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How Does Environmental Data from ESG Concept Affect Stock Returns: Case of the European Union and US Capital Markets

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Abstract

This article examines the environmental, social, and governance (ESG) performance of firms, with a focus on the environmental pillar of the ESG concept. It is believed that the price of equities as well as sector-specific characteristics may be affected by ESG data. It also contributes to the argument that environmental performance and governance quality are related. The purpose of this paper is to statistically validate the separated environmental data from the ESG concept and investigate its impact on the equity price in the EU and the United States. Using simple linear regressions and a fixed effect panel data model, the association between environmental score and governance score, as well as equity price and environmental score, was estimated. This study examines the 500 largest US corporations comprising the S&P 500 index (S&P) and the 600 largest EU companies comprising the STOXX Europe 600 index (STOXX) (SXXP). This article analyzes ESG statistics for the period 2015–2020. The results indicate that a higher government score has a favorable effect on environmental pledges and that changes in stock price depend in part on environmental data. The novel contribution of this paper is that the results suggest a sector-specific contribution to the model, and it would be fascinating to analyze sector disparities and their ESG-related policies in greater detail.

Keywords:
ESG;
Equity Price;
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Governance.

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1- Introduction

Seven key nations have executed the ambition to establish worldwide environmental disclosure rules for corporations [1]. It rests on the premise that global corporations can influence, empower, and align actors up and down value chains across countries, cultures, and socioeconomic categories. The notion of environmental, social, and governance (ESG) practices has grown in significance over the past decade, as sustainable policy has emerged as the primary driver of development. On the other hand, the increasing interest of investors in green projects (Bloomberg predicts that green debt will increase from 2,000 USD to 8,000 USD by 2025 (2021)) and tightening regulation increase the value of ESG disclosure data, and it has become the primary investment tool [2]. Companies are driven to execute sustainable strategies by investors [3], public opinion [4, 5], and organizations such as the United Nations, the World Bank, and the European Union, among others.

The relationship between environmental responsibility and financial performance has been the subject of extensive study for decades. Milton Friedman, who claimed that environmental and social investments were not necessary costs for businesses and whose shareholder theory has been known since 1970, sparked similar discussions. CSR, responsibility, sustainability, shared value, green, and ESG are terms used in the business world to manage social and

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environmental responsibilities. The ESG concept is a common tool of sustainability in capital markets, where socially conscious investors evaluate the future financial performance of organizations based on their behavior. ESG can enhance conventional financial analysis primarily because these companies are likely to outperform their rivals over the long term. When the major capital markets examine ESG, however, two fundamental aspects emerge: the risks posed by poor ESG performance and the commercial prospects based on active ESG action. In this context, the incorporation of ESG elements into the investment process has shifted from a specialist activity to an industry standard. Nonetheless, the majority of corporate performance phenomena were understood in terms of financial performance indicators.

However, there is no single explanation for why organizations with superior ESG data outperform their competition. According to studies, integrating ESG into a company's valuation model increases its non-financial performance, including customer happiness, market acceptance, a cheaper cost of financing, and societal value provided to its stakeholders [6]. To make their basic process more environmentally friendly, however, needs substantial money. The vast majority of the literature focuses on the positive impact of ESG performance on financial outcomes [7–14]. Some authors have reported unfavourable effects [15–17] as well as mixed results [18, 19]. Numerous researchers investigate the impact of ESG data on stock returns [11, 15, 20-22]. However, the results of the articles analyzing the relationship between ESG and firm financial success are not conclusive. The studies found that the direction of the association between ESG and share price differed according to the market where the study was conducted, the time period analyzed, and the research methodology. The lack of a conclusive relationship provides a path for future research, which our study fills by evaluating the impact of environmental performance on share price in the U.S. and European markets using sectoral data for a certain time period. Previous empirical investigations demonstrated that the ESG disclosure score is used as an indication in the majority of instances. Such an approach does not adequately demonstrate the companies' contribution to the environment. Modern ESG analysis includes the separation of ESG pillars [8, 9, 18, 23–25]. The findings of these authors prompted further research into the environmental data of ESG, clarifying the relationship between E and G. These notions raise the question of whether it is true that the quantity and quality of environmental data in the ESG concept are extremely inadequate. In addition, the article examines how the environmental performance of the ESG score offered by the Bloomberg information platform influences the market value of corporations. The purpose of this article is to conduct a statistical analysis of environmental data derived from the ESG concept and assess its effect on stock prices in the EU and the United States. The stated aims:

- To make theoretical observations on the most recent research in which ESG or its individual indicators have been examined.
- Comparative statistical analysis of environmental and governance data.
- To examine the potential association between stock prices and environmental statistics in the EU and the United States.

The framework of the paper is comprised of four sections. The first chapter establishes the theoretical framework by beginning with a review of the theoretical context and a hypothesis statement. The third chapter employs regression analysis to test the model with data from the European and American financial markets. The conclusion is presented in the fourth section.

2- A Review of the Related Works

2-1- ESG Pillars

ESG is a comprehensive concept relating to competitive advantage risk and reward management, which is primarily influenced by such concepts as Environment Health and Safety, Sustainability, and CRS. Controlling investor risk, being honest with society, and adhering to stronger legislation regarding global risks such as climate change all contributed to the expansion of ESG ideas. However, its primary function is to assist investors in identifying dangers and opportunities. ESG is comprised of three pillars: environmental (measures the influence on the environment), social (demonstrates the link between diverse stakeholders), and governance (reveals how companies are managed). In general, sustainability performance is provided as a unit idea in numerous scientific studies analyzing variables of providing such information via ESG or other ratings [7, 10, 11, 19]. According to the industries, their activities, social contract, and legislation, as well as their target audience, each company has its own objectives for displaying information about these three pillars (investors, consumers, and partners). Initially, though, firms were more eager to publish social and governance information. Companies place a greater emphasis on enhancing governance and social data, as these initiatives typically do not require substantial expenditure. There is a body of research that attempts to distinguish the importance of distinct ESG pillars or factors [9, 18, 23, 24]. Hoang et al. (2021), examined the association between governance and environmental performance on a sample of 361 US companies between 2007 and 2016 using data from 2007 to 2016. Several characteristics of corporate governance (duality in CEO and chairman roles, concentration of decision power at the highest organizational level, gender diversity) can have a negative impact on environmental transparency and performance, according to the findings of a data regression study [23]. Veenstra & Ellemers (2020) found that not all

aspects of corporate social responsibility are given equal weight by rating agencies [25]. This is consistent with the findings of Miralles-Quirós et al. (2018), which demonstrate that the market does not place a significant value on the three ESG pillars [8]. According to Miralles-Quirós et al. (2018), the market considerably and positively values the environmental practices of businesses that are not involved in ecologically sensitive industries. Yoo & Managi (2021) discovered that the E score is positively associated with all sorts of financial performance, but the S and G scores had mixed effects [9].

In recent years, environmental, social, and governance (ESG) data have swiftly shifted from voluntary systems to mandated information, primarily due to increasing regulatory scrutiny. The European Council recommended taxonomy regulation - the broad classification system for the business sector - in order to facilitate the development of a singular concept of sustainable activities [1].

The tighter law stipulates that corporations engaged in ESG activities, particularly in the environmental dimension, will have greater legitimacy and should be evaluated favorably by stakeholders over time. Compliance with regulatory standards and forward-looking policies typically go hand in hand with greater sophistication in business governance; hence, the quality of company governance should have a direct bearing on the amount and quality of environmental data. Inspired by studies [9, 18, 23, 24], we posed the topic of whether high quality of governance indicators leads to improved environmental performance in this study.

H1: *The environmental score is positively impacted by the high quality of companies' governance data at the frontiers of ESG concept.*

2-2- Financial Company Performance and the Environmental Pillar of ESG

The investigation of the relationship between financial performance and sustainability values at the company level relies on two major classical theories: Milton Friedman's shareholder theory from 1970 and Edward Freeman's stakeholder theory from 1984. M. Friedman stated that a company's main obligation is to its shareholders and that investing in various ethical standards increases costs and disadvantages enterprises economically, resulting in lower market prices. There are papers that support this notion by demonstrating that there is no positive correlation between profit or equity price and social or sustainable actions [15-17]. Edward Freeman remarked that a company's true success resides in satisfying all of its stakeholders, not just those who could profit from its shares. According to this hypothesis, it is anticipated that financial markets will reward companies for their efforts to implement ESG. There are an increasing number of articles supporting this strategy [7-14]. Today, since sustainability is the primary worldwide strategy of all modern organizations, it is quite perilous not to pursue this path. In many instances, firms support numerous sustainability programs in order to maintain a positive social image. However, that is not the focus of this essay. Statistical findings between financial performance and ESG are inconsistent in a number of studies [10, 12, 14]; thus, the topic is still significant in the scientific community. Depending on the empirical data employed, scientific empirical publications of studies analyzing the relationship between corporate financial performance and ESG rating can be categorized. The first category of studies analyzes financial performance using historical accounting data and key financial indicators, including returns, sales turnover, debt ratios, and other firm- or industry-specific data [26, 27]. The second group of articles investigates market information in relation to ESG data, such as stock return and price [21-35]. The third set of studies examines the incorporation of accounting and market data into a single model [12-17, 36-45].

