The Effect of ESG Data of Companies on Financial Performance: A Panel Data Analysis on The BIST Sustainability Index

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Şirketlerin ESG Verilerinin Finansal Performans Üzerindeki Etkisi: BİST Sürdürülebilirlik Endeksinde Panel Veri Analizi

Abstract

The relationship between companies' environmental, social, and governance (ESG) data and their financial performance is of significant interest. The primary aim of this study was to investigate whether the ESG scores of companies in the BIST Sustainability Index impact their financial performance. By analysing the relationship between ESG scores and financial performance indicators of 26 companies, whose ESG scores were calculated by S&P Global for the period 2018-2022, using the panel data analysis method, we found compelling results. ESG factors were found to have a significant and positive effect on return on assets (ROA), return on equity (ROE), net profit margin (NPM), and asset growth (AGR) but a negative effect on the market-to-book ratio (MBR).

Keywords   :   ESG, Sustainability, Financial Performance, Panel Data Analysis.

JEL Classification Codes :   M14, M40, M49.

Öz

Şirketlerin ESG verileri ile finansal performansları ilişkisi son zamanlarda literatürde sıklıkla araştırılan konulardan biridir. Bu çalışmada temel amaç; güncel BIST Sürdürülebilirlik Endeksi'nde yer alan şirketlerin ESG skorlarının finansal performansları üzerinde etkisinin olup olmadığını test etmektir. Bu amaç doğrultusunda; S&P Global tarafından ESG "skoru" hesaplanan 26 firmanın, 2018-2022 dönemindeki ESG skorlarıyla finansal performans göstergeleri arasındaki ilişki panel veri analizi yöntemiyle incelenmiştir. Elde edilen sonuçlar; ESG faktörlerinin; aktif karlılığı (ROA), özsermaye karlılığı (ROE), net kar marjı (NPM), ve aktif büyüme (AGR) üzerinde pozitif yönlü anlamlı bir etki ancak Piyasa Değeri/Defter Değeri (MBR) üzerinde negatif bir etkisi olduğunu göstermiştir.

Anahtar Sözcükler   :   ESG, Sürdürülebilirlik, Finansal Performans, Panel Veri Analizi.

1. Introduction

Today, the number of conscious consumers is increasing exponentially with the contribution of communication technologies, which puts pressure on companies' responsibility based on environmental and social sensitivity. Because stakeholders want to know the frequency and content of voluntary initiatives and operations that support company activities, all financial or non-financial business information is constantly requested by groups such as consumers, non-governmental organisations, media organisations, investors, or shareholders. Moreover, conflicts between countries, global economic recession, corruption scandals in companies, global warming, environmental problems, and the climate crisis create an obligation for companies to provide specific generally accepted reports, taking into account stakeholder demands. Therefore, how sustainability activities within corporate social responsibility are carried out becomes one of the most critical issues for companies.

The concept of ESG has been created to evaluate sustainability-related activities, especially those based on environment, social responsibility, and governance. ESG is used intensively to evaluate activities that are difficult to measure, and it has a decisive role in stakeholders' financial decision-making for companies.

The uncertain conditions that have emerged due to the pandemic process and global financial crises in recent years compel companies to be closer to sustainability. Besides, ESG has many benefits, such as contributing to corporate communication, protecting stakeholder rights, increasing business value, facilitating the opportunity to compare with other companies, and reducing risk perception. In this sense, sustainability activities play a crucial role in the success of companies, and the impact of new reporting and business models, such as ESG, on companies is gaining importance.

Accordingly, the main objective of this study is to determine whether there is any relationship between ESG scores, which have recently become of great importance for companies, and their financial performance and to choose the level and direction of this relationship. In this context, an application was made on the companies included in the Sustainability Index operating in Borsa Istanbul. Since the continuity of the ESG performance data is important in making a healthy contribution to the literature, the BIST Sustainability Index was specifically selected as the sample. The study's contribution to the literature is to "provide information that helps critical decisions to be taken by both company managers and investors according to the shape of the relationship between companies' ESG scores and financial performance".

In this context, the present study, which first includes the conceptual framework and a broad literature review, analyses whether the ESG scores of 26 companies in the BIST Sustainability Index impact financial performance between 2018 and 2022. Then, the findings obtained with the panel data method used in the study are presented

comprehensively through tables, followed by a discussion of the results and recommendations.

2. Conceptual Framework

Information on the environmental (E), social (S), and governance (G) quality of companies is abbreviated using the term ESG. Each of the three headings in this term consists of distinct subtopics (Clark & Viehs, 2014: 3). Basically, the origin of the ESG concept is based on the issue of Socially Responsible Investors (SRI). The SRI is a broad investment concept that considers not only the economic aspects of companies but also the environmental, social, and governance aspects (Staub-Bisang, 2012). ESG is defined as a broad set of three central factors that measure sustainability: managing business strategy and creating added value in the long term (Nasdaq, 2019).

Since the negative effects of climate change have started to threaten countries worldwide, the need to manage environmental risks and the increase in the importance given to ethics, transparency, and security have caused ESG elements to be considered more recently (Legal, 2023). In addition to these, financial crises and accounting and auditing scandals have unfortunately created a prejudice in the public opinion against financial reporting by companies. This situation must be clarified for many issues, such as transparency, reliability, quality, timing, and data accuracy. Companies have found the solution by openly sharing all financial and non-financial data with stakeholder groups (Raimo et al., 2021: 1412). Such an environment has paved the way for companies to attach more importance to ESG disclosures. ESG, which has existed in theory for many years but has not found much application area and can be evaluated based on corporate governance understanding, has started to be seen as an important factor that can help solve problems such as insecurity or uncertainty (Şeker & Şengür, 2022: 3).

