Environmental&Social&Governance Behavior of Companies During the COVID-19 Outbreak

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Abstract

This study assesses the change in the environmental, social, and governance (ESG) behavior of the Borsa Istanbul (BIST) ALL companies during the COVID-19 pandemic using panel data regression analysis. Additionally, cluster analysis highlights specific ESG strengths and challenges faced by these companies during the pandemic. For these purposes, data pertaining to the ESG scores and financial ratios of companies listed in the BIST-ALL for the years 2017-2020 is acquired from the Thomson Reuters Eikon database. The results of the regression analysis indicated a significant improvement in the ESG performance of the BIST ALL companies over the course of the COVID-19 pandemic. The cluster analysis resulted in the classification of the companies into 5 distinct clusters. Notably, companies in sensitive industries such as energy, mining, pharmaceuticals, and chemicals exhibited poor ESG performance during the COVID-19 outbreak. Furthermore, the cluster with superior ESG performance also demonstrated highly favorable financial ratios. This research provides valuable insights for assessing the ESG performance of companies during the pandemic.

Keywords: Environmental, social and governance (ESG), cluster analysis, regression analysis, COVID-19, BIST

Jel Codes: C23, C38, Q56

COVID-19 Salgını Sırasında Şirketlerin Çevresel&Sosyal&Yönetişim Davranışları

Özet

Bu çalışma, COVID-19 salgını sırasında Borsa İstanbul (BIST) TÜM şirketlerinin çevresel, sosyal ve yönetişim (ÇSY) davranışlarındaki değişimi panel veri regresyon analizi kullanarak değerlendirmektedir. Ayrıca, kümeleme analizi, bu şirketlerin pandemi sırasında karşılaştıkları belirli ÇSY güçlü yönlerini ve zorluklarını ortaya koymaktadır. Bu amaçla, 2017-2020 yılları için BIST-TÜM'de işlem gören şirketlerin ÇSY skorları ve finansal oranlarına ilişkin veriler Thomson Reuters Eikon veri tabanından elde edilmiştir. Regresyon analizinin sonuçları, COVID-19 salgını süresince BIST TÜM şirketlerinin ÇSY performansında önemli bir iyileşme olduğunu göstermektedir. Kümeleme analizi sonucuna göre, özellikle, enerji, madencilik, ilaç ve kimya gibi hassas sektörlerdeki şirketler COVID-19 salgını sırasında zayıf ÇSY performansı sergilediği ifade edilebilir. Ayrıca, yüksek ÇSY performansına sahip kümedeki şirketler, oldukça olumlu finansal oranlara da sahiptir. Bu araştırma, pandemi sırasında şirketlerin ÇSY performansını değerlendirmek için değerli bilgiler sunmaktadır.

Anahtar kelimeler: Çevresel, sosyal ve yönetişim (ÇSY), kümeleme analizi, regresyon analizi, COVID-19, BIST

Jel Kodu: C23, C38, Q56

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1. INTRODUCTION

The COVID-19 pandemic, primarily a health crisis with extensive global economic consequences, was officially declared by the World Health Organization in March 2020 (Rubbaniy, Khalid, Rizwan, and Ali, 2022; Al Amosh and Khatib, 2023). Following this declaration, financial uncertainty soared. In March 2020, the Chicago Board Options Exchange Volatility Index calculated the highest level of financial volatility ever recorded in recent history, surpassing even the levels seen during the Great Depression (Caggiano, Castelnuovo, and Kima, 2020; Roubini, 2020).

In such an environment, the ESG performance of companies serves as a crucial metric for investors (Hwang, Kim, and Jung, 2021). ESG denotes the incorporation of environmental, social, and governance considerations into corporate and investor business models (Friede, Busch, and Bassen, 2015). During the COVID-19 outbreak, there was a notable emphasis on ESG risk. Following the market downturn in February 2020, investors have sought low-ESG risk funds while avoiding high-risk options. Notably, there was a preference for funds with low governance and environmental risks over social factors (Ferriani and Natoli, 2021). According to Rubbaniy et al. (2022) compiled from different reports, the worldwide capitalization of ESG-focused assets reportedly hit US$40 trillion during the pandemic, and significant investors began to prioritize ESG concerns in pursuit of enhanced future returns.

The market reaction to the ESG performance of the companies during the COVID-19 period was also investigated by many empirical studies for different markets. Some studies indicate a positive reaction to ESG performance during the pandemic (Beloskar and Rao, 2023; Dai, 2022; Li, Feng, Pan, and Sohail, 2022), while others suggest an insignificant or even negative relationship (Demers, Hendrikse, Joos, and Lev, 2021; Takahashi and Yamada, 2021; Nirino, Petruzzella, Alam and Campobasso, 2022; Bodhanwala and Bodhanwala, 2023).

Although the market response to companies' ESG activities during the COVID-19 pandemic was thoroughly investigated in the literature, there are only a few empirical studies examining how companies altered their ESG behavior during the pandemic. Among these limited studies, all of which addressed cross-country samples, some revealed that companies enhanced their ESG performance during the COVID-19 period (Al Amosh and Khatib, 2023; Bifulco, Savio, Izzo, and Tiscini, 2023), whereas others obtained different results when dividing the sample into groups (Cassely, Ben Larbi, Revelli, and Lacroux, 2021).