Using the Hausman-Taylor model, Saygili et al. (2022) determined the association between financial performance indicators ROA (based on accounting) and Tobin Q (based on market) and ESG practices (referring to environmental dis-closure score and 20 independent ESG indicators). The analysis was conducted on Turkish publicly traded companies from 2007 to 2017. The Environmental Dis-closure Score was taken as a separate independent indicator reflecting the Environmental pillar, and the results demonstrate that environmental disclosures have a detrimental impact on business financial performance. The Turkish financial markets do not regulate environmental disclosure, and corporations are not required to submit regular sustainability reports. The association between social and governance indices is favorable, although the governance dimension has a greater impact on predicted company financial performance [18]. This study demonstrates that environmental data are insignificant in the analyzed developing nation due to the absence of specific regulations. The data demonstrate that governance excellence increases company value. Yoo & Managi [9] analyze the impact of different ESG scores on financial performance (ROA, gross profits, total market value, total liabilities, and total assets) using the fixed effect model on two data sets: Bloomberg ESG scores (referring to the level of disclosure) and MSCI ESG scores (representing how a company implements and performs ESG behaviour) for the period of 2007 to 2019 with over one million samples. The conclusion indicates that ESG disclosure is more crucial for the profitability indicator, whereas action is more crucial for Tobin's Q. The impact of environmental disclosure on selected financial indicators is good, whereas the impact on social and governance ratings is mixed. The results, however, do not indicate whether data disclosure or action is more significant (2021). This article contributes to the body of knowledge by discussing the significance of the ESG concept's environmental pillar. The Alareeni & Hamdan (2020) study was also selected for a comprehensive analysis because it highlighted environmental performance. Financial performance referred

to as ROA, ROE, and Tobin's were integrated with independent indicators ESG Index, Environmental Index, CSR Index, and CG Index for assessing samples of US S&P 500-listed companies from 2009 to 2018. Environmental performance and CSR disclosure are positively associated to market performance as evaluated by Tobin's Q, according to the principal findings. Environmental and corporate social responsibility disclosure is inversely correlated with ROA and ROE. In addition, corporate governance disclosure is positively associated with ROA and Tobin's Q, but adversely associated with ROE [19]. Using regression analysis, Rossi & Harjoto (2020) analyzed 156 Italian listed companies over 18 years, from 2001 to 2018 [7]. They utilized three distinct metrics of corporate performance: annual total shareholder return, Stern Stewart's economic value added, and Tobin's Q, in addition to non-financial indicators and data disclosure via the Standard Ethics Rating. They discovered that ratings are positively related to firm value and negatively related to firm risk, and that by increasing non-financial disclosures, firms can simultaneously maximize investors' and non-investing stakeholders' interests, thereby minimizing the residual loss resulting from the stakeholder–agency problem [13]. Mohammad & Wasiuzzaman [10] analyzed company observation data for 3,966 Bursa Malaysia-listed enterprises between 2012 and 2017 using clustering and regression techniques. This study demonstrates that ESG transparency enhances corporate performance. A one-unit rise in the ESG disclosure score is associated with a 4% improvement in firm performance in Malaysia, according to the study. Both research studies integrated accounting data and market information with data on financial performance.

The empirical literature, which exclusively estimates the effects of ESG on market information, does not generate unified results. Despite the fact that some research works have revealed a negative correlation or insignificant results [11, 28] that higher ESG scores improve business value. Feng et al. hypothesized that an association should exist between ESG rating and the danger of a future stock price drop (two proxies for firm-specific crash risk: negative conditional skewness and down-to-up volatility). The regression analysis revealed a statistically and economically significant negative correlation for Chinese firms. These data support the hypothesis of stakeholder (2021). Boltona & Kacperczyk (2021) [15] analyzed stock performance by evaluating the influence of emission on 2005-2017 data for US corporations from the Trucost & FactSet data sets. The authors demonstrated that greater returns indicate shares in companies with greater total carbon dioxide emissions. The results show the conflicting nature of the financial market, as companies with higher emissions provide a larger stock return as a negative risk premium alternative.

Loof & Sahamkhadam (2021) investigated if ESG investment benefited shareholders during the COVID-19 pandemic crisis and discovered that higher ESG ratings were related with lower risk but also lower return potential [21]. The subject was investigated using regression analysis on a variety of equities listed in 10 nations over the year 2018-2020: the United States, Canada, Sweden, Germany, France, France, the United Kingdom, the Netherlands, Australia, China, and Japan. Therefore, ESG ratings have assisted investors in mitigating the danger of market turmoil caused by a pandemic, while retaining a basic risk-reward trade-off. This article's findings are consistent with those of Boltona & Kacperczyk (2021) [15] and contribute to Friedman's shareholder theory. During 2010–2015, Miralles-Quirós et al. (2018) [8] ran a regression analysis using Brazilian market data (So Paulo Stock Exchange). Book value per share and earnings per share are dependable indicators, whereas the ESG score, environmental performance, social performance, and governance performance are independent variables.

Environmentally sensitive industries (those with high environmental impacts, such as those related to energy (including gas and oil), chemicals, electronic utilities, paper and pulp, and mining and steel production) and other industries have different CSR performance, according to the authors (not related to environmentally sensitive industries). The authors discovered that investors do not place a high value on the three pillars of ESG. Particularly, the market has a favourable and important opinion of environmental practices implemented by businesses outside of ecologically sensitive industries. In contrast, the market has a favourable and substantial opinion of the social and corporate governance practices implemented by corporations in sensitive industries. Disclosure of ESG ratings and efforts to increase ratings do not guarantee the long-term viability of ESG enterprises, the authors find. Stock market results are more intricate than accounting statistics. In actuality, investors seek bigger returns, which explains why equities in the oil, coal, and other heavy industries continue to be popular, since they encourage greater opportunistic risk-taking. The most recent studies [29, 20] on the impact of ESG disclosure on the stock performance of firms emphasize the beneficial impact of ESG. Shanaev & Ghimire (2022) [20] demonstrated that decreased ESG ratings have a detrimental effect on stock returns. Such pervasive tendencies serve as an urgent warning to firms to invest more heavily in ESG disclosure and the auditing process. Table 1 is a synopsis of the main points made in the cited articles.

Theoretical study of scientific papers has demonstrated that ESG performance, its efficacy, and its evolution contribute to improved financial outcomes (historical accounting data and stock returns).

H2: *The change in the price of the company stock depends on the environmental score/or its change.*

Table 1. Summary of main observations in the cited articles (by authors)

