. In addition, the market risk may also have an effect on the overreaction in this index in the specified period.

Companies paying more attention to sustainability reports, which are optional to be published in order to be included in the sustainability index, may lead to both an increase in their reputation and more recognition by investors. In this way, companies can both provide capital and contribute to increasing shareholder value. While investors will obtain abnormal returns by purchasing stocks of companies included in the sustainability index, they will also encourage companies to publish sustainability reports and contribute to minimizing the damage that companies cause to the environment. In addition, investors can benefit from the publication of information about the companies that will be included in the index when deciding to change or keep their existing stocks.

It is thought that comparing the results obtained from this study by investigating whether investors overreact to the sustainability index in the stock markets of developed and developing countries will help to determine whether the overreaction is limited to this country and to obtain an idea about whether sustainability reporting is evaluated positively. In addition, by conducting an Event Study, how investors react to being included in the index or removed from the index can also be determined.

Data Availability

The data used to support the research findings are available from the corresponding author upon request.

Conflicts of Interest

The author declares no conflict of interest.

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