ESG, which can also be defined as incorporating environmental, social, and governance issues into business models, clearly includes corporate governance within its scope. ESG practices play a significant role in the diversified information demands of stakeholders trying to access information with the developing technology. This situation is because such practices are a corporate governance approach that shows that companies act sensitively and responsibly towards their stakeholders (Atasel & Güneysu, 2023: 189).

In today's rapidly changing conditions, paying attention to ESG practices is critical for companies to have a long-term competitive advantage. This situation is also valid for stakeholder groups with which companies have mutual relations. For instance, investors expect companies with investment relationships to approach ESG policies proactively. Only then can good public relations be created (Legal, 2023).

ESG data consists of three sub-dimensions: environmental, social, and governance. The environmental dimension consists of the quality of environmental practices, such as introducing environmental management systems, reducing environmental pollution,

minimising carbon emissions, and measures for resource utilisation. Another sub-dimension, the social dimension, consists of human rights policies, labour, product and community responsibility, and the availability of some worker safety policies. On the other hand, the governance dimension includes various issues such as executive compensation, the structure of the organisation's management board, defences against purchase and takeover, and shareholder and corporate social responsibility strategies (Clark & Viehs, 2014: 3).

ESG guides companies to assess risks and opportunities through its operational impact on environmental, social, and governance issues. Environmental factors include air, water, or soil pollution, climate impact, carbon footprint, and energy use. Social factors include implications for all stakeholders, including the satisfaction, reputation, and privacy of customers, employees, or suppliers and issues such as diversity, equality, and inclusion. Governance factors include financial reporting, fraud prevention, wage transparency, and general labour agreements (Legal, 2023). Among the mentioned sub-dimensions of ESG, governance is the most important one. While the importance of environmental and social risks may vary by sector, governance risk is specific to companies (Broadstock et al., 2021).

Strong ESG practices provide many benefits to companies. It is possible to list them as follows (Legal, 2023):

- Helping increase the liquidity of company shares.
- Paving the way for competitive values against other competitors in the sector.
- Ensuring companies are resilient to activist interventions.
- Companies become experts in attracting and retaining the best talent.
- Investors of companies that attach importance to ESG practices also support strengthening the company in the long term.

In addition to the benefits listed, ESG practices contribute to the prevention of environmental pollution at the macro level, especially nationwide, and help create a protective shield against climate change that harms the national economy.

The most fundamental feature of ESG data is that it can benefit companies and society simultaneously. ESG investments help companies to reduce costs and increase revenues. Developing and encouraging cooperation between companies creates an advantage over competitors (Korwatanasakul, 2020). In addition, it enables companies to be comprehensively investigated and their activities to be rated by expert rating agencies. The most important of these rating agencies are expert organisations such as "Thamson Reuters' ASSET4", "Ethical Investment Research and Information Service (EIRIS)", and "Sustainability Asset Management (SAM)", which thoroughly evaluate the ESG activities of companies (Dorfleitner et al., 2015).

ESG is a type of report that examines the environmental impact, social practices, governance criteria, and related performance of companies and organisations. These reports, considered multidimensional statements, are important in creating investors' perceptions of

companies' success. They are essential for publicly traded and internationally operating companies (Ecobuild, 2023).

ESG is a comprehensive report that includes how companies invest in practices related to 10 main topics, consisting of 186 sub-categories and three main categories: social, environmental, and governance. The ESG score obtained based on these reports is an indicator that explains the data related to companies' sustainable performance goals. ESG scores are presented as numbers (0-100) and letters (D-, A+) by calculating the data obtained from different sources with formulas for specific parameters. Certain percentiles have been determined for indicators within the ten main themes within the environmental, social, and governance categories. According to these percentiles, both individual ESG scores and the overall ESG score can be calculated if necessary (Şişman & Çankaya, 2021).

Financial performance, which constitutes another part of the study, provides a holistic perspective on the performance of companies (Coşkun, 2007). Financial performance is using company resources effectively, acting according to objectives, and producing valuable outputs for stakeholders (Ranjbar et al., 2017). Financial performance analysis is crucial in evaluating past strategic decisions and alternatives (Easton et al. 2018). Although financial performance measurement methods are classified differently, the most commonly used classification is in three groups. These are (Kaya, 2022):

- Traditional (accounting-based) measurement methods (Ratio analysis, DuPont analysis),
- Market-based measurement methods (Tobin's Q, MBR, price/earnings),
- Value-based measurement methods (EVA-economic value-added, MVA-market value-added, CVA-cash value-added, SVA-shareholder value-added, WACC-weighted average cost of capital).

It is known that many factors generally affect the financial performance of companies. The relationship between financial and non-financial information disclosures and financial performance in companies attracts the attention of business management and parties who are in a relationship with the company (Atasel & Güneysu, 2023: 190). An important indicator that can be counted among financial performance indicators is profitability. ROA, ROE, NPM, MBR, and AGR are among the ratios that are prioritised in measuring companies' financial performance. Moreover, it is also possible to measure the relationship between ESG scores and financial performance by using the profitability indicators of companies in the analysis.