Authors (year)	Hypothesis/question	Dependable variables	Independent variables	Control variables	Data, period	Methods used	Results
Meng-tao et al. (2023)	ESG information disclosure is beneficial to improve stock liquidity	stock liquidity	ESG	ROA, R&D/income, Size, Age, Audit, Cash/Income	2011 – 2020, China, Bloomberg	Baseline regression mode	- Share liquidity of companies with better ESG disclosure. - Operating experience has increased significantly compared to those with poor ESG disclosure.
Shanaev & Ghimire (2022)	-	stock returns	ESG rating changes	Market, size, value, momentum, profitability, and investment factors	US-traded firms rated by MSCI in 2016–2021	four-factor model, multi-factor model augmented with momentum	ESG downgrades are found to have a negative effect on share prices.
Chen et al. (2023)	ESG performance is correlated with the cost of equity capital	Cost of equity capital	ESG	size, sales growth rate, asset-liability ratio, book-to-market ratio, debt tax shield, turnover rate, and corporation nature	China's A-share market by using relevant data from the Sino-Securities index 2010 and 2020	bidirectional fixed effects model	The results show that ESG efficiency can mean a significant reduction in the cost of equity capital of listed companies.
Boltona & Kacperczyk (2021)	- Carbon emissions are perceived as a systematic risk factor. - Financial markets do not price carbon risk effectively. - Shares in high emitting companies are like other 'sin stocks'; socially responsible investors avoid them to the extent that the marginalised companies offer higher stock returns.	Monthly return of an individual stock RET i, t is the monthly return of an individual stock i in month t	Emissions	Market capitalization, leverage, ROE, book value/ market capitalization, cumulative stock return; book value/assets, Herfindahl index, plant, property & equipment	2005-2017, two data sets: Trucost and FactSet in the US.	Regression analysis, cross-sectional panel data	Carbon emissions have a significant impact on the return on stocks - carbon premium reflects lower investor demand for shares in companies with high emissions.
Feng et al. (2021)	There is a link between the ESG rating and the risk of future share price falls.	two proxies for firm-specific crash risk: negative conditional skewness (NCSKEW) and down-to-up volatility (DUVOL)	ESG rating in year t (Sino-Securities ESG ratings)	Firm-specific weekly returns; total market value; financial leverage; ROA; market-to-book ratio; share turnover; absolute value of discretionary accruals.	2009-2020, China Stock Market and Accounting Research	Regression analysis	ESG ratings are negatively related with the probability of falling share prices
Lööf & Sahamkhadam, (2021)	Did ESG investments benefit shareholders during the COVID-19 pandemic crisis?	Forecast for stock	ESG scores	Industry, country variables	2018 – 2020, stocks which are listed in ten countries.	Regression analysis (correlated rand om effects)	Better ESG ratings are associated with a lower risk of adverse effects, but also with a lower potential to increase returns
Mohammad & Wasiuzzaman (2021)	- Company performance is positively related to ESG disclosure. - Strong competitive advantage positively moderates the relationship between ESG disclosure and performance	Tobin's Q, ROIC	Environmental score ESG Disclosure Scores, ROIC	Directors on the board, Market capitalization, profitability, liquidity, cash flow, debt, total assets	2012-2017, 3966 observations from out of 661 firms listed in the Bursa Malaysia	Regression analysis with clustering techniques	ESG disclosure improves a company's performance.
Yoo & Managi (2021)	Analysis of the impact of different scores (two different ratings) on financial performance	ROA, gross profits, total market value, total liabilities, total assets	E score, S score, G score	Coefficient vector of ESG scores before year 2012, coefficient vector of ESG scores after year 2012.	2007 – 2019, Bloomberg ESG scores and MSCI ESG.	Fixed effect, panel model	The result shows that disclosure is more important for profit and action is more important on Tobin's Q. E score; action would be positively associated with all types of financial performance, while S and G scores show different results.

Alareeni & Hamdan (2020)	- Environmental measures affect the performance of firms. - CSR disclosure affects firm performance. - Corporate governance disclosure affects firm performance. ESG disclosure affects firms' performance	ROA, ROE, Tobin's Q	ESG Index, Environmental Index, CSR Index, CG Index	Firm size, financial leverage, Asset turnover, Assets growth	2009 - 2018. Companies listed on the US S&P 500.	Panel regression analysis, t-test and z-test	Environmental and corporate social responsibility disclosure is negatively associated with ROA and ROE, but positively related to Tobin's Q. Additionally, disclosure of corporate governance is positively related to ROA and Tobin's Q and negatively related to ROE.
Rossi & Harjoto (2020)	A positive relationship between the company's rating and its performance. A negative relationship between the company's rating and the company's risk. Negative relationship between the firm's SER and the firm's agency costs.	Annual total shareholder return (TSR), Stern Stewart's economic value added (EVA), Tobin's Q	Standard Ethics Rating (SER)	Ownership structure, firm age, firm size, ROA, Industry, debt	2001 - 2018, 156 Italian listed companies.	Regression analyses - pooled ordinary least squares, fixed-effects and random-effects panel data	Standard ethics ratings are positively correlated with enterprise value and negatively correlated with enterprise risk and agency costs.
Saygili et al. (2020)	Environmental practices; Socially responsible practices and corporate governance practices have a significantly positive impact on the CFP of XKURY companies.	ROA, Tobin Q	Environmental Disclosure Score and Twenty Separate Variables of Social and governance pillars	Company size; Free-float percentage of the company, foreign partners, cash dividends per share, net income to sales, sales to average total assets, total liabilities to shareholders Equity.	2007-2017, Turkish listed companies of the Istanbul Borsa Corporate Governance Index (XKURY)	Hausman-Taylor (1981) model	Environmental disclosure has a negative impact on the CFP. Social indicators, show mixed results.
Do & Kim (2020)	- ESG companies have higher short-term (or long-term) abnormal returns than non-ESG companies. - The higher the overall ESG ratings, the higher the short-term (or long-term) abnormal returns. - Firms with new ESG ratings have higher short-term/long-term abnormal returns than those without. - Firms with higher ESG ratings have higher short-term (or long-term) abnormal returns than others. - Firms with lower ESG ratings have lower short-term (or long-term) abnormal returns than others.	Three types of abnormal returns (AR)	ESG ratings and their changes	risk–free returns, annualized market returns, annual dividend yield, stock price volatility, largest shareholder's ownership, foreign shareholder ownership, leverage ratio, fixed ratio, return on assets, size of firm	2020, Korea Corporate Governance Service; Financial accounting data from KIS-Value and stock market data from DataGuid	Regression analysis (Sharpe-Lintner, Fama, and French, Carhart. fixed effects panel model).	The signaling effect of ESG ratings and changes in ESG ratings persists for at least one year from the date of disclosure, and then fades in opposite directions within 3 years.
Mar Miralles-Quirós et al. (2018)	Whether social responsibility activities play a significant role in improving firm value	Book value per share, Earnings per share	Environmental performance, social performance, Governance performance, General ESG performance	CSR performance with a dummy variable that takes the value 1 if company *i* belongs to an environmentally sensitive industry	2010–2015, the So Paulo Stock Exchange	Regression analysis (Ohlson's model)	There is a clear positive and significant relationship between sustainability information and share price

3- The Data and Methods Used in the Analysis

With increased interest in this sector, there are numerous ratings and scores for ESG data disclosure. This research utilized Bloomberg's proprietary ESG rating data in order to give comparable data for analysis. Bloomberg's ESG scores are a data-driven measure of corporate environmental, social, and governance performance that investors can use to swiftly evaluate performance on a variety of major problems, including climate change, health and safety, and companies' governance policies. Bloomberg has formulated governance scores for approximately 4,300 global firms across all industries and countries that are included in the Bloomberg ESG Score Universe (BESGSCO Index). Using transparent, data-driven environmental and social ratings to evaluate sustainability. However, it can be challenging to gain useful insights from the hundreds of sustainability data disclosed by corporations. Because environmental and social disclosures are not standardized and vary considerably, it is also difficult to compare organizations using a single data point. The transparent and comparable Bloom-berg ESG scores reveal the connection between each score and the company-provided data that supports it [1]. Currently, the Environmental pillar in the Bloomberg database contains 34 sector-specific metrics across three categories: Climate Risk, Resource Efficiency, and Emissions. Social pillar: Human Capital Management, Health and Safety, Supply Chain (28 indicators); Governance pillar: Compensation, Audit, Shareholder Rights, Diversity, Entrenchment, and Over boarding (28 indicators) (Appendix I).

Companies that issue publicly traded common stock and are listed on the respective country's stock exchange are analyzed. This study focuses on the 500 largest publicly traded US firms from the S&P 500 Index (S&P) and the 600 largest EU companies from the STOXX Europe 600 Index (SXXX), providing ESG data from 2015 through 2020. The S&P 500® is widely recognized as the most accurate indicator of large-cap US equities and serves as the foundation for numerous financial products. The index consists of 500 top companies and represents roughly 80% of the total market capitalization.

The STOXX Europe 600 index is a subset of the STOXX Global 1800 index and is produced from the STOXX Europe Total Market Index (TMI). With a set number of 600 components, the STOXX Europe 600 Index comprises large, medium, and small capitalization companies in 17 European nations. For the final panel data fit estimation, SP and Stoxx Europe 600 data were merged into a single sample. Following (Table 2) is a brief description of the data set's essential characteristics.

Table 2. Basic statistical information of the data set

	Number of companies	Of which rating in 2015-2020 available			Average score of rated companies		
		E rated	S rated	G rated	E	S	G
SXXP	600	453	521	555	59,9	69,0	74,6
S&P	505	261	375	493	55,5	54,6	81,3
					Change from 2015 (in %)		
SXXP					41	17	11
S&P					28	2	3

Simple statistical analysis of Bloomberg data reveals that 453 firms from the SXXP index and 261 companies from the S&P index submitted environmental data between 2015 and 2020. Environmental data disclosure is the weakest relative to other pillars (social and governance), yet Europe is the leader in environmental consciousness. Companies and investors value and utilize this type of information due to the expansive nature of the government's data coverage. Comparing the average scores of the assessed firms reveals that the governance pillar has the highest score, and that US (S&P) corporations have a higher quality of governance. The average environmental score is significantly lower, but the improvement rate is higher, particularly in Europe (+41%). In the end analysis, only companies with at least some E information are evaluated; they account for around 71% of the entire number of enterprises. A preliminary study was conducted using aggregated data at the sector level. According to the Global industry categorization standard, Bloomberg classifies companies into eleven sectors: Communications, Consumer Discretionary, Consumer Staples, Energy, Financials, Health Care, Industrials, Materials, Real Estate, Technology, and Utilities.

