Lisbon School of Economics & Management
Universidade de Lisboa

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MASTER´S FINAL WORK

DISSERTATION

MARKET VALUE RELEVANCE OF ENVIRONMENTAL, SOCIAL AND GOVERNANCE (ESG) SCORES

ANA RITA CARNEIRO DOS SANTOS

OCTOBER - 2021

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SUPERVISION:
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ABSTRACT, KEYWORDS AND JEL CODES

ABSTRACT:

This study analyses the association between Corporate Social Responsibility (CSR) and market data, more concretely share prices and stock returns, for companies listed in the STOXX Europe 600 Index, from 2010 to 2019 period. To measure CSR was used the ESG (Environmental, Social, and Governance) overall score from Refinitiv and its three components: Environmental Score, Social Score, and Governance Score. The modified Ohlson model proposed by Barth and Clinch (2005) was used to study the price model, while the modified Ohlson model proposed by Ota (2005) was used to study the return model. Results suggest a positive association between CSR and market data, but in most models, especially in the price model, these are not statistically significant. Nevertheless, a statistically significant association between market data and changes in ESG scores was found. An additional robustness test suggests that the financial crisis impacted the relationship between CSR and market data. In the years affected by the crisis, investors are less concerned with sustainability issues.

KEYWORDS: Corporate Social Responsibility; ESG; Environmental Score; Social Score; Governance Score; Market Data; Share Prices; Stock Returns.

JEL CODES: G32; M14; Q56.

RESUMO, PALAVRAS-CHAVE E CÓDIGOS JEL

RESUMO:

Este estudo analisa a relação existente entre o conceito de Responsabilidade Social (CSR) e dados de mercado, mais concretamente preços e retornos das ações, para empresas do Índice *STOXX Europe 600*, para o período de 2010 a 2019. Para medir a Responsabilidade Social, foi usado o indicador ESG proveniente da base de dados Refinitiv, bem como os seus três componentes: ambiental, social, e de *governance.* Foi usado o modelo modificado proposto por Barth and Clinch (2005) para estudar o modelo do preço, enquanto o modelo modificado proposto por Ota (2005) foi usado para estudar o modelo do retorno. Os resultados sugerem uma relação positiva entre a Responsabilidade Social e os dados de mercado, no entanto, na maioria dos modelos, especialmente no modelo do preço, esta relação não é significante. Apesar disso, existe uma relação significante entre os dados de mercado e a variável que representa as variações no ESG. Foi ainda aplicada uma análise de robustez que mostrou que a crise financeira teve impacto na relação entre as duas variáveis em estudo. Nos anos afetados pela crise, os investidores tornaram-se menos preocupados com aspetos ambientais.

PALAVRAS-CHAVE: Responsabilidade Social; ESG; *Environmental Score; Social Score; Governance Score*; Dados de mercado; Preço das ações; Retorno das ações.

CÓDIGOS JEL: G32; M14; Q56.

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TABLE OF CONTENTS

Abstract, Keywords and Jel Codes i
Acknowledgments iii
Table of Contents iv
Glossary v
List of Tables vi
List of Appendices vi
1. Introduction 1
2. Literature Review and Hypotheses Development 3
2.1. Corporate Social Responsibility (CSR) 3
2.2. Impact of ESG on the market 4
2.2.1. Value relevance concept and framework 4
2.2.2. Empirical evidence 6
2.3. Research questions and research hypotheses 11
3. Sample and Methodology 12
3.1. Sample 12
3.2. ESG scores 13
3.3. Market data 14
3.3.1. Share price 14
3.3.2. Market return 17
4. Results 18
4.1. Share price 18
4.1.1. Descriptive Statistics 18
4.1.2. Correlation Matrix 19
4.1.3. Model Results 20
4.2. Market Return 24
4.2.1. Descriptive statistics 24
4.2.2. Correlation Matrix 25
4.2.3. Model Results 25
4.3. Robustness analysis 28
5. Conclusion 31
References 34
Appendices 39

GLOSSARY

CSR – Corporate Social Responsibility

ESG – Environmental, Social, and Governance

EU – European Union

GRI - Global Reporting Initiative

IR – Integrated Reporting

JEL – Journal of Economic Literature

OECD - Organization for Economic Cooperation and Development

UK – United Kingdom

LIST OF TABLES

Table I - Price Model Descriptive Statistics 19

Table II - Price Model regression results 20

Table III - Price model regression results with ESG interaction terms 22

Table IV - Price model regression results using ESG interaction terms and the Changes in ESG 23

Table V - Return Model Descriptive Statistics 25

Table VI - Return model regression results 26

Table VII - Return model regression results with Changes in ESG 27

Table VIII - Regression results of the share price model regarding the impact of crisis periods 29

Table IX - Regression results of the stock return model regarding the impact of crisis periods 30

LIST OF APPENDICES

Appendix A - Sample composition by country 39

Appendix B - Sample composition by economic sector 39

Appendix C - Share price model variables definition 40

Appendix D - Stock return model variables definition 41

Appendix E - Price model Pearson Correlation Matrix 42

Appendix F - Return model Pearson Correlation Matrix 43

Appendix G - Hausman test results 43

Appendix H - Price model robustness analysis (taking into consideration financial crisis) 44

Appendix I - Return model robustness analysis (taking into consideration financial crisis) 45

1. INTRODUCTION

Nowadays, Corporate Social Responsibility (CSR) is a growing concern across the business sector and society. There are increasing concerns about sustainability issues, such as climate change, global warming, pollution, and wealth, forcing companies to adapt to their new reality and concepts. There is increasing demand from society with these concerns, which is reflected in the business world.

Market data is a fundamental concept for investors to be able to make conscient decisions. Hence arises the concept of market value relevance, analysing the ability of non-financial information, in this case, sustainability information, to capture information that affects market value.

Most empirical research found a positive association between market data and CSR (Reverte, 2016; Torre et al., 2020; Miralles-Quirós et al., 2018; Kaspereit & Lopatta, 2016; Setyahuni & Handayani, 2020). However, there is not a complete consensus among the authors. In general, there is a positive and statistically significant relationship between these variables. However, Miralles-Quirós et al. (2018) found that Social Score is not statistically significant. Setyahuni & Handayani (2020) found that Governance Score is not significant in both models, price and return.

To study the relationship between CSR and market data, namely share prices and stock returns, a sample of 381 and 379 firms, respectively, from STOXX Europe 600 is used, covering 19 countries of the European Union and 9 different economic sectors, from 2010 to 2019 period. This study is based on the model proposed by Ohlson (1995). In the price model will be used a modified Ohlson model proposed by Barth & Clinch (2005), which is used to scale the variables to mitigate the potential errors due to differences in firm size, for example. On the other hand, a modified Ohlson model proposed by Ota (2005) will be used in the return model. The ESG measurement comes from the Refinitiv database.

This study finds a positive relationship between market data and both price and return. However, in the price model, the sustainability measures are not statistically significant, being this association weak or absent. This study includes a variable of changes in ESG Scores to test whether the impact is significant or not in market data. The variable of

changes is statistically significant in all models, suggesting that investors give more value to the analysis of the changes in CSR.