While analyzing how companies' ESG behaviors changed during the COVID-19 period, we believe that focusing on a specific context rather than a cross-country sample, enabled the findings of the research to better represent all the individual companies in the sample. This is because factors such as the varying economic and social impacts of COVID-19 on countries, different ESG regulations in countries, and the likelihood of companies' ESG motivations being influenced by country-specific factors make it challenging for results obtained from a cross-country sample to fully represent all the companies in the sample. The fact that Cassely et al. (2021) obtained different results when dividing the sample into two groups can also be considered evidence supporting our argument. Therefore, unlike other studies in the extant literature, this study focused on the companies listed in the BIST ALL rather than a cross-country sample.

One purpose of this study is to analyze how COVID-19 affected the ESG performance of the BIST ALL companies. To achieve this, we performed a regression analysis using 174 observations from 63 companies for the years 2017-2020. The second aim of this study is to make a thorough assessment of companies' ESG performance during the pandemic. Cluster analysis enabled us to identify in which ESG pillars the BIST ALL companies succeeded and where they failed. Additionally, following the cluster analysis, we investigated whether there were significant differences in financial ratios between the clusters. To the best of our knowledge, this is the first study to examine companies' ESG

behavior during the pandemic through cluster analysis. Hence, this study seeks to fill this gap in the literature and make a meaningful contribution. The findings of this study provide insight into the ESG behavior of the companies in times of crisis, and based on these findings, make suggestions for creditors and regulatory authorities to support the ESG activities of the companies.

The paper is structured as follows: In the next section, we provide a concise overview of the study's theoretical underpinnings and conduct a review of pertinent literature. The methodology section covers the research design, study scope, data collection, and methods employed. Results are presented and discussed in the Results and Discussion section. Finally, the last section includes conclusions drawn from the findings and their policy implications.

2. LITERATURE REVIEW

Legitimacy theory encompasses the concept of a "social contract" between corporations and the broader society, serving as a guarantee of the company's legitimacy by aligning with societal expectations. If society perceives that the company is not conducting its operations in a legitimate fashion, it will violate this social contract, putting the company's legitimacy at risk (Deegan, 2002). The ESG activities of corporations should be recognized as a crucial element of this social contract, as there has been an increasing awareness of and demand for socially responsible behaviors in response to the sustainable development goals of nations and the world at large. Publicly traded companies are especially aware of this demand because they need to satisfy investor expectations on ESG matters to ensure their reputation and secure funding from the financial markets. However, as companies strive to meet ESG demands on one front, they must also allocate their financial resources efficiently to sustain their operations and generate profits. This equilibrium becomes even more critical during times of crisis as it becomes more challenging for companies to create value. (Bifulco et al., 2023).

Many papers have investigated the impact of ESG on company performance in times of crisis, although the results are not conclusive. Dai (2022) examined the lockdown periods in Wuhan and Shanghai and provided evidence for the lower risk of ESG equity indices compared to their traditional benchmark counterparts. The ESG performance of the Chinese listed companies was found to increase their cumulative abnormal returns during the COVID-19 pandemic (Li et al., 2022). Chiaramonte, Dreassi, Girardone, and Piserà (2022) found that financial stability is higher for European banks with higher ESG performance during financial turmoil. For the Indian stock market, it was observed that ESG performance decreased stock return volatility during the COVID-19 period (Beloskar and Rao, 2023). In contrast, alongside studies supporting a positive correlation between ESG and company performance during crises, some research suggests an insignificant or even negative relationship. The relationship between ESG performance and stock returns during the COVID-19 pandemic was found to be insignificant for the US companies (Demers et al., 2021), New Zealand listed companies (Białkowski and Slawik, 2022), Japanese stock market (Takahashi and Yamada, 2021), European listed companies (Nirino et al., 2022), and Indian companies (Bodhanwala and Bodhanwala, 2023). Analyzing the financial crisis period of 2007-2008, Petitjean (2019) found that the environmental performance of US companies is not correlated with financial performance. Moreover, a negative association was found between ESG scores and stock returns during the COVID-19 pandemic in the US and India (Yadav and Bhama, 2023).

Compared to the number of studies on the link between ESG and company performance, there is a scarcity of research focusing on how companies alter their ESG practices during times of crisis. Based on a cross-country dataset, Al Amosh and Khatib (2023) reported a positive and significant impact of COVID-19 on ESG performance. Similarly, Bifulco et al. (2023) conducted a cross-country study focusing on European countries and indicated that companies enhanced their ESG scores during the COVID-19 period. Cassely et al. (2021) reached different conclusions for coordinated and liberal

market economies in terms of the ESG behavior of companies during the 2008 economic crisis. They reported that ESG activities were seen as a burden in liberal market economies due to the extra costs they incurred. Conversely, in coordinated market economies, it provided companies with an opportunity to reshape their relationship with society, aiming to generate more shared value.

In the light of these empirical findings, we can assert that companies' ESG behavior in times of crisis, often exemplified by the COVID-19 era, as well as market reactions to ESG, may vary across different contexts. Consequently, there is a need for a more in-depth analysis of companies' ESG behavior within a specific context. We have attempted to carry out this in-depth analysis by conducting a regression analysis followed by a cluster analysis of the companies listed in Borsa Istanbul. While there are a few studies in the existing literature that have examined companies' ESG scores using cluster analysis (Sariyer and Taşkın, 2022; Ronalter, Bernardo, and Romaní, 2023), to the best of our knowledge, there is no other study that has examined companies' ESG behavior during crisis periods through cluster analysis. Therefore, this study aims to contribute to the relevant literature by filling this knowledge gap.