This paper's empirical evaluation and validation have two objectives: to analyze the impact of Governance data on Environmental data and to investigate the potential association between Equity price and Environmental data in the EU and US. The empirical study is based on regression analysis – simple linear regressions and fixed effect panel data model. The EViews was selected as the instrument of analysis. To eliminate potential data discrepancies, in some estimations, data was recalculated by adjusting the actual data to sector differences. As an example: Esector = Eactual/Eaverage_sector, where E sector is environmental indicator adjusted by sector average. An additional advantage is obtained by making this adjustment: it is easy to distinguish between sector leaders (Esector > 1) and lagards (Esector <1). Sector adjustment was made for these datasets: Environment score, Governance score and Price change.

Initial analysis was performed on aggregated sector-level data, in order to find any relationship between Environment and Governance score variables. Further analysis is performed to check if there is any relationship between company E or G scores and their equity price performance. The regression analysis performed comprises several steps. First, three-liner regression (Equations 1 to 3) was used to estimate the relationship between environmental and governance data. Second, linear regression with fixed effect panel model (Equations 4 and 5) was used to estimate the equity price performance and environmental data.

Linear regression:

$$Escore_i = \alpha + \beta\, Gscore_i + \varepsilon_i \quad (1)$$

$$Escore_i = \alpha + \beta\, Echange_i + \varepsilon_i \quad (2)$$

$$Escore_i = \alpha + \beta\, Gchange_i + \varepsilon_i \quad (3)$$

The fixed affect panel data model:

$$Pchange_{it} = \alpha + \beta\, E_i + \varepsilon_i \quad (4)$$

$$Pchange_{it} = \alpha + \beta\, E\ change_{it} + \varepsilon\ it \quad (5)$$

Environmental score (Industry-specific Environmental Scores, which track corporate environmental on dozens of financially material and industry-relevant issues) and equity price change are selected as dependable variables and Governance score (Governance Scores for Board Composition, which rank the relative performance of companies across industries on measure of diversity, director roles and independence), Governance score change (Governance score/Governance score t-1) as independent variable. Data of chosen indicators are taken from the Bloomberg system.

The flowchart of the process of the methodology is given bellow (Figure 1).

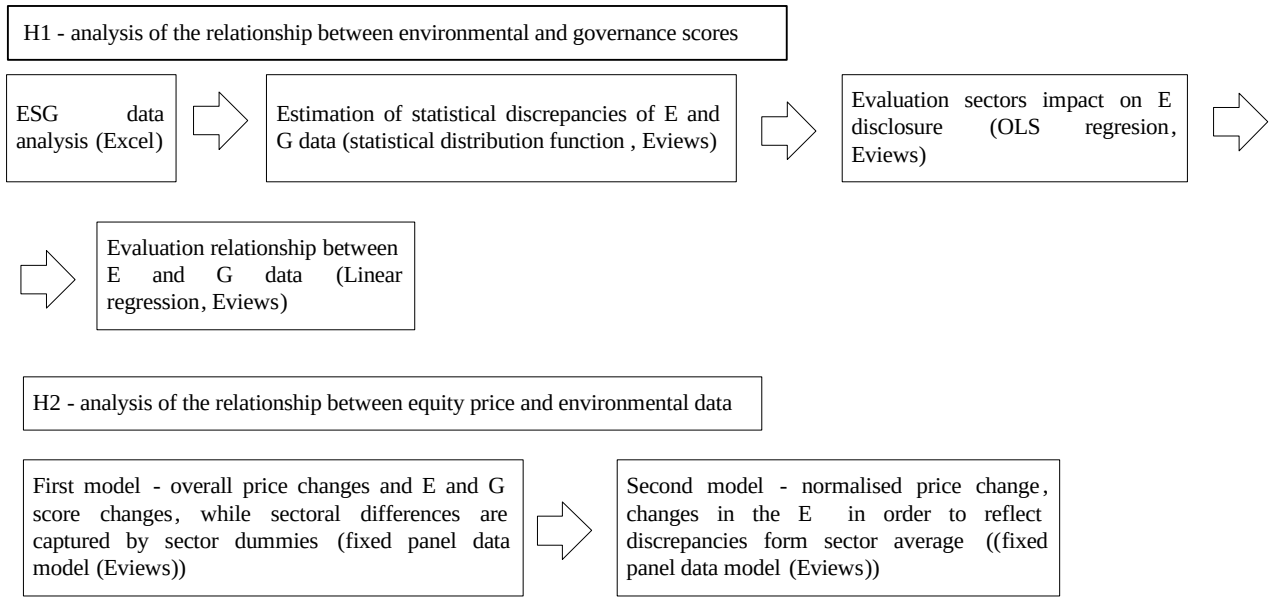

Figure 1. Process of the methodology (by authors)

4- The Empirical Analysis

4-1- Analysis of the Relationship between Environmental and Governance Scores (H1)

Using aggregated sector-level data, a preliminary analysis was conducted to identify any correlation between Environment and Governance score variables. The statistical discrepancies of the broad E and G scores were computed using the statistical distribution function of EViews to determine how the distribution of environmental and governance data varied. The range of environmental scores is substantially flatter, whereas governance scores are more concentrated between 70 and 90. The distributions of sample E-score and G-score data are shown below (Figure 2).

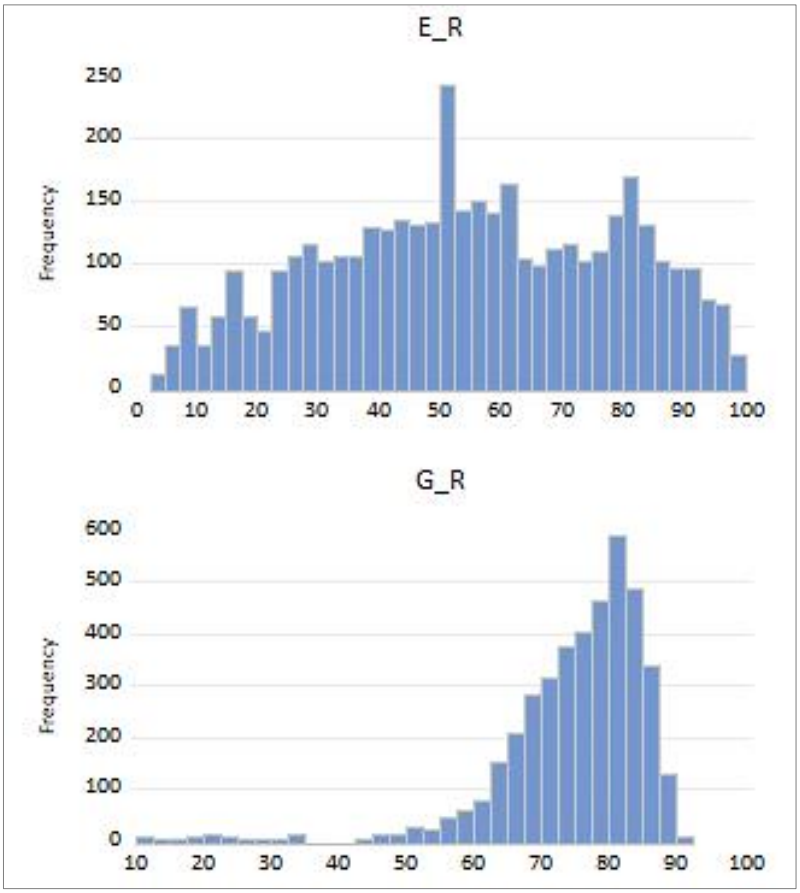

Figure 2. Statistical distribution function of E score and G score (EViews)

The majority of businesses disclose complete government data, while environmental data distribution is substantially flatter, with disclosure scores ranging from 25 to 95.