Investors have recently recognised that ESG factors are important indicators for company valuation, risk management, and even compliance with legal regulations. For this reason, companies' importance to ESG reporting and their investments in the issues included in the report significantly affect their favorability among investors (Şişman & Çankaya, 2021). Therefore, ESG performance and the financial performance of companies act in a mutually dynamic relationship.

3. Literature Review

In the literature review, it was realised that the most researched questions recently are "How do ESG scores affect the financial performance of companies or How does financial performance affect ESG scores?". The literature studies use companies' ESG scores as the independent variable and ROA, ROE, MBR, and EBIT ratios representing financial performance as dependent variables. The studies are generally conducted using panel data analysis and regression analysis. The results obtained for the relationship between ESG score and financial performance vary from significant and positive to negative and insignificant. These studies are summarised below.

In some of the studies in the literature, it has been stated that there is a significant and positive relationship between ESG scores and the financial performance of companies. Some of these studies are as follows:

Peiro et al. (2013) analysed the relationship between ESG score and financial performance with ANOVA in their study. In the survey, ROA, revenue per employee, earnings before interest and tax, cash flow per share, and net current assets were used as dependent variables, while ESG scores were used as independent variables. As a result, according to ESG scores, US firms selected from the bottom 25% of their sectors performed better than firms selected from the top 25% of their sectors.

Ortas et al. (2015) investigated the impact of companies' commitment to the United Nations Global Compact (UNGC) on ESG scores and financial results. The panel data analysis used ROA and Tobin's Q as dependent variables, while ESG scores were considered independent variables. The study concluded that ESG performance significantly impacted financial performance".

In the study conducted by Giannarakis et al. (2016), ESG score was used as the independent variable, while ROA was used as the dependent variable. Using panel regression analysis, the study determined that socially responsible enterprises positively impacted financial performance.

Li et al. (2018) tested the effect of ESG scores and CEO power on firm value with panel data analysis. ROA and Tobin's Q were used as dependent variables, while ESG overall score and CEO power were used as independent variables. The study concluded that there was a positive relationship between ESG score and firm value.

Zhao et al. (2018) investigated the impact of ESG data on financial performance with panel data analysis. They used return on capital employed (ROCE) as the dependent variable, ESG overall score as the independent variable, and total assets (TA) and leverage ratio as control variables. They concluded that good ESG performance could improve financial performance.

Düzer and Önce (2018) examined the effect of sustainability information level on firms' financial performance with panel regression analysis. The study used ESG performance as the independent variable, while ROA, ROE, MBR, and P/E ratio were used as the dependent variables to represent financial performance. As a result of the study, environmental performance had a positive effect on ROA and ROE, and social performance had a positive impact on ROA.

Minutolo et al. (2019) used panel data analysis to determine the impact of ESG data on companies' financial performance. The study used Tobin's Q and ROA as dependent variables, while the ESG overall score was considered independent. Debt/assets, firm size, firm age, sales, and number of employees were used as control variables. The study concluded that ESG positively affected Tobin's Q and ROA.

Alareeni and Hamdan (2020) investigated the relationship between ESG score and financial performance with regression analysis, using ROA, ROE, and Tobin's Q ratios as financial indicators. The control variables were financial leverage, firm size, and asset turnover. The results showed that ESG disclosures positively affect financial performance.

Ting et al. (2020) determined the relationship between ESG and firm performance with regression analysis. Tobin's Q, ROE, and P/E ratios represent financial performance. As a result, it was determined that ESG disclosures positively affected financial performance.

Zhang and Lucey (2022) established an econometric model for the relationship between ESG scores and company financial performance, using ROA and sustainability investments as variables. They determined that ESG performance significantly and positively affected firm performance.

Doğan et al. (2022) conducted a linear regression analysis using ROE for financial performance and Tobin's Q ratio as a proxy for firm value. They stated that ESG total scores and sub-dimensions positively and significantly affected firm profitability and value.

Erben Yavuz (2023) used ROA as a profitability indicator and firm size and leverage ratio as control variables. According to the panel data results, a significant and positive relationship was determined between the ESG scores of the analysed firms and firm profitability.

Karyağdı and Şit (2023) investigated the impact of ESG performance on firms' cost of capital and financial performance. The study's independent variable was ESG performance; the dependent variables were ROA, MBR, and financial expenses/net sales. As a result of the dynamic panel data analysis, it was observed that the ESG performance of the analysed firms has a positive effect, especially on ROA.

Korkmaz and Nur (2023) investigated the relationship between ESG scores of banks operating in the BIST Bank Index and corporate performance. ROA was selected as the

financial performance indicator, and ESG scores were chosen as the independent variable. Panel data analysis was conducted for the study. As a result, it was determined that there was a statistically significant and positive relationship between ESG scores and company performance.

In the literature, some studies support the view that ESG practices adversely affect financial performance. There is no significant relationship or both. Some of these are listed below.

Nollet et al. (2016) used individual and overall ESG scores as independent variables and ROE as dependent variables. The results show a negative relationship between ESG data and corporate social performance.

Atan et al. (2018) determined the impact of ESG factors on financial performance with panel data analysis. The dependent variable in the study was ROE, Tobin's Q, and WACC, while the independent variable was ESG overall score and sub-scores. Firm size and leverage ratio were also used as control variables. As a result of the study, it was determined that there was no significant relationship between individual and combined ESG factors, firm profitability, and firm value.