3. METHODOLOGY

For the purposes of our study, we conducted two different analyses. First, we performed a regression analysis to examine the impact of COVID-19 on companies' ESG performance. In the next step, we conducted a cluster analysis to further examine companies' ESG performance over the COVID-19 period and analyzed the differences between clusters not only in terms of overall ESG scores but also individual ESG category scores, and key financial ratios.

3.1 Regression Analysis

3.1.1 Sample and Data for Regression Analysis

Although the initial sample of this study includes all the companies listed on the Borsa Istanbul Stock Exchange (BIST ALL), we had to make some eliminations from this initial sample mainly based on data availability. We retrieved data for ESG scores and financial ratios of BIST ALL companies for 2017-2020 from the Thomson Reuters Eikon database. From this initial dataset, we excluded financial companies since they have different financial characteristics than those of companies in other sectors. Next, we eliminated the companies with a fiscal year-end other than December 31st and the firm years with missing values. After these eliminations, the final sample for the regression analysis consists of 174 observations from 63 companies.

3.1.2 Model Specification

The regression model developed to examine the change in ESG scores of the companies over the COVID-19 period is as follows:

$$ESG_{it} = \beta_0 + \beta_1 Year\ Dummies + \beta_2 Control\ Variables + a_i + u_{it} \tag{1}$$

The dependent variable of the regression model (ESG) represents the overall ESG score of the company i at time t. The overall ESG scores, calculated by Refinitiv, are aggregated scores of 10 individual ESG category scores. Among these category scores, emission, innovation, and resource use scores make up the environmental pillar score (E) of ESG. The social pillar of ESG (S) includes the categories of human rights, product responsibility, workforce, and community. Finally, the governance pillar (G) of ESG comprises the management, shareholders, and CSR strategy categories. For each category, pillar, and finally, the overall ESG score, Refinitiv produces a score between 0 and 100, with higher scores indicating better performance (Refinitiv, 2022).

The independent variables of the regression model, which are the main variables of interest, are the dummy variables developed for each year of the sample, namely, 2017, 2018, 2019, and 2020.

In line with previous studies, several control variables that may affect companies' ESG performance were introduced into the regression model (Bifulco et al., 2023; Khan, Naeem, and Xie, 2022; Uyar, Elmassri, Kuzey, and Karaman, 2023). Size (SIZE), financial leverage (LEV), return on assets (ROA), cash flow margin (CFM), book value per share (BVPS), revenue per share (RPS), and growth of the company (GROWTH), which is measured by the annual change of total assets, were added to the regression model as control variables.

All the variables included in the regression model are summarized in Table 1.

Table 1: Description of Variables

Dependent Variable	Description	Data Source
ESG	Overall ESG Score	Thomson Reuters Eikon Database
Independent Variable		
YEAR	dummy variables for each year in the sample	Created by authors
Control Variables		
SIZE	the natural logarithm of total assets	Thomson Reuters Eikon Database
LEV	the ratio of liabilities to assets	
ROA	the ratio of income after taxes to average total assets	
CFM	the cash flow expressed as a percent of total revenue	
BVPS	the ratio of total equity to average shares outstanding	
RPS	the ratio of total revenue to average shares outstanding	
GROWTH	the annual percent change in total assets	

3.2 Cluster Analysis

Although the regression analysis indicated that there was a positive change in companies' ESG activities during the COVID-19 period compared to previous years, we needed further research to find out which companies performed better on which ESG dimensions. To this end, we conducted a cluster analysis addressing individual ESG category scores for the year 2020. Cluster analysis enabled us to group BIST ALL companies based on similarities in their ESG category scores and to further analyze whether there are significant differences between clusters in terms of their financial ratios.

3.2.1 Sample and Data for Cluster Analysis

Since we aim to analyze the differences between the clusters in terms of financial ratios after cluster analysis, we included only non-financial BIST ALL companies with a year-end closing date of December 31st in the cluster analysis. The final sample for the cluster analysis consists of 59 nonfinancial BIST ALL companies with ESG data available in the Thomson Reuters Eikon database.

The cluster analysis was performed on 10 ESG category scores, which are explained in Table 2.

Table 2: Variables for Cluster Analysis

Code	Category	Pillar	Data Source
E1	Resource Use Score	Environmental	Thomson Reuters Eikon Database
E2	Emissions Score	Environmental	
E3	Environmental Innovation Score	Environmental	
S1	Workforce Score	Social	
S2	Human Rights Score	Social	
S3	Community Score	Social	
S4	Product Responsibility Score	Social	
G1	Management Score	Governance	
G2	Shareholders Score	Governance	
G3	CSR Strategy Score	Governance	

4. RESULTS and DISCUSSION

4.1 Regression Results

4.1.1 Descriptive Statistics

Before estimating our regression model, all the control variables (SIZE, LEV, ROA, CFM, BVPS, RPS, GROWTH) were subjected to winsorization at 5% of the lower and upper tails to mitigate the outlier effect on the regression results. The summary of ESG scores and winsorized control variables is provided in Table 3. The minimum and maximum values of ESG scores are 4.06 and 92.79, respectively. This wide range between minimum and maximum values of ESG scores indicates that the sample is not biased in terms of ESG performance. The average ESG score in the sample (54.48) is just above the average of Refinitiv's lowest (0) and highest (100) ESG scores.