In addition, Bloomberg's premise for evaluating the E score is significantly less stable and dependent on only a few metrics. According to Bloomberg statistics, 2-13 factors are used to construct E score (depending on the industry) and 37 variables are used to construct G score on average. Materials has the most environmental indicators (13), followed by Utilities (11), Industrials, and Energy (9). The Financials, Health Care, Real Estate, and Technology sectors only provide two environmental data and communications indicators variables. The less broad environmental disclosure practice in comparison to social and governance data indicates that this is a new area for businesses and that not all of them devote as much effort to analyzing their environmental impact. As they are more environmentally unfriendly and have the methodology to regulate their environmental impact, material-intensive industries have a more robust environmental regulation heritage.

A sector-by-sector review of environment and governance data could assist determine how companies share data on these pillars. The observation demonstrates that there are considerable variances between the average Environmental scores of various sectors. Approximately 36% of Environment score differences can be attributed to/explained using the sector-specific equation shown below (Table 3 and Figure 3).

Table 3. OLS regression estimation dummy variables for sectors (EViews data)

$E\_R\_2020_{(1\ldots10)} = \alpha + \beta S_{(1\ldots10)} + \varepsilon_{(1\ldots10)}$		
Code	**Variable**	**Definition**
Dependent variable	E_R_2020 it	Environmental score/Environmental score-1
Independent variable	S (1…10)	Sectors: Communications (S1), Consumer Discretionary (S2), Consumer Staples (S3), Energy (S4), Financials (S5), Health Care (S6), Industrials (S7), Materials (S8), Real Estate (S9), Technology (S10).
Control variable	ROA	Return on assets, calculated as profit before nonrecurring items divided by total assets.
Control variable	Asset	Total balance sheet size

Dependent Variable: E_R_2020
Method: Least Squares
Date: 11/05/21 Time: 13:54
Sample: 1 451
Included observations: 451

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	50.72361	3.428966	14.79268	0.0000
S1	-2.169188	4.761908	-0.455529	0.6490
S2	1.929616	4.227513	0.456442	0.6483
S3	5.198872	4.324997	1.202052	0.2300
S4	16.20676	5.796010	2.796193	0.0054
S5	26.97218	4.007927	6.729708	0.0000
S6	29.17494	4.684859	6.227496	0.0000
S7	-6.149169	3.883383	-1.583457	0.1140
S8	2.559531	4.213310	0.607487	0.5438
S9	26.51618	5.004922	5.298021	0.0000
S10	26.62425	5.064918	5.256600	0.0000

R-squared	0.377944	Mean dependent var	59.68609
Adjusted R-squared	0.363806	S.D. dependent var	21.92073
S.E. of regression	17.48436	Akaike info criterion	8.584579
Sum squared resid	134509.3	Schwarz criterion	8.684859
Log likelihood	-1924.823	Hannan-Quinn criter.	8.624099
F-statistic	26.73316	Durbin-Watson stat	2.013878
Prob(F-statistic)	0.000000		

Figure 3. OLS regression estimation dummy variables for sectors (EViews data)

The model was evaluated using the characteristics of the fitted model, R^2 and the adjusted R^2 has been calculated by EViews (Table 3). The R-squared is 0.38, and the adjusted R-squared is 0.36. The P-value of the student's t-test was used to test the statistical significance of the influence of the independent variables on the dependent variable. When the P-value is less than 0.05, it indicates that this coefficient has a statistically significant explanatory power with a 95% probability (it is presented in the "*Prob*" column of the table). The F statistic is used to test the overall goodness of fit of the model or, more specifically, to determine whether all the slope coefficients of the regression model are equal to zero. As shown in the table, the F statistic for the final quadratic model is 26.73316, and the probability of a zero F statistic does not exist. Financials (S5), Health Care (S6), Real Estate (S9), Technology (S10) demonstrate a significant difference from the average of Environmental score. This result is expected and is reasonable, as these sectors have much less environmental risk compared to the industrial and energy sectors. This can be clearly seen by fitting the dummy sector dummy variable to the environmental rating (Figure 4). It supports the economic logic, as these sectors' activity is less directly related to heavy energy or environmental resource usage, and they have fewer indicators describing environmental impact.

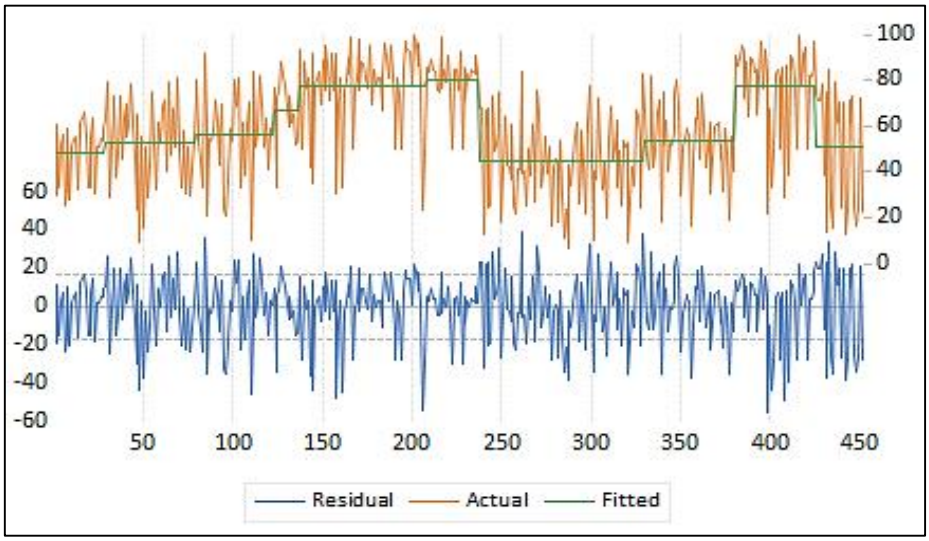

Figure 4. OLS regression estimation dummy variables for sectors (EViews)

In the subsequent step of the investigation, linear regression was used to examine the correlation between environmental data and governance score. This research was conducted using aggregated data at the sector level. The association between Environment and Governance score variables was investigated by examining a variety of sector performance data set combinations. Only the G score and change in E score were shown to have a somewhat stronger correlation, which might be explained by effective corporate governance having an effect on the company's environmental goals. The association between other sectoral data combinations looks probable but statistically negligible. Listed below are a number of graphical displays (Figures 5 and 6).

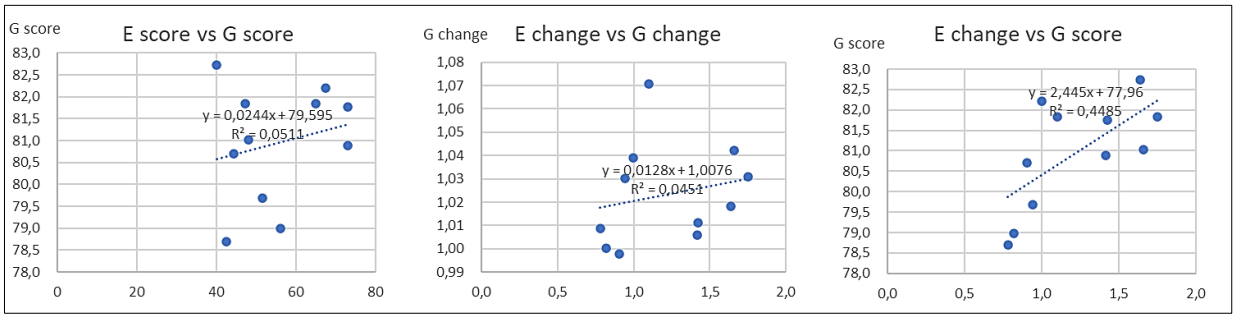

Figure 5. S&P Sector Dependencies

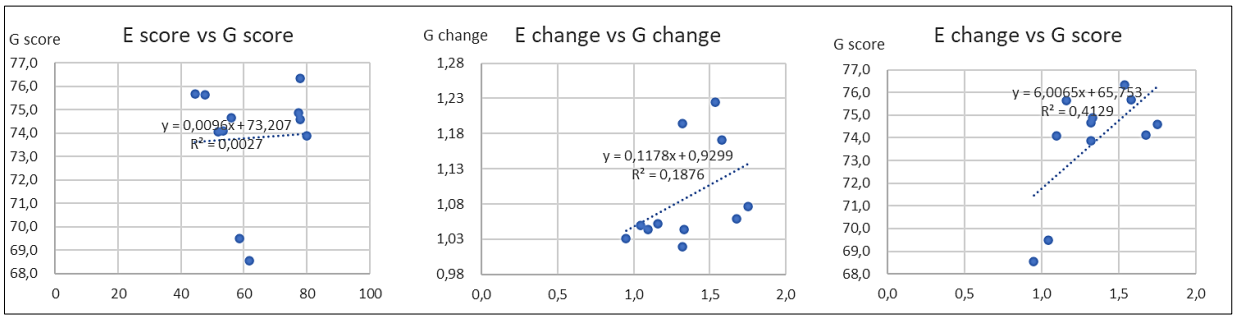

Figure 6. Stoxx Europe 600 Sector Dependencies

The highest value of R^2 is seen to be in the relationship between E and Governance score – the third graph for US data (R^2 = 0.45) and the sixth for Europe (R^2 = 0.41). Analysis results show that there exists some positive relationship between initial/historical company Governance score and potential change in company Environmental score. That is, companies which are better governed have the propensity to improve their environmental values more and this conclusion supports business logic. It is seen that high initial governance score does not lead to high historical environmental score. The results are in line with the study of Hoang et al. [23], in general, it is seen from the ESG data that US companies demonstrate higher quality of governance.