Regarding the return model, this study founds a positive association between stock returns and CSR, in line with Torre et al. (2020), Kaspereit & Lopatta (2016), and Setyahuni & Handayani (2020). This association is statistically significant using the ESG overall score and Environmental Score. Adding the variable of changes in ESG scores, the association between this variable and CSR is statistically significant in all models, except for Governance Score.

Using a robustness analysis, the results from this study point to a significant impact of the financial crisis on the association between CSR and market data, especially in the case of share prices. In the financial crisis period, investors tend to be more concerned about financial and economic issues than sustainability issues, leading to an irrelevant association in these periods.

This study contributes to the existing literature because, firstly, it is the first study, to the best of our knowledge, analysing the value relevance of ESG scores' changes in a European context. Secondly, the previous studies only consider static sustainability indicators and do not consider their changes, which is crucial for this study. It also provides evidence on the association between each of the three components of the ESG score and market data, which is a little-studied topic, mainly in Europe. Furthermore, this study contributes to the literature on the financial crisis and its impact on CSR.

This dissertation is divided into the following sections: Section 2 provides a literature review of this topic, with a bit of definition of the most relevant concepts, the models used in this study, and the empirical evidence, as well as the research questions and used hypotheses. In section 3 is presented the sample and methodology used in this study, and section 4 is presented the results. The final section, section 5, is used to present the main conclusions, limitations, and possible future research. In the last part, there are the references and appendices used.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Corporate Social Responsibility (CSR)

Since a few years ago, corporate social responsibility (CSR) has been a growing concern within the companies and the general population, being one of the most significant trends of the last decade in the world. This concern puts substantial pressure on firms to disclose their CSR efforts to ensure that stakeholders are aware of the companies' initiatives on social, environmental, and governance issues (Nekhili et al., 2016; Gonçalves, Gaio & Costa, 2020).

The corporate social responsibility concept has several definitions amongst the authors. However, it is defined by Barnea and Rubin (2010, p. 71) as "actions taken by firms with respect to their employees, communities, and the environment that go beyond what is legally required of a firm." McWilliams (2016) also defines this concept in the same way. To better capture all the companies' concerns and actions regarding CSR, a new concept was developed: the ESG, which stands for Environmental, Social, and Governance (Starks, 2009). ESG can be defined as the three key factors in analysing how far advanced the companies and the countries are in terms of sustainability and their investments' ethical impact.

This paper will use the ESG scores from Refinitiv, which are divided into categories for each ESG pillar score. The environmental criteria investigate the firms' performance in the natural environment, with three categories: emission, innovation, and resource use. The social criteria focus on firms and their relations with people, including workforce, human rights, community, and product responsibility. Finally, the governance criteria look at how the firms control themselves, and it also has three categories: management, shareholders, and CSR strategy (Refinitiv, 2020).

Nowadays, investors are increasingly paying attention to these non-financial factors when analysing a firm, and consequently, companies are increasingly making disclosures in their annual report or in a sustainability report. There are a set of standards that guide the CSR reporting, such as OECD Guidelines for Multinational Enterprises, ISO14000 Series, and Global Reporting Initiative (GRI), which is the most followed standard, according to Chiu et al. (2020) and Gonçalves et al. (2020). De Klerk et al. (2015)

concluded that the ESG disclosure following this GRI guidelines is positively related to stock prices. According to the most recent KPMG Survey of Corporate Responsibility Reporting of 2017, the CSR reporting in America has increased by six percentage points from 2015 to 2017. In Europe, this percentage was 77% in 2017, and the countries that had the highest CSR reporting were in the Asia Pacific Region (such as Japan, India, and Malaysia).

The impact of each one of the three components on ESG disclosure is different. According to the previous literature, social performance has the strongest positive relationship with ESG disclosure, followed by environmental performance, and lastly, economic performance (Alsayegh & Rahman, 2020). Furthermore, the level of transparency among the three components is different. In general, the highest level of transparency occurs on the governance score and the lowest on the environmental score. The sector also impacts transparency (Oncioiu et al., 2020). The financial industry is the one that has the least transparency by opposition to the materials and utility sectors which are the most transparent (Tamimi & Sebastianelli, 2017). Although the financial sector is the least transparent, CSR has become an important issue because the banking industry is crucial for the global economy's proper functioning. Furthermore, the growing concern about CSR is an opportunity for the banking industry re-gain the reputation lost with the past economic crisis (Miralles-Quirós et al., 2019). The profitability and capital spending levels also impact ESG scores positively. The higher levels of disclosure scores are presented in the companies that have higher levels of profitability and capital spending, according to Iatridis (2013).

2.2. Impact of ESG on the market

2.2.1. Value relevance concept and framework

The ESG disclosure information produces evident impacts on the market value and market data, according to Aureli et al. (2020). This relationship between market value and CSR performance has been studied over the last few years. Hence, arises the value relevance concept.

Hassel et al. (2005, p. 45) define value relevance as "the ability of accounting or non-accounting measures to capture or summarize information that affects equity value." This

paper aims to investigate the value relevance on the market data of the ESG components. Some previous studies provide different views on how ESG is valuable for the market and the stakeholders. The value relevance of the traditional financial and accounting information has decreased in the last decades (Gonçalves, 2015), being the investors increasingly concerned about the information that does not appear directly in the companies' financial statements. Hence, the value relevance of non-financial information, such as the ESG disclosure information, has been increasing (Reverte, 2016).

Nekhili et al. (2016) argue for a positive effect of CSR and its reporting on the capital market. However, the previous literature on this topic provides mixed results. Reverte (2016) argues that these mixed results can be explained with the underlying theories, which have a different impact on the relationship between market data and CSR performance.

The stakeholder theory has an essential role in proving the positive relationship between CSR disclosure and market value (Nekhili et al., 2016). This theory states that a firm's success depends on its ability to comply with stakeholders' expectations. So, being CSR a growing concern in society in general, this represents an opportunity to meet market participants' information demand.

The agency theory assumes a constant relationship between economic agents, and they act opportunistically in the market, causing information asymmetries. The non-financial information disclosure can mitigate these asymmetries, reducing the economic uncertainty and generating more value to investors, and thus, increase the market data, such as share prices (Wang & Li, 2016; Gonçalves, Pimentel & Gaio, 2021). Consequently, this theory suggests that CSR disclosure is value-relevant (Cordazzo et al., 2020).

On the other hand, the legitimacy theory is viewed as a socio-political theory, and it suggests that companies act in society within the norms, values, and legislation. Companies often disclose non-financial information to maintain their society's legitimacy (Woodward et al., 2001). According to Reverte (2016), the legitimacy theory suggests that CSR disclosures can be perceived as irrelevant or even negatively related to stock prices, in opposition to the stakeholder and agency theories.