Ahlklo and Lind (2019) investigated the relationship between ESG scores and financial performance. ROA, Tobin's Q, and stock return were used as dependent variables, while ESG overall score and sub-scores were used as independent variables. Moreover, Beta, leverage ratio, firm size, R&D intensity, and dummy variables were used as control variables. The results show no significant relationship between ESG score and financial performance.

With panel data analysis, Sjögren and Wickström (2019) examined the relationship between ESG rating and financial performance. Company annual revenue change was the dependent variable, ESG ratings were the independent variables, and firm size, economic resources, and financial leverage were the control variables. As a result, they determined a negative relationship between ESG and financial performance.

Velte (2019) examined the impact of ESG data on accrual-based and actual earnings management with correlation analysis. As a result, a bidirectional relationship was determined between ESG performance and earnings management.

Kuiper and Galzev (2020) used correlation analysis to determine the impact of ESG data on stock prices. The results showed no relationship between ESG rating changes and abnormal returns.

Houqe et al. (2020) investigated the impact of companies' total ESG scores on the cost of debt (COD). They determined a significant negative relationship between total ESG performance and firms' COD.

Duque-Grisales and Aguilera-Caracuel (2021) used panel data analysis to test whether companies' financial performance was related to ESG scores. They determined a statistically significant negative relationship between ESG score and financial performance.

Akyıldırım et al. (2022) examined how ESG news was perceived by the market and the event study algorithm in which this information was transferred to stocks. They obtained results showing that negative ESG news only generated abnormal returns for companies close to 10%.

In light of the literature review, it is difficult to say that there is a consensus on the subject, and it is seen that different results are obtained for other sectors. The results of the present study show that ESG factors have a significant and positive effect on ROA, ROE, NPM, and AGR. However, ESG scores have a negative impact on MBR, indicating that ESG scores tend to decrease the MBR. Therefore, the results of this study are in line with the majority of the studies mentioned in the literature (Peiro et al., 2013; Friede et al., 2015; Ortas et al., 2015; Giannarakis et al., 2016; Li et al., 2018; Zhao et al., 2018; Minutolo et al., 2019; Ting et al., 2020; Zhang & Lucey, 2020; Doğan et al., 2023).

This study examines the impact of ESG scores on the financial performance of companies in the BIST Sustainability Index, which includes Türkiye's leading companies. The relationship between ESG scores calculated by S&P Global and companies' financial performance indicators for 2018-2022 is analysed using panel data analysis. The results, slightly different from the primary studies, explain the impact of ESG factors on key financial indicators and provide detailed information on the direction and intensity of this impact. The study contributes to understanding the complex, multifaceted relationship between sustainability performance and the financial performance of companies.

4. Data and Methodology

The study's main objective was to examine the impact of the ESG scores of 26 companies in the BIST Sustainability Index on their financial performance over the same period between 2018 and 2022. The study was conducted using the panel data analysis method. S&P Global started recording publicly available ESG scores in 2017. However, in this study, we could access the complete data of only 26 companies in the BIST Sustainability Index for 2018-2022. The companies' ESG scores were obtained from the S&P Global website, while financial data were obtained from the Finnet database.

S&P Global is a system that evaluates the ESG performance of more than 10,000 companies worldwide. Separate scores are calculated for each dimension, and a weighted average of these scores is used to create a total score. Furthermore, sector-specific criteria are also taken into account in the scoring. The total ESG score ranges from 0 to 100, with 100 representing the best performance. S&P Global determines unique scores for each sector using information points ranging from 600-1000 and ultimately calculates an ESG score for

each company. These scores assess and compare companies' sustainability performance (S&P Global, 2022).

Table 1 shows the ESG scores of the 26 companies in the analysis by sector.

Table: 1
Sectors and Average ESG Scores

Sector	Mean ESG Score	Number of Companies
Manufacturing Industry	26.72	10
Banking	38.36	6
Wholesale and Retail	21.26	3
Technology, Information, and Communication	22.93	3
Financial Institutions	32.41	1
Electricity, Gas, and Water	29.23	1
Transportation and Warehousing	37.85	1
Holdings and Investment Companies	36.63	1

According to Table 1, the number of firms with ESG scores is highest in the manufacturing industry sector. The banking sector has the highest average ESG score, while the wholesale and retail sectors have the lowest average ESG score.

The banking sector's high ESG scores may be due to its strict regulations and disciplined practices. On the other hand, the wholesale and retail sectors are less regulated and less experienced in social responsibility, which may explain their low ESG scores. Sectoral ESG score differences result from factors such as regulatory pressure, operational risks, social responsibility requirements, consumer and investor expectations, public perception, and innovation capacity. This situation explains the better or worse ESG performance of companies in some sectors compared to others.

Table 2 below gives the variables used to measure financial performance in testing the impact of ESG scores on companies' financial performance.

Table: 2
Definitions of Variables

Variable	Definition	Abbreviation
ESG score	ESG score	ESG
Return on assets	Net Profit/Total Assets	ROA
Return on equity	Net Profit/ Equity	ROE
Net profit margin	Net Profit / Net Sales	NPM
Market-to-book ratio	Market-to-book ratio	MBR
Asset growth	Percentage change in asset size	AGR

Below are the equations of the model, which test the relationship between financial performance ratios and ESG scores.