Table 3: Descriptive Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
ESG	174	54.48	20.45	4.06	92.79
SIZE	174	23.29	1.1	21.20	25.42
LEV	174	64.92	18.48	21.72	92.65
ROA	174	6.67	6.42	-4.26	20.59
CFM	174	16.32	14.82	1.29	57.98
BVPS	174	10.70	9.77	1.12	37.76
RPS	174	32.27	35.93	1.39	128.39
GROWTH	174	23.71	17.36	-1.59	65.99

Notes: Variables are defined in Table 1.

In order to test whether there is a multicollinearity problem in our regression model, pairwise correlations between the variables in the regression model were investigated by Pearson's correlation analysis. The results of Pearson's correlation analysis, which are presented in Table 4, show that our regression model does not suffer from any serious multicollinearity issues. We also employed variance inflation factor (VIF) analysis to check the multicollinearity issue. The VIF values, which are significantly lower than the threshold value of 10 (Hair, Black, Babin, and Anderson, 2019), also confirm the non-existence of a multicollinearity problem in the regression model.

Table 4: Pairwise Correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) ESG	1.00							
(2) SIZE	0.44*	1.00						
(3) LEV	0.23*	0.09	1.00					
(4) ROA	-0.25*	-0.15*	-0.51*	1.00				
(5) CFM	-0.34*	0.04	-0.51*	0.55*	1.00			
(6) BVPS	0.25*	0.32*	0.04	0.06	0.06	1.00		
(7) RPS	0.32*	0.14*	0.43*	-0.03	-0.39*	0.57*	1.00	
(8) GROWTH	-0.06	-0.05	0.00	0.38*	0.11	0.11	0.13*	1.00

*Notes: Variables are defined in Table 1. *** p<0.01, ** p<0.05, * p<0.1*

4.1.2 Regression Results and Discussion

We employed several tests to select the most appropriate estimator among pooled ordinary least squares (OLS), random-effects (RE), and fixed-effects (FE) estimators for our regression model. First, the Breusch-Pagan Lagrange Multiplier (LM) test was used to decide whether the OLS or RE estimator was appropriate to estimate the regression model. The Breusch-Pagan LM test produced a significant test statistic (34.06, p<0.01), indicating that the RE estimator should be preferred to the OLS estimator. Second, Hausman's test was employed to select between the FE and RE estimators. The significant test statistic of Hausman's test (149.45, p<0.01) showed that FE should be selected instead of RE. Based on these results, the FE estimator was determined to be the most appropriate estimator for our regression model. Therefore, the regression model formulated by Equation (1) was estimated by a fixed-effect estimator. Table 5 provides FE results (FE), FE results with robust standard errors (FERobust) that are robust to serial correlation and heteroskedasticity problems, and FE results with Driscoll Kraay standard errors (FEDriscoll) that are robust to heteroskedasticity, serial correlation, and cross-sectional dependence, respectively.

Since the dummy variable belonging to the year 2017 was accepted as the reference year among the YEAR dummy variables created to determine the YEAR effect on the ESG score, the coefficients of the 2017 dummy variable (YEAR=2017) are reported as "0" in Table 5. When we compare the coefficient of the 2020 dummy variable (YEAR=2020) with those of other years, it is seen that it has a significant and the highest coefficient in all models. This means that, holding control variables constant, the change in ESG score associated with the change from 2017 to 2020 is positive and significant. Based on the regression results with Driscoll Kraay standard errors presented in the last column of Table 5, other year dummies (2018 and 2019) also have significant but lower coefficients than 2020. From this point of view, we can say that while the change in ESG score is also significant and positive in 2018 and 2019 compared to 2017, this positive change is the highest in 2020. These results are consistent with those of Bifulco et al. (2023), who employ a similar regression model to test the change in ESG scores during the COVID-19 period. Although we agree with Bifulco et al.'s (2023) interpretation that companies' ESG interest does not decrease during crisis periods such as COVID-19 because they aim to mitigate the negative impact caused by COVID-19 with the positive impact of their ESG activities, we believe that this strong and positive relationship between 2020 and ESG score is also related to Turkey-specific developments. The "Sustainability Principles Compliance Outline" published by the Capital Market Board (CMB) of Turkey in 2020 made it mandatory for listed companies to comply with the "Comply or Explain" principle. In other words, companies are required to declare whether they comply with the principles in the outline and, if not, to justify it (CMB, 2020).

It can be argued that such developments are useful in increasing ESG awareness and the activities of companies.

Table 5: Regression Results

Dependent Variable	FE ESG	FERobust ESG	FEDriscoll ESG
YEAR=2017	0.00	0.00	0.00
	(.)	(.)	(.)
YEAR=2018	3.12	3.12	3.12**
	(1.26)	(1.08)	(5.56)
YEAR=2019	4.72	4.72	4.72***
	(1.47)	(1.17)	(7.39)
YEAR=2020	12.60***	12.60**	12.60***
	(3.11)	(2.40)	(17.64)
SIZE	7.80	7.80	7.80*
	(1.39)	(1.19)	(2.92)
LEV	-0.31	-0.31	-0.31
	(-1.36)	(-1.41)	(-1.95)
ROA	-0.27	-0.27	-0.27
	(-0.81)	(-1.05)	(-1.40)
CFM	0.26	0.26*	0.26
	(1.50)	(1.83)	(1.74)
BVPS	-0.69**	-0.69**	-0.69*
	(-2.00)	(-2.24)	(-2.97)
RPS	0.05	0.05	0.05
	(0.43)	(0.42)	(1.21)
GROWTH	0.06	0.06	0.06
	(1.07)	(0.94)	(2.17)
Constant	-111.88	-111.88	-111.88
	(-0.88)	(-0.74)	(-2.13)
N	174	174	174
R2	0.38	0.38	0.38