Several studies have analysed the relationship between ESG scores and market data, such as stock returns and share prices. The majority of these studies use the Ohlson model or the modified Ohlson model proposed by Barth & Clinch (2005). The Ohlson model proposed by Ohlson (1995) refers that the market value of equity is a function of a firm's book value, accounting earnings, and other non-financial relevant information (Hassel et al., 2005). This model assumes that the value of equity is equal to the present value of all the future dividends, and there is a clean surplus relationship. Furthermore, the abnormal earnings follow a modified first-order process, and the other information follows a simple first-order process (Hassel et al., 2005). In the Ohlson model, the non-financial relevant information is not specified, so each author performs the analysis with the variable(s) considered more relevant to the study.

Barth and Clinch (2005) proposed the modified Ohlson model, and it involves scaling the variables to mitigate the potential errors due to differences in firm size, for example. Several scaling measures can be used, such as market to book ratio, returns, among others. However, these authors conclude that the most effective one that mitigates the scale effects is a model that uses a share price specification.

2.2.2. Empirical evidence

Torre et al. (2020) studied the relationship between ESG score and stock returns, and how ESG can affect the returns using a sample of firms from Eurostoxx 50. Firstly, they computed a panel data analysis, and then, a multiple regression for each company was performed. They investigate the impact of ESG components and divide each one into four sub-components. Their analysis shows a weak linear correlation between the ESG score and stock returns. However, they also find a positive and statistically significant relationship between stock returns and ESG overall index. That impact varies from company to company, meaning that if the investors decide to invest in one company could have higher returns than invest in another company. According to these authors, this derives from each company's sectors. In some industries, the ESG investments have more relevance for profitability than in other sectors, such as energy and utility sectors.

These findings were reinforced by Setyahuni and Handayani (2020) and by Kaspereit & Lopatta (2016), who also concluded a positive and significant relationship between ESG information and returns. The impact of each ESG component was analysed by

Setyahuni and Handayani (2020). They found that investors reacted positively with environmental and social scores regarding stock returns and share prices. On the other hand, governance score is not reacted by investors in both returns and prices. Limkriangkrai et al. (2017) also said that high environmental and social scores generate higher average monthly returns. This positive effect of ESG performance on stock returns was also observed by Consolandi et al. (2020) using a large sample of companies headquartered in the U.S.

In contrast to this finding, Jadoon et al. (2020) concluded that environmental performance is perceived by investors as irrelevant when it comes to enhancing firm valuation. The sample used in this study was 247 companies included in the best 30 green capital markets ranked by the Global Green Economy Index, being this the reason why the conclusion is different from other authors.

The aggregated ESG score is the most important for investors, according to Setyahuni and Handayani (2020) and Rajesh (2020). The former used both a price model and a return model derived from the Ohlson model. One limitation of this study was that the ESG disclosure information could be affected by company size because larger companies have more resources to make better disclosures in terms of quality. This limitation was studied by Artiach et al. (2010), who investigates the factors that influence high levels of CSR performance. They reached the conclusion that firm size strongly impacts the high levels of CSR performance, indicating that the leading CSR firms are significantly bigger. Artiach et al. (2010) went even further and found that capacity for growth also has a significant impact on high CSR levels; however, it is a weaker impact compared to that observed in the firm size.

Tamimi and Sebastianelli (2017) also investigate the impact of firm size and other ESG score factors using a nonparametric test. They found that the large-cap companies have higher ESG disclosure scores. Furthermore, other factors are important when analysing the ESG scores, such as the gender-diverse board of directors. The larger and more gender-diverse board of directors, the higher the ESG scores. The number of employees also has a positive and significant impact on CSR (Acabado et al., 2020).

Chauhan and Kumar (2019) and Wang et al. (2011) investigated ESG disclosure's effect on different types of investors. They argue that foreign investors have a preference

to invest in firms that have greater ESG disclosure, particularly in the area of governance. In contrast, domestic investors have a smaller concern about this (Chauhan & Kumar, 2019). Beyond that, individual investors respond less to ESG disclosure than institutional investors (Wang et al., 2011).

The sector also impacts the association between market data and CSR performance. The financial industry is an essential sector with extraordinary features studied by Miralles-Quirós et al. (2019) using 20 different stock markets. They concluded that environmental and governance performances are positively associated with share prices, and social performance is negatively associated with them. They also argue that the value relevance of ESG scores is higher in the common law countries, i.e., countries in which there is a set of unwritten laws based on legal precedents established by the courts, in which the shareholder protection is also higher.

Reverte (2016) used a modified Ohlson model with a share price specification to mitigate size differences, and in the non-accounting relevant information, he added the CSR disclosure. His analysis addressed the same issue of analysing CSR disclosure's value relevance. However, he took a step further by analysing not only the direct effects of CSR performance on stock prices, but also its indirect effects on stock prices through the interaction between the main accounting variables (earnings and book value of equity) and the CSR disclosure. Besides, there may still be an indirect effect between the stock prices and CSR reports (for example, Gonçalves, Gaio & Ferro (2021) argue the mitigating impact of CSR on earnings). CSR disclosure leads to a better perception of the investors, causing lower economic uncertainty and lower risk for investors.

Following the study of Reverte (2016), the CSR disclosures appear to be value-relevant and positively associated with stock prices, meaning that higher CSR disclosures lead to higher stock prices. This author's results are in line with the previous ones showing that there is a positive relationship between ESG scores and market data. There is also an association between CSR performance and future market performance because CSR information disclosure leads to higher market capacity in predicting future earnings changes. As already mentioned, the sector/industry has a significant impact. Some industries are called environmentally-sensitive in which CSR disclosure is associated with higher share prices than other industries, according to Reverte (2016), Miralles-

Quirós et al. (2018), and De Klerk et al. (2015). These environmentally-sensitive industries are exposed to higher public concern levels because there are higher risks related to potential litigation. The disclosure of CSR information makes investors have a greater perception of these risks, and so, they can make a better assessment, leading to higher market valuation of the shares (Reverte, 2016).

Miralles-Quirós et al. (2018) used the companies' share prices as the independent variable to study the value relevance of CSR that operate in developed countries, and they also used a modified Ohlson model, as Reverte (2016) already used. They found that environmental, governance, and ESG overall scores are positively and significantly associated with share prices. Social performance is also positively associated, but this one is not statistically significant.

De Klerk et al. (2015) investigate the relationship between CSR and share prices with a sample of UK companies. As well as other authors mentioned above, they used a modified Ohlson model proposed by Barth and Clinch. Their findings contribute to the existing literature by concluding that high CSR disclosure levels are associated with higher share prices, so there is a positive relationship between both. While these authors used a sample of UK companies, Deng & Cheng (2019) used a sample of China's companies to study the same thing, investigate the relationship between the stock market performance and ESG scores. Although the sample is different and different countries, the conclusion is the same; there is a positive correlation between both variables.

All of these mentioned studies do not consider the possibility of events causing a decrease or an increase in the share prices related to the ESG scores. This is a limitation as it is important to consider these events for decision-making. This limitation was considered by Kim et al. (2014), who studied whether CSR mitigates or contributes to stock price crash risk, which is measured as the conditional skewness of return distribution, and the mitigating effect was proved. With a sample of more than 12,000 companies, they found that there is a significant and negative relationship between CSR performance and stock price crash risk. In this case, the price crash risk is often associated with financial reporting transparency. If the companies use CSR to cover up bad news and divert attention from the shareholders, it is associated with higher price crash risk.