4-2- Analysis of the Relationship between Equity Price and Environmental Data (H2)

Using fixed panel data models for disaggregated company-level data, the relationship between pricing and environmental variables was estimated in subsequent steps of the investigation. Two variants of panel data estimation were employed to validate the hypothesis: the first model uses overall price changes and E and G score changes, whereas sectoral differences are captured by sector dummies. In the second model, price change, the changes in the E and G scores were normalized to represent the sector averages, and discrepancies were derived from the sector averages. The first example is shown below (Table 4 and Figure 7).

Table 4. OLS regresion estimation (EViews data)

$DPX_{it} = \alpha + \beta_1 S1_{it} + \beta_2 S6_{it} + \beta_3 S10it + \beta_4 DE\_R(-1)_{it} + \beta_5 G\_R_{it} + \beta_6 ROA + \beta_7 Asset + \varepsilon_{it}$		
Code	**Variable**	**Definition**
Dependent variable	DPXi	Change in the price of the equity for *i* company in time *t*; difference from the average of the sector (to eliminate the specific sector discrepancy)
Independent variable	S1	Communications (Dummy)
	S6	Health Care (Dummy)
	S10	Technology (Dummy)
	DE_R(-1)	The change in environmental score lagged by 1.
	G_R	Governance score
Control variable	ROA	Return on assets, calculated as profit before non-recurring items divided by total assets.
	Asset	Total balance sheet

Dependent Variable: DPX
Method: Panel Least Squares
Date: 11/01/21 Time: 16:16
Sample (adjusted): 2017 2019
Periods included: 3
Cross-sections included: 538
Total panel (unbalanced) observations: 1603

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.144689	0.043979	26.02797	0.0000
S1	-0.090961	0.023811	-3.820107	0.0001
S6	0.056547	0.019782	2.858585	0.0043
S10	0.100352	0.024465	4.101866	0.0000
DE_R(-1)	0.047183	0.013924	3.388739	0.0007
G_R	-0.001072	0.000550	-1.950915	0.0512
ROE	0.000265	9.72E-05	2.728121	0.0064
ASSET	-6.19E-08	1.39E-08	-4.466458	0.0000

Effects Specification

Period fixed (dummy variables)

R-squared	0.368399	Mean dependent var	1.117991
Adjusted R-squared	0.364830	S.D. dependent var	0.279911
S.E. of regression	0.223082	Akaike info criterion	-0.156338
Sum squared resid	79.27640	Schwarz criterion	-0.122778
Log likelihood	135.3049	Hannan-Quinn criter.	-0.143877
F-statistic	103.2401	Durbin-Watson stat	2.072442
Prob(F-statistic)	0.000000		

Figure 7. OLS regression estimation (EViews data)

R-squared is 0.37, and adjusted R-squared is 0.36. The F statistic is used to test the overall fit of the model or, more specifically, to determine if all of the slope coefficients in the regression model are zero. As shown in the table, the F-statistics of the final quadratic model are 103.2401, while the probability of zero F–statistics is non-existent. Communications, Health Care, Technology, Change of Environmental Score, ROE, ASSET demonstrate significant impact on Change of Equity Price. The model shows that environmental data positively impacts price changes. The regression coefficients next to Communications have a negative sign, which means that if all other conditions are equal, this sector produces less stock price growth. Assets have a negative sign, indicating that higher assets do not lead to higher stock price growth. It can be that huge companies do not lead to a higher price of equity. Improvement in the quality of environmental data should increase with more standardization and regulation, and this should help improve the integration of environmental values in the discovery of companies' financial performance.

The second model employing differences from sector averages is changed such that no dummy variables are required for identifying sector-related data, as instead of raw data, differences from specific sector averages are generated first. The illustration of this estimate is shown below (Table 5 and Figure 8).

Table 5. OLS regression estimation (EViews data)

$R\_AVG\_DIF(-1)_{it} + \beta_2$ ROA + ε it		
Code	**Variable**	**Definition**
Dependent variable	DPX_AVG_DIFit	Change in the equity price from sector average (in order to eliminate the specific sector discrepancy) for country i in time t
Independent variable	DE_R_AVG_DIF(-1)	Change in Environmental score difference from the sector average (in order to eliminate the specific sector discrepancy) lagged by 1.
Control variable	ROA	Return on assets, profit (before non-recurring items) / total assets.

Dependent Variable: DPX_AVG_DIF
Method: Panel Least Squares
Date: 11/05/21 Time: 13:50
Sample (adjusted): 2016 2019
Periods included: 4
Cross-sections included: 538
Total panel (unbalanced) observations: 1984

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.968206	0.013321	72.68307	0.0000
DE_R_AVG_DIF(-1)	0.052193	0.015948	3.272628	0.0011
ROE	0.000125	7.30E-05	1.710299	0.0874

Effects Specification

Period fixed (dummy variables)

R-squared	0.280313	Mean dependent var	1.011343
Adjusted R-squared	0.278493	S.D. dependent var	0.251121
S.E. of regression	0.213306	Akaike info criterion	-0.249159
Sum squared resid	89.99788	Schwarz criterion	-0.232245
Log likelihood	253.1655	Hannan-Quinn criter.	-0.242946
F-statistic	154.0832	Durbin-Watson stat	1.938267
Prob(F-statistic)	0.000000		

Figure 8. OLS regression estimation (EViews data)

An alternative model comparing differences from the sector average was also tested between the change in equity price and the change in the environmental score. The R-squared is 0.28, and the adjusted R-squared is 0.28. The F statistic is used to test the overall fit of the model or, more specifically, to determine if all of the slope coefficients in the regression model are zero. As shown in the table, the F statistics of the final quadratic model are 154.0832, while the probability of zero F statistics is non-existent. The results also validate the concept that environmental data favourably influences the price change of stocks. It is also established that technological and resource utilization disparities between industries should be considered when analyzing the price impact of environmental data. It could be noted that the current trend to significantly increase environmental regulation and reporting requirements would unquestionably improve data quality, but should be calibrated against the increased cost for companies, especially small businesses, which could experience a substantial increase in reporting costs. Overall, both models demonstrate a statistically significant association between a company's environmental score and its stock price, supporting the stakeholder argument.

5- Conclusions and Discussions

At a time when environmental issues are becoming more and more urgent, proactive environmental preservation is of the utmost importance. Therefore, in this article, we contribute to the stream of debate on the significance of paying attention to the quality of the environmental data provided in ESG or similar concepts. Using regression analysis, the relationship between environmental data, governance data, and stock price was investigated. The econometric study was conducted in two major steps: estimating the link between environmental score and governance score using aggregated sector-level data and the association between equity price and environmental score using disaggregated company-level data.

First, the ESG concept identifies environmental, social, and governance measures as three significant intangibles that are interconnected. Consequently, the increasing environmental risk begs the question of how the environmental pillar is addressed within the ESG framework. The basic observation reveals that corporations in Europe and the United States invest less in publishing environmental data for the time being, although the governance rating is inherently more stable and higher. Taking a more in-depth look at the ESG concept, social and governance aspects should be treated as prerequisites for good environmental data, and governance aspects should be treated as prerequisites for good social and environmental data. These findings are reinforced by the findings of Veenstra & Ellemers [25]: the first step of analysis reveals that environmental data is not released uniformly in comparison to governance data. Depending on the industry, the number of revealed environmental factors ranges from 2 to 13 variables. Regression analysis revealed that environmental data provided by companies in the Financials, Health Care, Real Estate, and Technology sectors differ significantly from those provided by companies in other sectors. These results are consistent with Miralles-Quirós's [8] conclusion that the market is more supportive of environmental practices carried out by companies that are not involved in environmentally sensitive industries. In the third phase, line regression is used to determine how governance data influence the disclosure of environmental data. According to Hoang et al. [23], the model that included environmental

score change and governance score was the most statistically valid and demonstrated that effective governance might lead to improved environmental management. This result is supported by economic logic, since better-governed organizations have a greater propensity to improve their environmental values. Governance data appears to be of greater importance to corporations and investors, although environmental scores have selectively improved in recent years. Governance information appears to be of greater interest to corporations and investors, while environmental rankings have selectively improved during the past few years.