*Notes: Variables are defined in Table 1. t statistics in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01*

4.2. Cluster Analysis Results and Discussion

Table 6 provides descriptive statistics for the overall ESG scores and individual pillar scores of the companies. The companies analyzed in the cluster analysis have an average ESG score of 58.58. Notably, ARCLK has the highest ESG score among these companies, while SELEC has the lowest. It's worth mentioning that ARCLK excels in overall ESG performance but doesn't hold the top position in any specific pillar. On the other hand, SELEC, which holds the lowest ESG score, also ranks as the weakest performer in both the environmental and social pillars. When assessing the average scores of the pillars, it becomes evident that companies excel most in the social pillar but exhibit their weakest performance in the governance pillar.

Table 6: Descriptive Statistics of ESG Scores

Scores	Mean	Std. Dev.	Min	Max
ESG	58.58	20.59	4.07 / SELEC	90.39 / ARCLK
Environmental	55.68	24.49	0.00 / SELEC	97.15 / KCHOL
Social	64.47	24.45	1.52 / SELEC	97.61 / ENKAI
Governance	52.10	22.18	3.61 / KOZAA	94.47 / ENJSA

Table 6 displays the overall ESG score and the individual pillar scores that make up this overall ESG score. However, each pillar score comprises multiple category scores, and companies may excel in one category while performing poorly in another. To identify the precise areas where companies excel or face challenges, we performed a cluster analysis using the category scores provided in Table 2.

The K-means method was used to cluster companies based on 10 category scores. The K-means algorithm divides M points in N dimensions into K clusters to minimize the within-cluster sum of squares (Hartigan and Wong, 1979). The method is a non-hierarchical clustering method, and therefore the number of clusters should be determined before the analysis. We used the Elbow method to determine the number of clusters. As illustrated in Figure 1, the Elbow method led us to conclude that the ideal number of clusters is 5.

Figure 1: Optimal Number of Clusters by Elbow Method
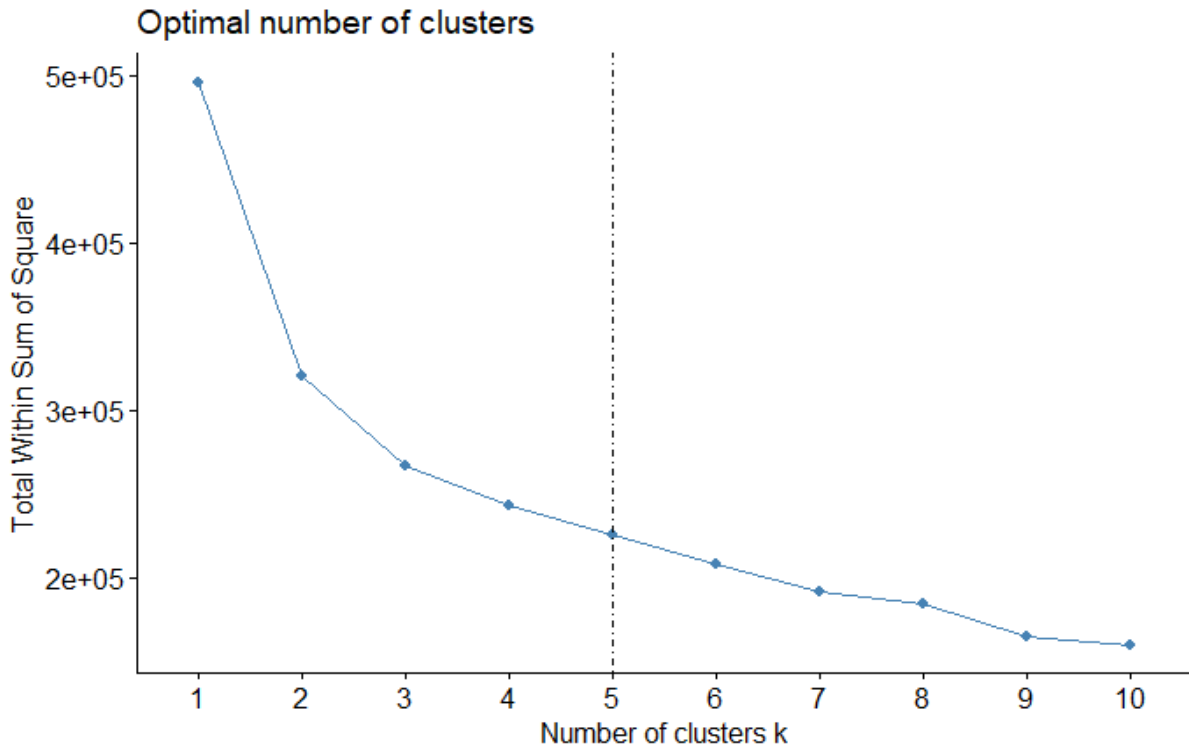
After determining the number of clusters, cluster analysis was performed by the K-means method. Figure 2 shows the result of the cluster analysis with the K-means method. Companies and cluster memberships are provided in the appendix.