On the other hand, there is a lower price crash risk if there is high transparency in reporting and less bad news.

Murata and Hamori (2021) used a sample composed of three regions: Europe, the U.S., and Japan, to investigate how ESG disclosures are related to future share price crash risk. With a regression analysis and controlling for other determinants of the stock price crash risk, such as stock volatility, financial leverage, firm size, and controlling for endogeneity, they found that ESG disclosure is statistically significant and negative in Europe and Japan samples. In the U.S., the relationship appears to be not significant. So, the conclusion is that the stock price crash risk depends on the region because different stock markets have different characteristics.

In terms of value relevance of ESG disclosure information, the report can be presented in one single report, combining with the financial information reporting. This report is called integrated reporting (IR). Landau et al. (2020) analysed this integrated reporting's value relevance. They concluded that there is a negative impact on market valuation unless firms provide an IR audited by a Big 4 company. The sustainability reporting is an alternative to disclosing non-financial information, which is positively perceived by the capital markets (Kaspereit & Lopatta, 2016). Mervelskemper and Streit (2017) conclude that ESG performance is valued more strongly when firms publish an ESG report, whether it is stand-alone or integrated.

The European Union implements the Directive 2014/95/EU to disclose non-financial information. This directive says that the companies must disclose environmental issues, social and governance. It applies to (i) listed on EU exchanges or with significant operations in the EU, (ii) defined as "large" (i.e., with 500 or more employees), or (iii) designated as public-interest entities by EU member states due to their activities, size, or the number of employees (Grewal et al., 2019).

Grewal et al. (2019) investigated the market reaction associated with implementing this EU directive and the mandatory non-financial information disclosure. They concluded that there is an average negative market reaction of -0.79% across all firms included in this study sample. Furthermore, they concluded that there is a less negative market reaction for firms having better ESG performance (particularly in the areas of E and G). Another factor that can be analysed together with stock market reaction is the

ESG news. Capelle-Blancard & Petit (2019) investigated this relationship between ESG news and the stock market reaction. They found that the firms that face negative events have a drop in their market of approximately 0.1%. In contrast, firms that face positive events have no impact on average on the market.

2.3. Research questions and research hypotheses

As previously explained, while some authors concluded that there is a positive relationship between market data and CSR performance (Torre et al., 2020, Setyahuni & Handayani, 2020, and Kaspereit & Lopatta, 2016), others found that there is a negative relationship between both variables (Hassel et al., 2005), and others provide evidence that the association is perceived as irrelevant by investors (Jadoon et al., 2020). So, it is clear that there are mixed results on this topic. Furthermore, there are some unstudied topics. In terms of decision making and the risk analysis for the investors, it is important to analyse the market impact when there are changes in ESG scores, being this a less studied topic in the previous literature.

Consequently, this paper analyses the following research questions:

Research Question 1: Considering the ESG scores, which measure the corporate social responsibility of the firms, what is the market's reaction, and which one of the three pillars is the most significant for the market?

Research Question 2: If there are changes in the ESG scores, what is the impact on market value relevance?

Although there are mixed results regarding the relationship between the market data and the ESG scores' components, the main previous literature found a positive association between market data and ESG scores, in general. In this sense, the following hypotheses are advanced:

H1. A: There is a positive relationship between stock prices and ESG components.

H1. B: There is a positive relationship between market return and ESG components.

Considering now the changes in the companies' ESG scores, is expected that the impact on the market is different among the three components of the ESG. Accordingly,

it will be analysed the impact of these changes in terms of value relevance with the following hypotheses:

H2. A: The relationship between stock prices and ESG components changes with changes in the ESG scores.

H2. B: The relationship between market return and ESG components changes with changes in the ESG scores.

3. SAMPLE AND METHODOLOGY

3.1. Sample

In order to study the relationship between corporate social responsibility and market data, the data was retrieved from the Thomson Reuters Refinitiv database, which provides detailed data about ESG for many companies worldwide.

This analysis included a sample from the STOXX Europe 600 Index for the 2010-2019 time-period as a first step. With a fixed number of 600 components, this index represents large, mid, and small-capitalization companies across 17 European region countries. Firstly, it was included the entire sample. However, then, the financial sector companies were excluded because of their accounting system's particular characteristics (Reverte, 2016; Gonçalves & Coelho, 2019) since they have a precise industry regulation. Beyond that, companies with unavailable ESG scores or unavailable variables in terms of market data were also excluded. It was considered required at least five years of data of the same company to have reliable results.

Regarding the share price model, the final sample is composed of 381 companies, covering 19 countries in the European Union, and 9 different economic sectors, which are represented in a total of 3,177 firm-year observations.

The sample composition is presented in the Appendix I, by country, and in the Appendix II, by economic sector. These appendices evidence that the United Kingdom, France, and Germany are the most represented countries in the sample, with 25,40%, 15,96%, and 10,48%, respectively. Furthermore, the most represented economic sectors in the sample are Industrials, Consumer Cyclicals, and Basic Materials, with 20,49%, 17,97%, and 13,91%, respectively.

On the other hand, regarding the stock return model, the final sample is composed of 379 companies, covering 19 countries in the European Union, and 9 different economic sectors, which are represented in a total of 2,858 firm-year observations.

The sample composition is presented in the Appendix I, by country, and in the Appendix II, by economic sector. These appendices evidence that the United Kingdom, France, and Germany are the most represented countries in the sample, with 26,10%, 15,89%, and 10,11%, respectively. Furthermore, the most represented economic sectors in the sample are Industrials, Consumer Cyclicals, and Basic Materials, with 20,82%, 17,81%, and 13,40%, respectively.

Next, it is important to approximate the distribution of the variables to be normal (meaning that the excess skewness is equal to 0 and kurtosis is equal to 3) in order to avoid biased results. The data was submitted to the Winsor test and to the Winsorizing process that allows dropping the outliers, which are among the most important factors that can cause biased results. This process allows limiting the extreme values of the data. The dependent variables' observations at 1% and 99% percentiles were excluded, to avoid skewed results due to outliers (Gonçalves, Gaio & Lélis, 2020).

3.2. ESG scores

Refinitiv offers one of the most comprehensive ESG databases, covering over 70% of global market cap, across more than 450 different ESG metrics, with a time-period going back to 2002. ESG scores from Refinitiv are designed to transparently measure a company's ESG performance across ten main areas (resource use, emissions, and innovation in terms of environmental, workforce, human rights, community, and product responsibility in terms of social and management, shareholders, and corporate social responsibility strategy in terms of governance). Basically, Refinitiv captures over 450 company-level ESG measures, of which a subset of 186 of the most comparable and material per industry was selected. These are grouped into ten categories which are listed above. These categories are, in turn, grouped into three-pillar scores (environmental, social, and governance) and then the final ESG overall score.