Second, the use of fixed influence panel data to examine the impact of special factors on price changes demonstrated that environmental data have a beneficial effect on price fluctuations. In accordance with the findings of Quirós et al., the Health Care and Technology sectors demonstrate significance in this model [8]. In summary, these results of disaggregated company-level panel data estimation models contribute to the body of literature supporting the favorable influence of monetary policy [29, 30]. Currently, as regulations become more stringent, firms are compelled to engage in environmental development, particularly in developed nations. Financial, Health Care, Real Estate, and Technology sectors have a far smaller environmental impact than Industrial and Energy sectors. Consequently, these industries do not collect and report environmental indicators that are unimportant to them, and our model reveals a considerable deviation from the average Environmental score.

Theoretical examination of scholarly articles has demonstrated the correlation between ESG performance and financial performance. In our opinion, the newer direction of analysis should delve deeper and analyze specific information of ESG indicators that lead to improved stock performance, as not all ESG information is equivalent and relevant in predicting future stock returns, and returns are dependent on the level of market regulation. Therefore, if regulation becomes more stringent (due to the push of the World Bank and the rise of other global leading institutions), returns to environmentally conscious enterprises will likely increase, particularly in markets that have trailed behind. In the future, when environmental data collection and distribution increase owing to regulation or demand from active investors, a broader dataset, comprising more detailed environmental factors and a bigger selection of enterprises (including not only large- and mid-cap companies but also small companies), may be utilized. By clustering companies into categories based on industry and analyzing environmental winners and losers separately, a restricted range of ESG characteristics may be segregated for further examination.

6- Declarations

6-1- Author Contributions

Conceptualization, G.L. and A.L.; methodology, D.G.; software, A.L.; investigation, G.L.; resources, G.L.; data curation, K.P.; writing—original draft preparation, D.G.; writing—review and editing, K.P.; visualization, G.L.; supervision, A.L.; funding acquisition, G.L. All authors have read and agreed to the published version of the manuscript.

6-2- Data Availability Statement

The data presented in this study are available in the article.

6-3- Funding

Funding by Faculty of Economics, Vilniaus Kolegija / University of Applied Sciences; Saltoniškių g. 58 - 1, 08105, Vilnius, Lithuania.

6-4- Institutional Review Board Statement

Not applicable.

6-5- Informed Consent Statement

Not applicable.

6-6- Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

7- References

[1] Holger, D., & Sardon, M. (2021). G-7 Calls for Making Climate-Change Reporting Compulsory. WSJ Pro Sustainable Business. Available online: https://www.wsj.com/articles/g-7-calls-for-making-climate-change-reporting-compulsory-11623080613 (accessed on January 2023).

[2] World Business Council for Sustainable Development. (2022). How business can lead the transformations the world need, WBCSD, Geneva, Switzerland. Available online: https://accionempresas.cl/content/uploads/wbcsd-vision-2050-time-to-transform.pdf (accessed on January 2023).

[3] Matos, P. (2020). ESG and Responsible Institutional Investing Around the World: A Critical Review. SSRN Electronic Journal. doi:10.2139/ssrn.3668998.

[4] Baldini, M., Maso, L. D., Liberatore, G., Mazzi, F., & Terzani, S. (2018). Role of Country- and Firm-Level Determinants in Environmental, Social, and Governance Disclosure. Journal of Business Ethics, 150(1), 79–98. doi:10.1007/s10551-016-3139-1.

[5] Bogers, M., Chesbrough, H., & Strand, R. (2020). Sustainable open innovation to address a grand challenge : Lessons from Carlsberg and the Green Fiber Bottle. British Food Journal, 122(5), 1505–1517. doi:10.1108/BFJ-07-2019-0534.

[6] Lee, M. T., Raschke, R. L., & Krishen, A. S. (2022). Signaling green! Firm ESG signals in an interconnected environment that promote brand valuation. Journal of Business Research, 138, 1–11. doi:10.1016/j.jbusres.2021.08.061.

[7] Rossi, F., & Harjoto, M. A. (2020). Corporate non-financial disclosure, firm value, risk, and agency costs: evidence from Italian listed companies. Review of Managerial Science, 14(5), 1149–1181. doi:10.1007/s11846-019-00358-z.

[8] Miralles-Quirós, M. M., Miralles-Quirós, J. L., & Valente Gonçalves, L. M. (2018). The value relevance of environmental, social, and governance performance: The Brazilian case. Sustainability, 10(3), 574. doi:10.3390/su10030574.

[9] Yoo, S., & Managi, S. (2022). Disclosure or action: Evaluating ESG behavior towards financial performance. Finance Research Letters, 44, 102108. doi:10.1016/j.frl.2021.102108.

[10] Mohammad, W.M.W., & Wasiuzzaman, S. (2021). Environmental, Social and Governance (ESG) disclosure, competitive advantage and performance of firms in Malaysia. Cleaner Environmental Systems, 2. doi:10.1016/j.cesys.2021.100015.

[11] Feng, J., Goodell, J. W., & Shen, D. (2022). ESG rating and stock price crash risk: Evidence from China. Finance Research Letters, 46, 1544–6123. doi:10.1016/j.frl.2021.102476.

[12] Sha, Y., Zhang, P., Wang, Y., & Xu, Y. (2022). Capital market opening and green innovation-Evidence from Shanghai-Hong Kong stock connect and the Shenzhen-Hong Kong stock connect. Energy Economics, 111. doi:10.1016/j.eneco.2022.106048.

[13] Zhou, Q., Sun, S., & Liu, Q. (2019). The capital flow of stock market studies based on epidemic model with double delays. Physica A: Statistical Mechanics and Its Applications, 526. doi:10.1016/j.physa.2019.03.098.

[14] Leung, W. S., Mazouz, K., Chen, J., & Wood, G. (2018). Organization capital, labor market flexibility, and stock returns around the world. Journal of Banking and Finance, 89, 150–168. doi:10.1016/j.jbankfin.2018.02.008.

[15] Bolton, P., & Kacperczyk, M. (2021). Do investors care about carbon risk? Journal of Financial Economics, 142(2), 517–549. doi:10.1016/j.jfineco.2021.05.008.

[16] Barnea, A., & Rubin, A. (2010). Corporate Social Responsibility as a Conflict between Shareholders. Journal of Business Ethics, 97(1), 71–86. doi:10.1007/s10551-010-0496-z.

[17] Nelling, E., & Webb, E. (2008). Corporate social responsibility and financial performance: the "virtuous circle" revisited. Review of Quantitative Finance and Accounting, 32(2), 197–209. doi:10.1007/s11156-008-0090-y.

[18] Saygili, E., Arslan, S., & Birkan, A. O. (2022). ESG practices and corporate financial performance: Evidence from Borsa Istanbul. Borsa Istanbul Review, 22(3), 525–533. doi:10.1016/j.bir.2021.07.001.

[19] Alareeni, B. A., & Hamdan, A. (2020). ESG impact on performance of US S&P 500-listed firms. Corporate Governance: The International Journal of Business in Society, 20(7), 1409–1428. doi:10.1108/cg-06-2020-0258.

[20] Shanaev, S., & Ghimire, B. (2022). When ESG meets AAA: The effect of ESG rating changes on stock returns. Finance Research Letters, 46. doi:10.1016/j.frl.2021.102302.

[21] Lööf, H., Sahamkhadam, M., & Stephan, A. (2022). Is Corporate Social Responsibility investing a free lunch? The relationship between ESG, tail risk, and upside potential of stocks before and during the COVID-19 crisis. Finance Research Letters, 46, 102499. doi:10.1016/j.frl.2021.102499.

[22] Lapinskienė, G. (2011). Sustainable enterprises: Responses of market values. Business Systems & Economics, 1(1), 71-83.

[23] Hoang, V.T.H., Przychodzen, W., Przychodzen, J., & Segbotangni, E. A. (2021). Environmental transparency and performance: Does the corporate governance matter? Environmental and Sustainability Indicators, 10, 100123. doi:10.1016/j.indic.2021.100123.

[24] Jacoby, G., Liu, M., Wang, Y., Wu, Z., & Zhang, Y. (2019). Corporate governance, external control, and environmental information transparency: Evidence from emerging markets. Journal of International Financial Markets, Institutions and Money, 58, 269–283. doi:10.1016/j.intfin.2018.11.015.