Figure 2: Cluster Plot
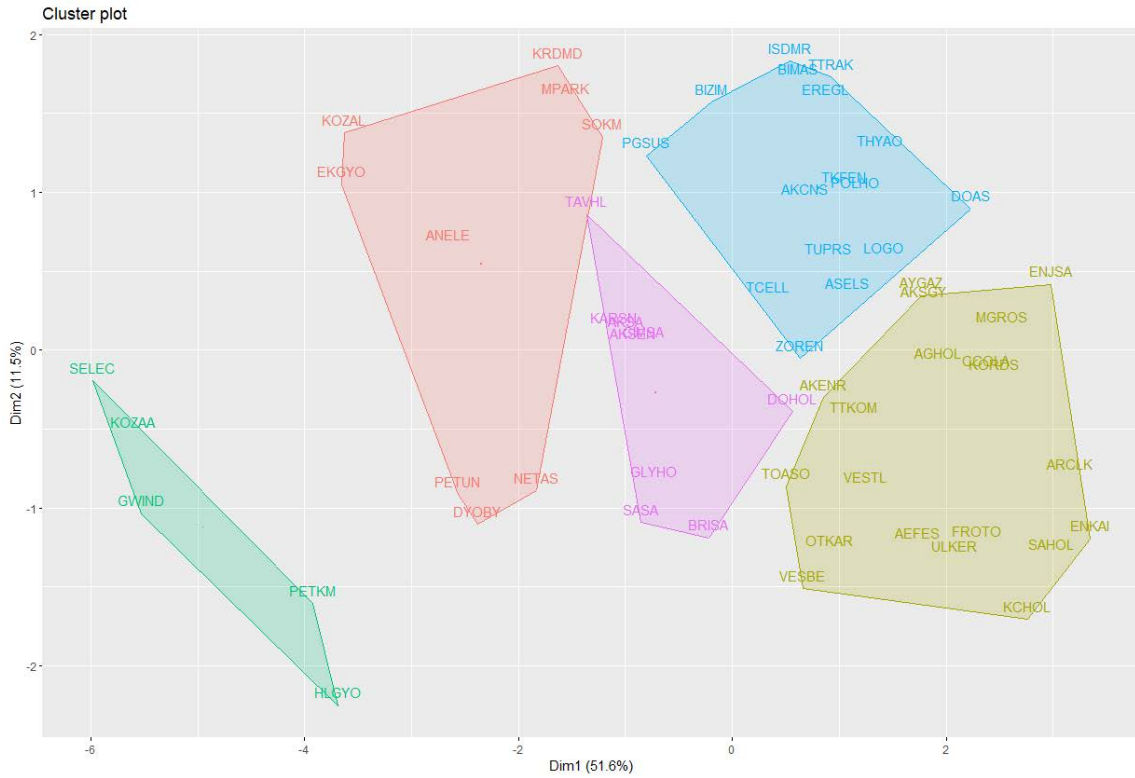
The descriptive statistics of the category scores by cluster are summarized in Table 7. The clusters consist of 9, 20, 5, 16, and 9 companies, respectively. ANOVA analysis was conducted to determine whether the clusters were well separated and to identify any significant differences among them. The ANOVA results, shown in the last column of Table 7, demonstrate significant differences between clusters across all the categories used in the cluster analysis. Notably, Cluster 2 outperforms the others in all category scores except for G2 (shareholders score). Conversely, Cluster 3 has the lowest scores in all categories except E3 (environmental innovation score). Further analysis of Cluster 3 showed that 4 out of the 5 companies in this cluster operate in sensitive or, in other terms, controversial industries such as energy, mining, drugs, and chemicals. Although there is no consensus that sensitive industries consistently result in low ESG performance, companies operating in sensitive industries may have a higher likelihood of causing social and environmental harm (Garcia, Mendes-Da-Silva, and Orsato, 2017).

Table 7: Descriptives of the Category Scores by Cluster

Variable	Cluster	Obs.	Mean	Std. Dev.	Min	Max	Sig. of the diff. between clusters
E1	1	9	59.62	14.30	42.75	80.92	<.01
	2	20	**82.44**	16.64	44.12	99.11	
	3	5	6.57	9.06	0.00	17.99	
	4	16	67.88	20.23	27.68	96.05	
	5	9	42.70	16.45	16.83	74.26	
E2	1	9	52.10	12.62	28.19	68.27	<.01
	2	20	**84.37**	13.46	59.48	98.61	
	3	5	0.94	2.11	0.00	4.71	
	4	16	75.97	16.02	48.67	93.42	
	5	9	32.41	18.78	12.65	61.05	
E3	1	9	23.55	23.45	0.00	50.83	<.01
	2	20	**66.21**	23.63	11.54	96.44	
	3	5	35.65	37.88	0.00	80.18	
	4	16	16.91	20.70	0.00	61.68	
	5	9	15.43	28.77	0.00	85.71	
S1	1	9	58.15	22.27	23.49	96.75	<.01
	2	20	**91.61**	9.45	63.81	99.32	
	3	5	19.71	20.97	4.03	54.92	
	4	16	75.54	22.27	19.70	99.32	
	5	9	50.54	20.02	13.32	74.47	
S2	1	9	77.03	13.42	56.25	96.77	<.01
	2	20	**79.35**	19.07	40.91	95.65	
	3	5	3.97	8.88	0.00	19.85	
	4	16	58.89	17.81	23.38	87.16	
	5	9	12.03	11.93	0.00	30.41	
S3	1	9	54.07	16.35	33.48	85.38	<.01
	2	20	**82.77**	16.25	35.55	97.76	
	3	5	17.96	21.59	1.42	44.76	
	4	16	74.42	13.31	54.02	97.51	
	5	9	38.62	27.84	3.53	82.50	
S4	1	9	49.51	24.16	11.27	78.50	<.01
	2	20	**83.82**	16.44	40.52	99.72	
	3	5	20.54	19.20	0.00	40.52	
	4	16	75.68	21.62	28.87	99.76	
	5	9	62.17	18.73	40.52	93.87	
G1	1	9	48.88	32.35	8.93	92.26	<.01
	2	20	**61.73**	25.64	23.21	98.21	
	3	5	20.48	23.79	2.38	61.31	
	4	16	58.04	27.17	16.07	99.41	
	5	9	42.66	25.11	5.36	79.17	
G2	1	9	37.77	17.76	13.69	62.50	<.01
	2	20	49.91	24.27	14.88	99.41	
	3	5	13.45	6.91	5.36	23.21	
	4	16	**76.45**	19.79	32.74	98.21	
	5	9	57.94	33.04	4.17	95.83	
G3	1	9	40.10	25.19	12.18	83.97	<.01
	2	20	**67.92**	19.71	41.03	98.72	
	3	5	1.28	1.98	0.00	4.49	
	4	16	63.06	19.24	41.03	95.51	
	5	9	16.52	12.68	1.92	41.03	