A percentage between 0 and 100 is disclosed for each one of the ten category scores. According to Refinitiv (2020), this percentile rank scoring methodology is based on three questions: how many companies are worse than the current one; how many companies

have the same value; and how many companies have a value at all. Furthermore, the ESG categories scores are calculated according to the following equation:

(1) $$Score = \frac{no.of\ companies\ with\ a\ worse\ value + \frac{no.of\ companies\ with\ the\ same\ value\ included\ in\ the\ current\ one}{2}}{no.of\ companies\ with\ a\ value}$$

This paper will use the three individual scores and the ESG overall score, which is computed with a simple sum of the category weights which vary with the industry (for the environmental and social pillars). For the governance pillar, the weights are the same for all industries.

3.3. Market data

3.3.1. Share price

The Ohlson model has been used in the previous literature to study the relationship between the market value of equity and the firm's book value, accounting earnings, and other non-financial relevant information (Ohlson, 1995). Furthermore, Barth and Clinch (2005) proposed the modified Ohlson model, and it involves scaling the variables to mitigate the potential errors due to differences in firm size, for example. Several scaling measures can be used, but the conclusion was that the share price specification is the most effective measure that mitigates the scale effects. Thus, the following equation represents the modified Ohlson model.

(2) $$P_{i,t} = \beta_0 + \beta_1 BVPS_{i,t} + \beta_2 EPS_{i,t} + \varepsilon_{i,t}$$

I follow such studies and employ the same model, adding the corporate social responsibility component as the non-financial relevant information, as Reverte (2016).

Following Reverte (2016), and to test the hypothesis H1.A, the following model is adopted which will investigate the relationship between share price and ESG scores, controlling for firm-specific characteristics, such as year, industry, and country effects:

(3) $$P_{i,t} = \beta_0 + \beta_1 ESG\_Score_{i,t} + \beta_2 BVPS_{i,t} + \beta_3 EPS_{i,t} + \beta_4 Size_{i,t} + \beta_5 Lev_{i,t} + \beta_6 ROA_{i,t} + \beta_7 Year_t + \beta_8 Industry_i + \beta_9 Country_i + \varepsilon_{i,t}$$

The same equation will be used to test the association between share prices and each component of ESG Score, replacing in the above equation the sustainability variable with

each of its three pillars: Environmental Score (*Env_Score)*, Social Score (*Soc_Score)*, and Governance Score (*Gov_Score).*

Where *i* denotes each company and *t* denotes the corresponding year. The ESG overall score (*ESG_Score*), Environmental Score (*Env_Score*), Social Score (*Soc_Score*) and Governance Score (*Gov_Score*) are the four independent variables which are computed as described in the previous section, according to Refinitiv. The other firm control variables are described below:

Book value per share (*BVPS*): Calculated as the ratio between the equity available to common shareholders and the number of outstanding shares. This metric represents the minimum value of a company's equity and measures the book value of a firm on a per-share basis. This variable is part of the modified Ohlson model and was used in several studies (Miralles-Quirós et al., 2019; Reverte, 2016; Setyahuni & Handayani, 2020; Torre et al., 2020).

Earnings per share (*EPS*): Computed as the ratio between the net income of the year and the number of outstanding shares of its common stock. A higher company's *EPS* indicates that the firm is more profitable. This variable is also part of the modified Ohlson model and was used in several studies, as the *BVPS* is already used (Miralles-Quirós et al., 2019; Reverte, 2016; Setyahuni & Handayani, 2020; Torre et al., 2020).

Firm's size (*Size*): Computed as the natural logarithm of the company's total assets, in thousands of euros (Setyahuni & Handayani, 2020). Preivous studies suggest that the bigger the company size, the higher the company's concern to disclose voluntary information (Cooper & Owen, 2007).

Leverage (*Lev*): Computed as the ratio between total debt and total equity. According to Alsayegh & Rahman (2020), firms are exposed to financial burden, and the higher this variable, the more likely are the firms to loose market share and to face a negative effect on profitability. Consequently, share prices will be affected.

Return on assets (*ROA*): Computed as the ratio between the net income of the year and the total assets and represents profitability. According to Artiach et al. (2010), firms with high levels of profitability appear to have a higher concern with sustainability.

Finally, the model is composed by dummy variables which are used to control for firm-specific characteristics. The industry, country and year control variables are included. All these variables are described in Appendix III with the respective computation formula.

After testing the direct effects of CSR on stock prices, it will be tested also its indirect effects through the interaction between CSR and main accounting variables (book value per share and earnings per share). According to Reverte (2016), CSR can affect the stock prices indirectly because the CSR reports can be perceived by investors as a source of additional information concerning the nature, composition, and trends of the value relevant accounting variables. To test these indirect effects, the interaction between the sustainability component and the other accounting variables are added, as in the following equation:

(4) $$P_{i,t} = \beta_0 + \beta_1 ESG\_Score_{i,t} + \beta_2 BVPS_{i,t} + \beta_3 EPS_{i,t} + \beta_4 ESG\_Score_{i,t} * BVPS_{i,t} + \beta_5 ESG_{Score\,i,t} * EPS_{i,t} + \beta_6 Lev_{i,t} + \beta_7 ROA_{i,t} + \beta_8 Size_{i,t} + \beta_9 Year_t + \beta_{10} Industry_i + \beta_{11} Country_i + \varepsilon_{i,t}$$

The same process will be applied in the equations of each of the three ESG components.

Considering now the changes in the companies' ESG scores, is expected that the impact on the market is different among the three components of the ESG. Accordingly, to test the hypothesis H2.A, I extend the model (4), which includes a new variable $Changes\_ESG_{i,t}$ which is computed as $\frac{ESG_t - ESG_{t-1}}{ESG_{t-1}}$.

(5) $$P_{i,t} = \beta_0 + \beta_1 ESG\_Score_{i,t} + \beta_2 BVPS_{i,t} + \beta_3 EPS_{i,t} + \beta_4 ESG\_Score_{i,t} * BVPS_{i,t} + \beta_5 ESG_{Score\,i,t} * EPS_{i,t} + \beta_6 Changes\_ESG_{i,t} + \beta_7 Size_{i,t} + \beta_8 Lev_{i,t} + \beta_9 ROA_{i,t} + \beta_{10} Year_t + \beta_{11} Industry_i + \beta_{12} Country_i + \varepsilon_{i,t}$$

This new variable will be added also in the equations of each of the three ESG components.

3.3.2. Market return

To study the relationship between the market return and the ESG scores, I will use a return model, which is a model that is based on Ohlson's model but it was modified by Ota (Setyahuni & Handayani, 2020). Ota (2005) proposed the following return model:

(6) $R_t = \beta_0 + \beta_1 EPS_t + \beta_2 \Delta EPS_t + \beta_3 \Delta F_t + \varepsilon_t$

Where R_t is the return over the 12-month period commencing on the third month after the end of the year t-1, EPS_t is earnings per share for period t deflated by P_{t-1}, ΔEPS_t is annual changes in earnings per share deflated by P_{t-1}, and ΔF_t is annual changes in management forecasts of next period's earnings per share deflated by P_{t-1}. All of the variables used in this model are described in Appendix IV.