Model 1: $ROA_{i,t} = \beta_1 + \beta_2.ROA_{it-1} + \beta_3.ESG_{it}$

Model 2: $ROE_{i,t} = \beta_1 + \beta_2.ROE_{it-1} + \beta_3.ESG_{it}$

Model 3: $NPM_{i,t} = \beta_1 + \beta_2.NPM_{it-1} + \beta_3.ESG_{it}$

Model 4: $MBR_{i,t} = \beta_1 + \beta_2.MBR_{it-1} + \beta_3.ESG_{it}$

Model 5: $AGR_{i,t} = \beta_1 + \beta_2.AGR_{it-1} + \beta_3.ESG_{it}$

i = 1,2,...n number of firms,

t = 1,2,....t number of periods

β_1 = constant term, β_2 and β_{23} = regression coefficients.

i = 1,2,...n = 26, number of firms

t = 1,2,3, t = 5 (2018-2022), number of periods

it-1: one lag of the variable rate

n x t = 26 x 5 = 130 indicates the number of observations for each variable.

In line with the purpose of the research, the data obtained by collecting the companies' data were organised in the Microsoft Excel program and made ready for analysis. It was then analysed using Eviews and Python programs. Descriptive statistics, horizontal cross-sectional dependencies, correlation matrix, causality analysis, and dynamic panel data analysis GMM techniques were used to achieve the research purpose.

The dynamic panel data analysis method is beneficial for solving endogeneity problems and testing the exogeneity of explanatory variables (Akyol, 2020). The dynamic GMM technique was first proposed by Arellano and Bond (1991) using the first difference estimator. However, Blundell and Bond (1998) have improved this approach, integrating the level and first difference series as tools to obtain the system GMM estimator (Ganda, 2019). This study uses the System Generalized Moments Estimator (System GMM) developed by Arellano and Bover (1995) and Blundell and Bond (1998). Compared to the Difference GMM, the System GMM method solves the endogeneity problem of the lagged variable to a significant extent and provides more consistent and efficient forecasts (Wang et al., 2022).

To avoid potentially expected endogeneity problems in the analysis, the Two-Stage System GMM approach is used. To determine the method's accuracy, the study should apply some tests. To estimate whether autocorrelation exists, the autocorrelation test results proposed by Arellano and Bond are examined (Albayrak & Akyol, 2020). For the results in the model to be accurate, the AR (2) probability value should be greater than 0.05 (Çeştepe et al., 2020). In addition, the Hansen test is also used in such studies to detect and ensure the presence of instrumental variables (Ağazade et al., 2017). The findings obtained as a result of the analyses are interpreted.

5. Findings

This section of the study presents the findings obtained from the analysis and interpretation. Table 3 below presents descriptive statistics for the variables used in the analysis covering the 2018-2022 period.

Table: 3
Descriptive Statistics of Variables

Variable	Mean	Median	Standard Deviation
ROA	7.855	5.950	8.760
ROE	27.186	22.925	47.649
NPM	14.099	9.735	14.545
MBR	4.808	1.555	22.013
AGR	40.549	35.275	27.826
ESG	29.500	25.510	17.971

According to Table 3, the mean value of ROA is 7.855, and the median value is 5.950 for all companies in the sample. The mean value for ROE is 27.186, and the median value is 22.925. For NPM, the mean value is 14.099, with a median of 9.735. The mean value is 4.808, with a median of 1.555 for MBR, and the mean value is 40.549, with a median of 35.275 for AGR. Moreover, the ESG score has a mean of 29.500 and a median of 25.510.

To determine the existence of long-run relationships in panel studies, it is important to examine the horizontal cross-sectional dependence between variables to obtain more reliable results. Ignoring horizontal cross-section dependence means that estimations using traditional panel estimators may produce misleading or even inconsistent parameters (Küçükaksoy and Akalın 2017). Therefore, the variables need to be tested for horizontal cross-section dependence. The hypotheses of the test are formulated as follows:

H_0: No horizontal cross-section dependence.

H_1: There is horizontal cross-section dependence.

When the probability value to be obtained as a result of the test is less than 0.05, the hypothesis H_0 is rejected at a 5% significance level, and it was concluded that there is horizontal cross-section dependence among the units forming the panel (Pesaran et al., 2008).

Table: 4
Horizontal Cross-Section Dependence Test Results

Test	t-statistic					
	ROA	ROE	NPM	MBR	AGR	ESG
Breusch-Pagan LM	645.013*	641.430*	586.676*	553.225*	545.300*	1173.265*
Pesaran scaled LM	12.551*	12.411*	10.263*	8.951*	8.640*	3.271*
Pesaran CD	13.812*	13.464*	11.100*	9.955*	18.838*	33.063*

Notes: * indicates horizontal cross-section dependence.

Among the horizontal cross-section dependence test statistics, Breush Pagan LM and Peseran scaled LM tests are used when T>N, while Peseran CD is used when N>T. The present study considered Peseran CD test results since N=26 T=5, i.e. N>T. In this test, hypothesis H_0 states no horizontal cross-sectional dependence between units, while the alternative hypothesis H1 states horizontal cross-sectional dependence between units. As seen in Table 4, the null hypothesis is rejected for all series, and it was concluded that there is horizontal cross-section dependence between units.