[25] Veenstra, E. M., & Ellemers, N. (2020). Esg indicators as organizational performance goals: Do rating agencies encourage a holistic approach? Sustainability (Switzerland), 12(24), 1–15. doi:10.3390/su122410228.

[26] Callan, S. J., & Thomas, J. M. (2009). Corporate financial performance and corporate social performance: An update and reinvestigation. Corporate Social Responsibility and Environmental Management, 16(2), 61–78. doi:10.1002/csr.182.

[27] Kuo, T. C., Chen, H. M., & Meng, H. M. (2021). Do corporate social responsibility practices improve financial performance? A case study of airline companies. Journal of Cleaner Production, 310, 127380. doi:10.1016/j.jclepro.2021.127380.

[28] Fatemi, A., Glaum, M., & Kaiser, S. (2018). ESG performance and firm value: The moderating role of disclosure. Global Finance Journal, 38, 45–64. doi:10.1016/j.gfj.2017.03.001.

[29] Meng-tao, C., Da-peng, Y., Wei-qi, Z., & Qi-jun, W. (2023). How does ESG disclosure improve stock liquidity for enterprises - Empirical evidence from China? Environmental Impact Assessment Review, 98. doi:10.1016/j.eiar.2022.106926.

[30] Chen, Y., Li, T., Zeng, Q., & Zhu, B. (2023). Effect of ESG performance on the cost of equity capital: Evidence from China. International Review of Economics & Finance, 83, 348–364. doi:10.1016/j.iref.2022.09.001.

[31] Singh, A. (2021). Investigating the dynamic relationship between litigation funding, gold, bitcoin and the stock market: The case of Australia. Economic Modelling, 97, 45–57. doi:10.1016/j.econmod.2021.01.007.

[32] Ameer, R., & Othman, R. (2012). Sustainability practices and corporate financial performance: A study based on the top global corporations. Journal of Business Ethics, 108(1), 61–79. doi:10.1007/s10551-011-1063-y.

[33] Omri, A., Euchi, J., Hasaballah, A. H., & Al-Tit, A. (2019). Determinants of environmental sustainability: evidence from Saudi Arabia. Science of the Total Environment, 657, 1592-1601. doi:10.1016/j.scitotenv.2018.12.111.

[34] Wang, S., Wang, H., Wang, J., & Yang, F. (2020). Does environmental information disclosure contribute to improve firm financial performance? An examination of the underlying mechanism. Science of the Total Environment, 714, 136855. doi:10.1016/j.scitotenv.2020.136855.

[35] Aharon, D. Y., & Siev, S. (2021). COVID-19, government interventions and emerging capital markets performance. Research in International Business and Finance, 58. doi:10.1016/j.ribaf.2021.101492.

[36] Didier, T., Levine, R., Llovet Montanes, R., & Schmukler, S. L. (2021). Capital market financing and firm growth. Journal of International Money and Finance, 118. doi:10.1016/j.jimonfin.2021.102459.

[37] Do, Y., & Kim, S. (2020). Do higher-rated or enhancing ESG of firms enhance their long–term sustainability? Evidence from market returns in Korea. Sustainability, 12(7), 2664. doi:10.3390/su12072664.

[38] Bae, K. H., Bailey, W., & Kang, J. (2021). Why is stock market concentration bad for the economy? Journal of Financial Economics, 140(2), 436–459. doi:10.1016/j.jfineco.2021.01.002.

[39] López, M. V., Garcia, A., & Rodriguez, L. (2007). Sustainable development and corporate performance: A study based on the Dow Jones sustainability index. Journal of Business Ethics, 75(3), 285–300. doi:10.1007/s10551-006-9253-8.

[40] Meyer, J. W., & Rowan, B. (1977). Institutionalized Organizations: Formal Structure as Myth and Ceremony. American Journal of Sociology, 83(2), 340–363. doi:10.1086/226550.

[41] Europe Commission. (2021). EU taxonomy for sustainable activities. Europe Commission, Brussels, Belgium. Available online: https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en (accessed on January 2023).

[42] Wijayana, S., & Gray, S. J. (2018). Capital market consequences of cultural influences on earnings: The case of cross-listed firms in the U.S. stock market. International Review of Financial Analysis, 57, 134–147. doi:10.1016/j.irfa.2018.03.007.

[43] Wang, X., Yan, J. (Karena), Yan, C., & Gozgor, G. (2021). Emerging stock market exuberance and international short-term flows. Journal of International Financial Markets, Institutions and Money, 75. doi:10.1016/j.intfin.2021.101417.

[44] Ziegler, A., & Schröder, M. (2010). What determines the inclusion in a sustainability stock index?. A panel data analysis for european firms. Ecological Economics, 69(4), 848–856. doi:10.1016/j.ecolecon.2009.10.009.

[45] Ziegler, A., Busch, T., & Hoffmann, V. H. (2011). Disclosed corporate responses to climate change and stock performance: An international empirical analysis. Energy Economics, 33(6), 1283–1294. doi:10.1016/j.eneco.2011.03.007.

Appendix I:

Indicators of Environmental Data

Category	Name
Climate Risk	Intensity of total greenhouse gas CO2 Emissions Intensity per Sales
	GHG/CO2 Intensity per Power Generated
	Total intensity of GHG CO2 Emissions Intensity per MBOE
	Intensity of total CO2 Emissions Intensity per RPM
	Carbon per Unit of Production
	GHG Scope 1 Intensity per Power Generated
	Fossil Fuels % Energy Capacity
	Total Renewables % Energy Capacity
	Embedded Carbon in Total Reserves
	Production Mix Oil Percent
	Climate Change Policy
Resource Efficiency	Energy Intensity per Sales
	Energy Intensity per MBOE Produced
	Energy Per Unit of Production
	Water Intensity per Sales
	Water Use per Power Generated
	Water Intensity per MBOE
	Water per Unit of Production
	Waste Generated per Sales
	Pct Water Recycled
	Load Factor Calculation
	Gallons/Liters per 100 RPM/RPK
	Avg Age of Aircraft in Fleet
	Biodiversity Policy
	Water Policy
Emissions	SOx Emissions per Sales
	NOx Emissions per Sales
	SO2/SOx Intensity per Power Generated
	NOx Intensity per Power Generated
	SO2/SOx Intensity per MBOE
	NOx Intensity per MBOE
	Spills per MBOE
	Gas Flaring per MBOE

Indicators of Social Data

Human Capital Management	Women Management to Employees Ratio
Health and Safety	Pct Women in Workforce
	Employee Turnover Pct
	Equal Opportunity Policy
	Anti-Bribery Ethics Policy
	Employee Protection / Whistle Blower Policy
	Lost-Time Incident Rate - Employees
	Total Recordable Incident Rate - Employees
	Fatality Rate
	Health and Safety Policy
Supply Chain	Human Rights Policy
	Policy Against Child Labor
	Fair Remuneration Policy
	Percentage Suppliers Audited
	Percentage of Suppliers in Non-Compliance

Indicators of Governance Data

Remuneration	Percentage Board of Director Comp Pd in Stock Awards
Independence	Say on Pay Number of Votes FOR
	Pct Non-Executive Directors on Comp Committee
	Clawback Provision for Executive Compensation
	Chg of Ctrl Benefits/Golden Parachute Agreements
	CEO Duality
	Non-Exec Pct Non-Exec Directors on Board
	Pct Independent Directors
	Independent Chairperson
	Independent Lead Director
	Former CEO or its Equivalent on Board
	Board Size
Audit	Pct of Independent Directors on Audit Committee
	Pct Non-Executive Directors on Audit Committee
	Pct Audit Committee Members on 3+ Boards
	Audit Committee Meeting Attendance Percentage
	Independent Audit Committee Chairperson
	Years Auditor Employed
Shareholder Rights	Dual-Class Unequal Voting Rights - Common Shares
	Classified Board System
	Poison Pill Plan
Diversity	Board Average Age
	Board Age Range
	Chief Executive Officer Age
	Chairman Age
	Percent of Executives that are Women
	Percent of Board Members that are Women
Entrenchment	Number of Board Members Serving Over 10 years
	Average Board Tenure
	Average Exec Tenure
	Tenure of the Chief Executive Officer Tenure
	Chairman Tenure
Over boarding	Pct Non-Executive Directors on 3+ Boards
	Pct of Executive Directors on 2+ Boards
	Number of Board Positions CEO Holds
	Number of Board Positions Chair Holds
	Number of Executive Positions Chair Holds