Following this model and the model proposed by Setyahuni & Handayani (2020), the following four models are adopted to study the hypothesis H1.B:

(7) $R_{i,t} = \beta_0 + \beta_1 ESG\_Score_{i,t} + \beta_2 \frac{EPS_{i,t}}{P_{t-1}} + \beta_3 \frac{\Delta EPS_{i,t}}{P_{t-1}} + \beta_4 Size_{i,t} + \beta_5 Year_t + \beta_6 Industry_i + \beta_7 Country_i + \varepsilon_{i,t}$

The same equation will be used to test the association between stock returns and each component of ESG Score, replacing in the above equation the sustainability variable with each of its three pillars: Environmental Score (*Env_Score)*, Social Score (*Soc_Score)*, and Governance Score (*Gov_Score).*

Where *i* denotes each company and *t* denotes the corresponding year. The ESG overall score (*ESG_Score*), Environmental Score (*Env_Score*), Social Score (*Soc_Score*) and Governance Score (*Gov_Score*) are the four independent variables which are computed as described in the previous section, according to Refinitiv. The other firm control variables are already described in the stock price model above. The ESG scores are not deflated by P_{t-1} because this information is assumed to be independent and not affected by the scale of the company (Setyahuni & Handayani, 2020).

Considering now the changes in the companies' ESG scores, is expected that the impact on the market is different among the three components of the ESG. Accordingly, to test the hypothesis H2.B, I extend the model, which includes a new variable $Changes\_ESG_{i,t}$ which is computed as $\frac{ESG_t - ESG_{t-1}}{ESG_{t-1}}$.

(8) $$R_{i,t} = \beta_0 + \beta_1 ESG\_Score_{i,t} + \beta_2 \frac{EPS_{i,t}}{P_{t-1}} + \beta_3 \frac{\Delta EPS_{i,t}}{P_{t-1}} + \beta_4 Changes\_ESG_{i,t} + \beta_5 Size_{i,t} + \beta_6 Year_t + \beta_7 Industry_i + \beta_8 Country_i + \varepsilon_{i,t}$$

This new variable will be added also in the equations of each of the three ESG components.

4. RESULTS

To test the equations presented in the section above, we need to choose a regression model to use. Firstly, the Hausman test was computed, which is used to find if the most appropriate model is the random effect model or the fixed effect model. As shown in Appendix VII, the *p-value* equals 0.0000, so we should use the fixed effects model.

Considering that I need to control for the effect of different characteristics of the firms at the industry level and at country and year levels, I need to add industry, year, and country dummy variables. According to Reverte (2016), the Ordinary Least Squares (OLS) method basic specification assumes that the standard errors are independent of each other. However, we need to consider that the disclosure prices on sustainability are relatively stable over the years, so the OLS assumption is unlikely to be held. This problem is solved using the clustered-robust standard errors, which are robust to heteroskedasticity, serial, and cross-sectional correlation. Clustering standard errors is essential when individual observations can be grouped into clusters where the model errors are correlated within a cluster but not between clusters. Consequently, a firm level cluster will be used. On the other hand, and as already explained, it will be used industry, year, and country dummy variables.

This results section is divided into two parts, each dedicated to each model: share price model and stock return model, which are described in the following topics.

4.1. Share price

4.1.1. Descriptive Statistics

The share price model descriptive statistics are described in the following Table I. As can be seen, the average share price for a European firm of the Euro Stoxx 600 is 59.05€. All the firms with stock prices inferior to 1€ were removed from the sample because they are considered penny stocks (Gonçalves, Gaio & Lélis, 2020). Companies with negative

equity were also excluded because they are considered distressed firms, which can skew the results. Regarding the CSR measures, the average ESG overall score is 62.76, which indicates that firms, on average, stand still above half of their sustainability potential. The social score is the ESG pillar that reveals the higher number, with 65.96, and the governance score is the one that reveals the minimum number, of 56.91. The variable *ROA* gives the average performance of the European firms, and it is about 6.0%.

The variables *Indbvps* and *Indeps* correspond to the interaction terms between the ESG score and BVPS and between ESG score and EPS, respectively, in order to access the indirect impact of these variables in the stock prices.

Table I - Price Model Descriptive Statistics

Variable	Obs.	Mean	Median	Std. Dev.	Minimum	Maximum
Price	3 177	59.05	25.27	134.4	1.6	1769.61
ESG_score	3 177	62.76	65.57	18.14	12.33	91.61
Env_score	3 177	63.08	67.19	23.54	.77	96.85
Soc_score	3 177	65.96	70.78	21.54	9.97	96.62
Gov_score	3 177	56.91	59.18	21.84	9.14	93.94
BVPS	3 177	22.07	9.77	41.56	.26	363.76
EPS	3 177	3.56	1.65	7.71	-.42	83.46
Lev	3 177	2.08	1.49	1.99	.17	12.96
ROA	3 177	.06	.05	.06	-.08	.29
Size	3 177	23.2	23.01	1	21.44	25.95
Changes_ESG	3 177	.05	.02	.18	-.83	5.59
Indbvps	3 177	1392.64	583.03	2723.06	5.7	27492.81
Indeps	3 177	227.31	99.91	509.17	-37.13	6920.31

4.1.2. Correlation Matrix

In Appendix V, the Pearson correlation matrix is presented. As can be observed, there is a statistically significant correlation between the CSR variables, like the ESG overall score and the three pillars. However, since these variables are not used together in a single model but rather each used individually, this is not considered a multicollinearity problem. Additionally, the correlations between *Price* and *EPS, ROA, BVPS, Leverage, and Size* are statistically significant.

The Variance Inflation Factors (VIF) were computed for all variables to test the problem of multicollinearity and confirm the correlation matrix results. As the VIF statistics for all the variables in the different models are low, not exceeding the critical

value of 10 (Reverte, 2016), it is considered that multicollinearity is not a big problem in this model.

4.1.3. Model Results

In the following Table II, the main results of the regressions estimated using the method are presented. In these models, the price is the dependent variable. The CSR variables are included, individually, in the four models. Firstly, the ESG overall score is tested, and then, the three pillars of the ESG score are tested. Several explanatory variables are also included: *ROA*, *EPS*, *BVPS*, *Leverage*, and *Size*. All the models include three control fixed effects: year, industry, and country effects.

Table II - Price Model regression results

VARIABLES	(1)	(2)	(3)	(4)
Constant	670.7100	666.3158	655.2344	657.4964
	(795.1722)	(800.0696)	(800.8854)	(792.0976)
ESG_score	0.0098			
	(0.1201)			
Env_score		-0.0302		
		(0.1266)		
Soc_score			-0.0372	
			(0.0835)	
Gov_score				0.0357
				(0.0531)
EPS	-4.4482***	-4.4449***	-4.4407***	-4.4501***
	(1.5803)	(1.5803)	(1.5781)	(1.5807)
BVPS	-1.4606***	-1.4581***	-1.4572***	-1.4588***
	(0.4689)	(0.4684)	(0.4712)	(0.4684)
ROA	-13.5334	-13.2685	-13.0351	-13.0803
	(35.1767)	(35.3737)	(35.0590)	(34.9292)
Leverage	-2.3976***	-2.4110***	-2.4070***	-2.3922***
	(0.7900)	(0.7981)	(0.7887)	(0.7935)
Size	-24.1098	-23.8143	-23.3152	-23.6044
	(34.0847)	(34.3028)	(34.2835)	(33.8700)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
Observations	3,175	3,175	3,175	3,175
Adj. R-Squared	0.9459	0.9459	0.9459	0.9459
P-value	0.0005	0.0005	0.0004	0.0006

Note: *, **, and *** refer to 10%, 5%, and 1% significance levels, respectively.