Table: 5
Correlation Matrix

	ROA	ROE	NPM	MBR	AGR	ESG
ROA	1	0.501914	0.074183	-0.066952	0.351111	-0.032604
ROE	0.501914	1	0.125943	-0.373508	0.201418	0.032102
NPM	0.074183	0.125943	1	-0.135786	0.099261	0.427518
MBR	-0.066952	-0.373508	-0.135786	1	-0.069217	-0.054105
AGR	0.351111	0.201418	0.099261	-0.069217	1	0.179369
ESG	-0.032604	0.032102	0.427518	-0.054105	0.179369	1

According to the correlation matrix in Table 6, a moderate positive correlation exists between ROA and ROE (0.501914), which implies that as companies' ROA increases, their ROE generally increases. The low positive and negative correlations between ROA and NPM (0.074183) and MBR (-0.066952) indicate that these variables do not have strong relationships. The low positive correlation of ROA with AGR (0.351111) indicates that an increase in the percentage of asset financing may positively affect ROA. Moreover, there is a slight negative correlation between ROA and ESG scores (-0.032604), but this relationship may be statistically insignificant. On the other hand, the moderately positive correlation between ESG scores and NPM (0.427518) indicates that companies with high ESG performance generally have better NPM, highlighting the potential positive impact of ESG on financial performance for investors and stakeholders.

Table: 6
Granger Causality Test (Wald Test) Results

Dependent Variable ROA				
	Chi-Sq	df	Prob.	
ESG	5.810303	2	0.05**	ESG scores are a Granger cause of ROA.
Dependent Variable: ROE				
	Chi-Sq	df	Prob.	
ESG	4.486452	2	0.106	ESG scores are not a Granger cause of ROE.
Dependent Variable: NPM				
	Chi-Sq	df	Prob.	
ESG	12.43181	3	0.00*	ESG scores are a Granger cause of NPM.
Dependent Variable MBR				
	Chi-Sq	df	Prob.	
ESG	0.735619	2	0.69	ESG scores are not a Granger cause of MBR.
Dependent Variable: AGR				
	Chi-Sq	df	Prob.	
ESG	6.792016	2	0.03**	ESG scores are a Granger cause of AGR.

*, **, and *** are significant at 1%, 5%, and 10% significance levels, respectively.
df: denotes the lag length.

In this study, Emirmahmutoğlu and Köse (2011) panel causality test is utilised to examine the causality relationship between variables. The test is a simple Granger causality test. The advantage of this test is that it can be used in heterogeneous panel data sets when there is horizontal cross-section dependence and no cointegration relationship between the series (Altiner, 2019; Acaravcı & Erdoğan, 2017). Another recent study in the literature is Juodis et al. (2021). This study proposes a new approach to test Granger causality in heterogeneous panels. The Juodis et al. (2021) test can be used for large values of N and works best when N is the same as or larger than T (Nazlıoğlu & Karul, 2023).

According to the results of the Granger Causality Test in Table 7, ESG scores have a statistically significant causal effect on ROA, NPM, and AGR. These results indicate that ESG performance impacts companies' financial performance indicators over time. On the other hand, ESG scores have no significant causal effect on ROE and MBR. In the Granger Causality Test, the "df" value indicates the number of lags used in the model. The df value next to each chi-square statistic indicates the lags of the independent variables used in each test.

Table: 7
GMM (Generalized Method of Moments) Test Results

Dependent Variable ROA			
Independent Variables	Coefficient	Test Statistic	P-Probability Value
ROA(-1)	-0.145214	-0.599978	0.551
ESG	0.166031	2.690697	0.01*
Other Tests Required for the Model		Test Statistic	P-Probability Value
Wald Test (χ2)		2.690697	0.00*
Hansen Test		8.824110	0.116
Arellano-Bond Autocorrelation Test AR(1)		-0.757243	0.448
Arellano-Bond Autocorrelation Test AR(2)		-1.297063	0.194
Dependent Variable: ROE			
Independent Variables	Coefficient	Test Statistic	P-Probability Value
ROE(-1)	-0.223885	-2.447598	0.02**
ESG	1.036332	2.817656	0.00*
Other Tests Required for the Model		Test Statistic	P-Probability Value
Wald Test (χ2)		2.817656	0.00*
Hansen Test		7.405208	0.192
Arellano-Bond Autocorrelation Test AR(1)		-1.991832	0.04**
Arellano-Bond Autocorrelation Test AR(2)		-0.830559	0.406
Dependent Variable: NPM			
Independent Variables	Coefficient	Test Statistic	P-Probability Value
NPM(-1)	0.463621	0.954577	0.34
ESG	0.233984	2.442805	0.01*
Other Tests Required for the Model		Test Statistic	P-Probability Value
Wald Test (χ2)		2.442805	0.00*
Hansen Test		6.133122	0.293
Arellano-Bond Autocorrelation Test AR(1)		-1.101692	0.270
Arellano-Bond Autocorrelation Test AR(2)		0.893762	0.371
Dependent Variable MBR			
Independent Variables	Coefficient	Test Statistic	P-Probability Value
MBR(-1)	-0.093963	-0.595636	0.550
ESG	-0.966368	-2.024799	0.04**
Other Tests Required for the Model		Test Statistic	P-Probability Value
Wald Test (χ2)		-0.792986	0.431
Hansen Test		8.609101	0.125
Arellano-Bond Autocorrelation Test AR(1)		-1.001464	0.316
Arellano-Bond Autocorrelation Test AR(2)		-1.039714	0.298
Dependent Variable: AGR			
Independent Variables	Coefficient	Test Statistic	P-Probability Value
AGR(-1)	-0.086506	-0.412228	0.6837
ESG	1.883489	6.733768	0.00*
Other Tests Required for the Model		Test Statistic	P-Probability Value
Wald Test (χ2)		6.733768	0.00*
Hansen Test		7.546365	0.183
Arellano-Bond Autocorrelation Test AR(1)		-2.854584	0.00*
Arellano-Bond Autocorrelation Test AR(2)		0.583686	0.559