In the next step, we analyzed the distribution of ESG and pillar scores by cluster, as illustrated in Figure 3. In terms of average ESG scores, the clusters can be ranked as follows: Cluster 2 has the highest average ESG score, followed by Cluster 4, Cluster 1, Cluster 5, and Cluster 3 with the lowest average ESG score, mirroring the pattern seen in the medians. If we exclude one outlier in Cluster 1, it becomes evident that Cluster 1 has the narrowest range of ESG scores, indicating that its ESG scores are the most homogeneous among the clusters.

In terms of pillar scores, Cluster 2 demonstrates the strongest performance in both the environmental and social pillars, aligning with its ESG score. However, when it comes to the governance score, Cluster 4 shows slightly higher mean and median values compared to Cluster 2. Cluster 3, on the other hand, consistently records the lowest values across all pillars.

Figure 3: Boxplots for ESG and Pillar Scores by Cluster
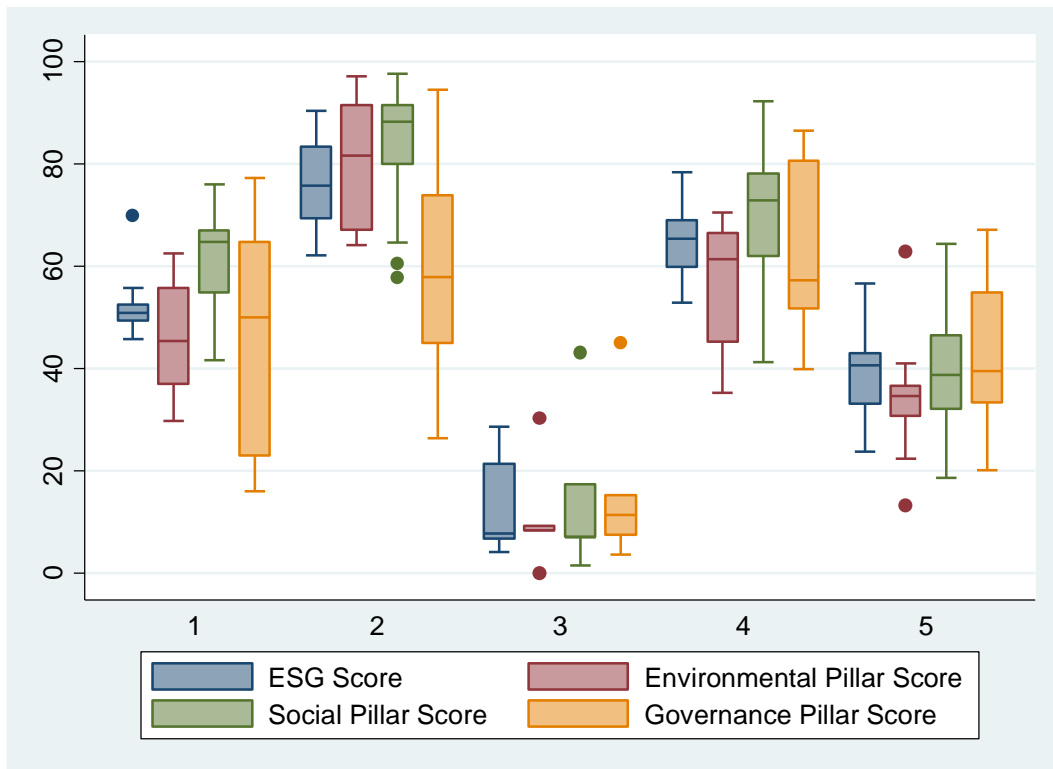
After examining the clusters in terms of ESG performance, we investigated whether the financial ratios of the clusters differ significantly. To this end, we performed an ANOVA analysis, including the variables SIZE, LEV, ROA, CFM, BVPS, RPS, and GROWTH. While we found significant differences in BVPS, RPS, and SIZE among the clusters, we did not find evidence of significance for the other financial ratios. In Table 8, we present only those financial ratios for which we found a significant difference between the clusters, along with the post hoc results. Based on the ESG performance analysis of the clusters, we know that Cluster 2 stands out as the top ESG performer, while Cluster 3 ranks at the bottom. The post-hoc results of the ANOVA analysis further confirm that Cluster 2 notably surpasses Cluster 3 in terms of both RPS and SIZE. In light of these two findings, it is possible to say that the higher ESG performance of the companies in Cluster 1 is related to their higher size and profitability. Larger and more profitable companies tend to attract greater public attention and

consequently experience increased scrutiny from stakeholders concerning their social performance (Jenkins, 2004; Gao, 2009). Additionally, large and profitable companies have more resources available to invest in ESG activities.