According to the table above, none of the sustainability variables are statistically significant for the price model, which means that these variables, by themselves, do not explain the effect on the stock prices. Hence, we cannot draw any conclusions from these models.

Regarding the explanatory variables, both *EPS* and *BVPS*, the modified Ohlson model variables, are statistically significant in all the models presented in this table. However, these variables present a negative association with the stock prices, which is the opposite of the results found in the previous literature by Reverte (2016). The variable *Leverage* presents a negative and significant association with the stock prices, which is consistent with the previous literature (Alsayegh & Rahman, 2020), since the higher this variable, the more likely are the firms to loose market share and to face a negative effect on profitability. On the other hand, *ROA* and *Size* are irrelevant in these models, being not statistically significant.

The adjusted R-Squared is a measure that determines the extent of the variance of the dependent variable, which the independent variables can explain. This measure gives whether the regression equation is a good fit or not. The higher the R-Squared, the better the regression equation, and thus the relevance of firms' financial and non-financial information to market performance. According to Table II, this measure takes values above 94%, which means that this model expresses well what is intended.

After testing the direct effects of CSR on stock prices, which did not result in any conclusion, its indirect effects will be tested through the interaction between CSR and main accounting variables (book value per share and earnings per share), represented in Table III.

The results show a slight difference in the interaction terms between ESG score and *BVPS* (*Indbvps)* and between ESG score and *EPS* (*Indeps*). The ESG overall score becomes positively and statistically significant, like the Governance Score. On the other hand, the Environmental and Social Scores appear to be not statistically significant. The ESG overall score is the one that presents the highest coefficient; therefore, investors value the ESG overall score more than its main components. Regarding each component, the governance score is the most value relevant, and social score is the most negligible value relevant for investors, according to these models.

In these models, *BVPS* and EPS become non value relevant, unlike the models presented in Table II. The explanatory variables are all non-significant, except for *Leverage*, which is negatively and statistically significant in all the models. This negative impact on the stock prices is explained by the fact that the higher this variable, the more likely the firms will loose market share and, consequently, face a negative impact on stock prices.

The indirect effects of CSR on the stock prices are perceived to be irrelevant in this sample since the coefficients of these interaction terms are not statistically significant. According to Reverte (2016), CSR can affect the stock prices indirectly because investors can perceive the CSR reports as a source of additional information concerning the nature, composition, and trends of the value relevant accounting variables. However, and according to these models, this is not so relevant for investors.

Table III - Price model regression results with ESG interaction terms

VARIABLES	(1)	(2)	(3)	(4)
Constant	690.3789	696.1877	718.9339	625.6603
	(786.8767)	(785.9853)	(786.3441)	(787.3780)
ESG_score	0.3250*			
	(0.1729)			
Env_score		0.1383		
		(0.0909)		
Soc_score			0.1036	
			(0.1155)	
Gov_score				0.1452**
				(0.0702)
EPS	-2.8436	-2.9484	-2.9709	-2.9217
	(4.7739)	(4.7685)	(4.7948)	(4.7760)
BVPS	-0.4460	-0.5551	-0.5726	-0.5125
	(0.9648)	(0.9612)	(0.9646)	(0.9780)
ROA	-14.3726	-14.7784	-15.0210	-11.8960
	(32.6686)	(32.8327)	(32.7522)	(32.7535)
Leverage	-2.0649***	-2.1273***	-2.1619***	-2.1383***
	(0.6978)	(0.7114)	(0.7072)	(0.7170)
Size	-26.1024	-25.8204	-26.7111	-22.7882
	(33.6498)	(33.6766)	(33.6100)	(33.6383)
Indeps	-0.0117	-0.0104	-0.0102	-0.0107
	(0.0112)	(0.0110)	(0.0111)	(0.0112)
Indbvps	-0.0248	-0.0229	-0.0227	-0.0233
	(0.0723)	(0.0719)	(0.0723)	(0.0720)

Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
Observations	3,175	3,175	3,175	3,175
Adj. R-Squared	0.9470	0.9469	0.9469	0.9470
P-value	0.0013	0.0009	0.0013	0.0018

Note: *, **, and *** refer to 10%, 5%, and 1% significance levels, respectively.

In the table below, and after the indirect effects of CSR on stock prices analysis, I added the variable of changes in ESG score to see the impact on the models.

Table IV - Price model regression results using ESG interaction terms and the Changes in ESG

VARIABLES	(1)	(2)	(3)	(4)
Constant	647.9081	649.3709	658.9709	603.7682
	(772.6903)	(773.7480)	(769.8206)	(775.5360)
ESG_score	0.2253			
	(0.1828)			
Env_score		0.1010		
		(0.0909)		
Soc_score			0.0595	
			(0.1114)	
Gov_score				0.0950
				(0.0838)
EPS	-2.3944	-2.4201	-2.4408	-2.4359
	(4.7590)	(4.7627)	(4.7796)	(4.7649)
BVPS	-0.4928	-0.5654	-0.5856	-0.5429
	(0.9899)	(0.9752)	(0.9795)	(0.9981)
ROA	-13.7371	-14.0175	-13.9944	-12.0791
	(33.0444)	(33.1998)	(33.0753)	(33.0446)
Leverage	-1.9580***	-1.9857***	-2.0152***	-2.0062***
	(0.6823)	(0.6921)	(0.6904)	(0.6967)
Size	-24.0416	-23.7547	-24.0568	-21.7615
	(33.0063)	(33.1391)	(32.8795)	(33.1156)
Indeps	-0.0355	-0.0352	-0.0350	-0.0347
	(0.0704)	(0.0703)	(0.0705)	(0.0704)
Indbvps	-0.0104	-0.0094	-0.0092	-0.0096
	(0.0119)	(0.0116)	(0.0116)	(0.0118)
Changes_ESG	14.7947*	16.1063**	16.1814**	15.2762*
	(8.4943)	(7.9520)	(7.8138)	(8.6679)
Year	Yes	Yes	Yes	Yes

Industry	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
Observations	3,175	3,175	3,175	3,175
Adj. R-Squared	0.9474	0.9473	0.9473	0.9473
P-value	0.0001	0.0002	0.0000	0.0004

Note: *, **, and *** refer to 10%, 5%, and 1% significance levels, respectively.

In the table above, and after the indirect effects of CSR on stock prices analysis, I added the variable of changes in ESG score to see the impact on the models.