According to the results of the GMM analysis in Table 8, the values of the dependent variable ROA in the previous period (ROA[-1]) have a statistically insignificant and negative effect on the current ROA (-0.145214 coefficient, -0.599978 test statistic, 0.551 p-value). However, ESG factors have a positive and statistically significant impact on ROA

(0.166031 coefficient, 2.690697 test statistic, 0.01 p-value). The Wald Test (χ2) confirms the model's overall validity with a p-value of 0.00, while the Hansen Test shows no over-specification problem (8.824110 test statistic, 0.116 p-value). The Arellano-Bond Autocorrelation Tests AR(1) and AR(2) show that there is no autocorrelation in the model (-0.757243 and -1.297063 test statistics, p-values of 0.448 and 0.194, respectively). These findings suggest that ESG positively affects ROA and that the model is generally valid and has appropriate instruments.

The values of ROE in the previous period (ROE(-1)) have a statistically significant negative effect on ROE in the current period (-0.223885 coefficient, -2.447598 test statistic, 0.02 p-value). ESG has a strong and positive impact on ROE (coefficient 1.036332, test statistic 2.817656, p-value 0.00), indicating that ESG factors significantly impact ROE. The overall model is statistically significant using the Wald Test (χ2) (2.817656 test statistic, p-value of 0.00). The Hansen test shows that the instruments used and the model's over-specification restrictions are acceptable (test statistic 7.405208, p-value 0.192). However, the Arellano-Bond Autocorrelation test reveals statistically significant first-order autocorrelation in the AR(1) model (-1.991832 test statistic, 0.04 p-value). However, the AR(2) test indicates that second-order autocorrelation is not a problem (-0.830559 test statistic, 0.406 p-value).

The relationship between the value of NPM in the previous period (NPM(-1)), another dependent variable, and the current period is positive (0.463621 coefficient). However, this relationship is not statistically significant (0.954577 test statistic and 0.34 p-value). On the other hand, ESG has a positive and statistically significant effect on NPM (0.233984 coefficient, 2.442805 test statistic, and 0.01 p-value). The overall validity of the model is confirmed by the Wald Test (test statistic of 2.442805 and p-value of 0.00), indicating that the model is appropriate. The Hansen test reveals no over-specification problem in the model (test statistic of 6.133122 and p-value of 0.293). The Arellano-Bond Autocorrelation Test shows that first and second-order autocorrelation is not a problem in the AR(1) and AR(2) models (test statistics of -1.101692 and 0.893762, p-values of 0.270 and 0.371, respectively). Overall, these results suggest that ESG factors have a significant impact on NPM, but past NPM values do not have a significant effect on current values. It shows that the overall structure of the model is valid.

The effect of another dependent variable, MBR, on the value of MBR in the previous period (MBR(-1)) is negative (-0.093963 coefficient), but this relationship is not statistically significant (-0.595636 test statistic and 0.550 p-value). The impact of ESG factors on MBR is negative (-0.966368 coefficient) and statistically significant (-2.024799 test statistic and 0.04 p-value), indicating that ESG factors tend to reduce MBR. Among the other tests required for the model, the Wald Test (χ2) has a test statistic of -0.792986 and a p-value of 0.431, indicating that the model is insignificant overall. The Wald test reveals the general validity of the model. The Hansen test examines the appropriateness of the model's over-specification constraints, and the test statistic of 8.609101 and p-value of 0.125 indicate no over-specification problem. The Arellano-Bond Autocorrelation test shows that first and

second-order autocorrelation is not a problem in the AR(1) and AR(2) models (test statistics -1.001464 and -1.039714, p-values 0.316 and 0.298, respectively).

The effect of the value of AGR in the previous period (AGR(-1)), another dependent variable, on the current period is negative (-0.086506 coefficient), but this effect is not statistically significant (-0.412228 test statistic and 0.6837 p-value). The impact of ESG factors on AGR is quite strong and positive (coefficient 1.883489), and this effect is highly statistically significant (test statistic 6.733768 and p-value 0.00), indicating that ESG factors significantly increase AGR. The overall validity of the model is confirmed by the Wald Test ($\chi2$) (test statistic of 6.733768 and p-value of 0.00), indicating that the model is statistically significant overall. The Hansen Test reveals no over-specification problem in the model (test statistic of 7.546365 and p-value of 0.183), meaning that the instruments used are appropriate and valid. Arellano-Bond Autocorrelation test AR(1) results show that there is first-order autocorrelation in the model, which is statistically significant (-2.854584 test statistic and 0.00 p-value), indicating that there may be some dynamic structural problems in the model. However, the Arellano-Bond Autocorrelation test AR(2) results indicate that second-order autocorrelation is not a problem in the model (0.583686 test statistic and 0.559 p-value). Overall, this analysis shows that ESG factors significantly increase AGR, the model has general validity, and there is no overdetermination problem with Hansen's test.