Table 8: Descriptives of the Financial Ratios by Cluster

Variable	Cluster	Obs.	Mean	Std. Dev.	Sig. of the diff. between clusters	Post-Hoc Results
RPS	1	9	7.81	4.93	<.01	Cluster2-Cluster3
	2	20	57.94	65.73		
	3	5	9.59	13.99		
	4	16	51.26	66.52		
	5	9	16.51	11.38		
BVPS	1	9	6.48	6.99	<.05	Cluster2-Cluster1
	2	20	14.46	10.88		Cluster2-Cluster5
	3	5	4.42	3.07		
	4	16	15.46	15.37		
	5	9	10.08	15.79		
SIZE	1	9	22.83	0.71	<.05	Cluster2-Cluster1
	2	20	23.97	1.35		Cluster2-Cluster3
	3	5	22.56	0.98		
	4	16	23.37	1.50		
	5	9	22.18	1.11		

Notes: Variables are defined in Table 1.

5. CONCLUSION

The purpose of this study is twofold: first, it aims to examine the change in the ESG behaviors of the BIST ALL companies during the COVID-19 period. For this purpose, a regression model was developed and estimated by the panel data fixed-effects estimator. In line with the second purpose of the study, a cluster analysis was performed based on the individual ESG category scores, which constitute the three pillars of ESG (environmental, social, and governance). This cluster analysis enabled us to make a more detailed comparison of the ESG performance of all BIST companies on an ESG pillar and category basis and also to assess whether the financial ratios of the clusters of companies, formed based on ESG category performance, exhibit significant differences or not.

The results of the regression analysis provided evidence for a strong and significant improvement in the ESG performance of the BIST ALL companies during the COVID-19 period. This improvement may be due to the companies' motivation to counter the negative impact of COVID-19 by emphasizing their positive ESG activities. However, we believe that this improvement was also achieved thanks to the "Sustainability Principles Compliance Outline" published by the Capital Market Board of Turkey in 2020. This outline requires companies to declare their compliance with its principles and, if not compliant, to provide a justification. Although compliance with the sustainability principles outlined is not mandatory, the requirement for justification in cases of non-compliance may have prompted companies to be more conscious of their compliance efforts.

Further examination of companies' ESG performance through cluster analysis highlighted the poor ESG performance of the companies operating in sensitive or, in other terms, controversial industries such as energy, mining, drug, and chemicals. Additionally, the finding indicating that the financial ratios of the cluster with the best performance in ESG category scores are significantly higher than the cluster with the poorest performance in ESG category scores can be attributed to the fact that large and profitable firms have more resources to allocate for ESG activities and the pressure they feel from stakeholders on ESG initiatives.

The findings of this study have practical and policy implications. The listed large and profitable companies appear to continue their ESG activities even in times of crisis, but the same is not true for the small and less profitable ones. In other words, the sustainability of ESG efforts correlates directly with the size and profitability of the company, and small enterprises face a disadvantage. Therefore, financial institutions should support those companies with insufficient funds to allocate for ESG activities through the tools of green finance. Additionally, the poor ESG performance of controversial industries should be analyzed more to find possible ways to overcome the sustainability problems of these types of industries. Finally, companies should be encouraged to engage in ESG activities through additional regulations, such as the Sustainability Principles Compliance Outline published by the Capital Market Board. This approach enables companies to develop, execute, and assess their ESG strategies, ultimately aiding them in attaining their ESG objectives.

We recognize that our study is subject to certain limitations, some of which may indicate potential avenues for future research. Firstly, we conducted our analysis using ESG scores provided by Refinitiv. It's worth noting that there are several other ESG rating agencies, such as Bloomberg, MSCI, and FTSE, among others. Therefore, the results presented in this study may be specific to Refinitiv's ESG scores, and different findings could arise when using scores from different rating agencies. Future research opportunities may involve comparing results obtained from multiple rating agencies' ESG scores. Secondly, our interpretations are solely based on statistical findings. To enhance these interpretations, conducting interviews with individuals responsible for sustainability within companies could be a valuable avenue for future research.

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Appendix. Companies and cluster memberships

Cluster	N	Company Codes
1	9	CIMSA, AKSEN, GLYHO, KARSN, SASA, BRISA, AKSA, TAVHL, DOHOL
2	20	TOASO, AKENR, OTKAR, TTKOM, VESTL, VESBE, AGHOL, CCOLA, KORDS, AEFES, MGROS, ULKER, FROTO, AYGAZ, AKSGY, ENJSA, KCHOL, ENKAI, SAHOL, ARCLK
3	5	SELEC, KOZAA, GWIND, HLGYO, PETKM
4	16	TTRAK, BIZIM, PGSUS, AKCNS, TCELL, POLHO, ZOREN, ISDMR, ASELS, TKFEN, TUPRS, EREGL, THYAO, BIMAS, LOGO, DOAS
5	9	KOZAL, ANELE, EKGYO, DYOBY, PETUN, NETAS, KRDMD, SOKM, MPARK