6. Conclusion

The concept of ESG, frequently encountered in the literature in recent years, is seen as an important criterion that reveals the performance of enterprises in environmental, social, and corporate governance areas and shapes their investment decisions and, thus, their activities. The ESG score, which significantly contributes to the development of businesses and has become increasingly important in recent years, has three sub-elements: environmental, social, and governance. ESG scores need to be calculated separately for these three elements, and the total ESG score is determined by combining these three sub-elements. The calculated ESG scores of the enterprises make a significant contribution in terms of transparency and objectivity in measuring the ESG performance and effectiveness of the enterprise based on the reported data (Çetenak et al., 2022).

The study aimed to test whether ESG scores calculated for the period 2018-2022 have an impact on the financial performance of 26 companies in the BIST Sustainability Index. Accounting-based ROA, ROE, NPM, MBR, and AGR were used as dependent variables, and the ESG overall score was used as an independent variable. First, a dynamic panel data analysis was conducted using descriptive statistics, cross-sectional dependence tests, correlation matrix, causality, and GMM tests. Moreover, the fact that some firms were not included in the analysis due to lack of data can be stated as the study's limitations.

According to the results of the analysis, ESG scores affect companies' financial performance indicators. ESG scores are not a Granger cause of ROE and MBR. The study of ROA and ROE revealed that ESG scores have a positive and statistically significant effect

on both indicators, indicating that ESG scores positively affect corporate profitability and ROE. The analysis of NPM also indicates that ESG scores have a positive and significant effect on improving NPM. However, ESG scores have a negative impact on MBR, indicating that ESG scores tend to decrease the MBR ratio. The analysis of AGR reveals that ESG scores significantly increase this ratio. The general validity and appropriateness of a single model (MBR Model) are not only supported by the Wald test, but Wald and Hansen's tests support all other models, and the Arellano-Bond Autocorrelation Test confirms the consistency of the model over time. These results suggest that ESG scores have significant and diverse effects on financial performance and that these factors should be considered when evaluating companies.

According to the results of the Difference GMM method, a one-unit increase in ESG score increases firms' ROA by 0.11 units, while according to the System GMM results, a one-unit increase in ESG score increases firms' ROA by 0.16 units. Accordingly, firms that want to increase their return on assets, which is one of the main variables affecting their financial performance, should increase their ESG performance. In addition, the Wald statistic value for Model 4, in which the "MBR" variable is a significant variable, is greater than 5%, indicating that the model is insignificant (Karyağdı & Şit, 2023). Şişman and Cankaya (2021) determined a statistically significant relationship between ESG overall score and ROA. Buallay (2019) examined the relationship between sustainability and bank performance with ROA, ROE, and Tobin's Q variables and reported that ESG positively affects all the variables used. Buallay, Fadel, Al-Ajmi, and Saudagaran (2020) investigated the effect of ESG performance on ROA, ROE, and Tobin's Q. As a result of the study, Tobin's Q variable negatively affects ESG, while ROA and ROE variables do not have a significant effect on ESG variable. Other studies align with this study's results except for one (Buallay et al., 2020).

The relationship between ESG scores and financial performance has been the focus of intense interest both in academic circles and the investment world in recent years. Various studies on the impact of ESG scores on financial performance generally show a positive relationship. This relationship implies that keeping companies' environmental responsibility, social contributions, and governance quality high can improve their financial performance in the long run. In particular, companies with high ESG scores are observed to manage risk more effectively, have a more favourable image with consumers and investors, and potentially comply better with legal regulations. These factors can positively affect the financial performance of companies by contributing to lowering operational costs, expanding market access, and diversifying the investor base. In addition, factors such as sector, geography, and company size can affect the dynamics of this relationship. The transformation process of ESG investments into financial returns can be costly in the short term, and it may take time to see the positive effects of these investments on financial performance. In conclusion, the positive relationship between ESG scores and financial performance emphasises the importance of sustainable investment and corporate strategies. In this context, companies and investors must incorporate ESG factors into their strategic decision-making processes for long-term success and stability.

Recommendations for investors generally emphasise the importance of ESG assessments for companies. First, investors are advised to use companies' ESG scores as a critical criterion when constructing and reviewing their portfolios. Companies with high ESG scores generally have better long-term financial performance, which is important for risk management and optimising return potential. Second, investors are advised to focus on sustainable investment strategies that consider financial returns and social and environmental impacts. This approach enhances investments' social and environmental contributions while supporting long-term financial performance. Finally, requiring transparent and regular reporting from companies on their ESG performance helps investors make more informed decisions and encourages companies to improve their ESG performance.

The recommendation for academics and researchers is to focus on multidimensional and qualitative analyses to understand the impact of ESG scores on financial performance. Multidimensional research covering various sectors, geographies, and periods helps better understand the complexities and dynamics of the relationship between ESG and financial performance. In addition to quantitative data analysis, qualitative studies should also be conducted. Qualitative analyses are critical in understanding the impact of factors such as corporate governance, corporate culture, and stakeholder relations on the financial performance of ESG scores. An in-depth examination of these factors helps to understand the impact of ESG scores on financial results more clearly. These recommendations aim to increase the methodological diversity and depth of research in academic studies to develop a more comprehensive understanding of the impact of ESG scores on financial performance.

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