Interestingly, the *Changes_ESG* variable is positively and statistically significant in all the models presented in the table above, unlike the isolated sustainability variables, which are not significant. This means that, for the market, it is more important to look at the changes in the sustainability variables along the years and their evolution than to look at the isolated variables of each year. Following the evolution of this indicator over the years, investors can have a long-term and continued notion of what the company's effort in sustainability matters and, consequently, can more easily predict future trends. On the other hand, and unlike the previous conclusion, a sole indicator of a single year indicates only the company's position of that year that may or may not correspond to the reality of the company's performance. In this way, investors can more easily decide on market issues by looking at the evolution of the indicator than at the single indicator

Empirically, the changes in ESG appear to have the most significant impact when we use the Social Score to test the sustainability of the firms in terms of stock prices, with a coefficient of 16.1814. On the other hand, the lowest impact of the fluctuations in ESG score is perceived using the ESG overall score, with a coefficient of 14.7947.

Like the results presented in Table III, this one also presents only the *Leverage* variable as being the statistically significant one.

4.2. Market Return

4.2.1. Descriptive statistics

The return model descriptive statistics are described in the following Table V. As can be seen, the average return for a European firm of the Euro Stoxx 600 is 12%. Regarding the CSR measures, the average ESG overall score is 62.87, which indicates that firms, on

average, stand still above half of their sustainability potential. The social score is the ESG pillar that reveals the higher number, with 65.91, and the governance score is the one that reveals the minimum number, of 57.28. Regarding the *EPS* variable deflated by P_{t-1}, firms exhibit, on average, 0.07.

Table V - Return Model Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Minimum	Median	Maximum
Return	2 858	0.12	0.25	-0.45	0.10	0.99
ESG_score	2 858	62.87	18.22	12.36	65.96	91.61
Env_score	2 858	63.23	23.50	0.96	67.41	96.81
Soc_score	2 858	65.91	21.42	10.54	70.65	96.53
Gov_score	2 858	57.28	22.01	9.40	59.67	94.11
$\frac{EPS_{i,t}}{P_{t-1}}$	2 858	0.07	0.06	-0.30	0.06	0.35
$\frac{\Delta EPS_{i,t}}{P_{t-1}}$	2 858	0.00	0.03	-0.16	0.00	0.14
Size	2 858	23.22	1.01	21.44	23.04	25.95
Changes_ESG	2 858	0.06	0.55	-0.96	0.02	27.69

4.2.2. Correlation Matrix

In Appendix VI, the Pearson correlation matrix is presented. As can be observed, there is a statistically significant correlation between the CSR variables, like the ESG overall score and the three pillars. However, since these variables are not used together in a single model but rather each used individually, this is not considered a multicollinearity problem. Additionally, the higher correlations are presented between *Size* and *ESG*, *Environmental*, *Social*, and *Governance Scores*, with a coefficient of 0.454, 0.391, 0.430, and 0.287 (p-value < 0.01), respectively.

The Variance Inflation Factors (VIF) were computed for all variables to test the problem of multicollinearity and confirm the correlation matrix results. As the VIF statistics for all the variables in the different models are low, not exceeding the critical value of 10 (Reverte, 2016), it is considered that multicollinearity is not a big problem in this model.

4.2.3. Model Results

In the following Tables VI and VII, the main results of the regressions estimated using the proposed models. In these models, the return is the dependent variable. The CSR variables are included, individually, in the four models. Firstly, the ESG overall score is

tested, and then, the three pillars of the ESG score are tested. Several explanatory variables are also included, such as *EPS_1*, which is given by $\frac{EPS_{i,t}}{P_{t-1}}$, *EPS_2,* which is given by $\frac{\Delta EPS_{i,t}}{P_{t-1}}$, and Size, which is computed in the same way as that used in the price model. In the models of Table VII, it has been included the variable *Changes_ESG*. All the models include three control variables, year, industry, and country effects.

Table VI - Return model regression results

VARIABLES	(1)	(2)	(3)	(4)
Constant	-8.870	-8.630	-8.587	-9.176
	(5.967)	(5.941)	(5.943)	(5.987)
ESG_score	0.00142**			
	(0.000663)			
Env_score		0.00103*		
		(0.000554)		
Soc_score			0.000796	
			(0.000498)	
Gov_score				0.000314
				(0.000382)
EPS_1	-0.494***	-0.486***	-0.486***	-0.464***
	(0.125)	(0.126)	(0.127)	(0.126)
EPS_2	0.268	0.266	0.258	0.254
	(0.176)	(0.178)	(0.176)	(0.175)
Size	0.385	0.376	0.374	0.401
	(0.257)	(0.256)	(0.256)	(0.258)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
Observations	2,856	2,856	2,856	2,856
Adj. R-Squared	0.1843	0.1841	0.1838	0.1832
P-value	0.0001	0.0002	0.0002	0.0004

Note: *, **, and *** refer to 10%, 5%, and 1% significance levels, respectively.

Following the table above, it can be concluded that there is a positive and statistically significant association between the stock return and ESG overall score and between environmental score and the stock return of the firms at 10% significance level. There is also a positive association between the social and governance scores and stock return, but this one is not statistically significant. This means that firms with higher stock returns have better corporate social performance, in general. This conclusion is the same as other authors have reached, such as Setyahuni & Handayani (2020).

Considering that the sample used in the study are the firms from the STOXX Europe 600, these companies are significant in terms of size, and this will make the Governance and Social components of the ESG to be irrelevant. According to Setyahuni & Handayani (2020), governance information disclosure is mandatory, so investors do not respond to this because they belive in the accuracy of the mandatory information disclosure content.

The coefficient of ESG overall score (0.00142) is the highest among its distinct components. Considering the return model, investors consider ESG in aggregate terms as the most value relevant, being in line in the previous literature (Setyahuni & Handayani, 2020).

In terms of explanatory variables, most of them appear to have a positive and significant association between stock prices, except for the variable *EPS_1,* the earnings per share deflated by price, which appears to have a negative and significant association between the stock return, at 1% significance level, in all the models. On the other hand, changes in earnings per share deflated by price and size have positive coefficients, meaning that the association with the dependent variable is positive. However, it is not significant in overall return models.

To test the impact of changes in ESG in the stock returns, the variable *Changes_ESG* was added to the models, resulting in the table below.

Table VII - Return model regression results with Changes in ESG

VARIABLES	(1)	(2)	(3)	(4)
Constant	-8.849	-8.609	-8.575	-9.124
	(5.967)	(5.942)	(5.943)	(5.989)
ESG_score	0.00136**			
	(0.000667)			
Env_score		0.00101*		
		(0.000555)		
Soc_score			0.00076	
			(0.0005)	
Gov_score				0.000279
				(0.000384)
EPS_1	-0.497***	-0.491***	-0.490***	-0.470***
	(0.126)	(0.127)	(0.128)	(0.128)
EPS_2	0.261	0.258	0.250	0.246
	(0.175)	(0.177)	(0.175)	(0.174)
Size	0.384	0.375	0.374	0.399

	(0.257)	(0.256)	(0.256)	(0.258)
Changes_ESG	0.00543*	0.00645**	0.00634**	0.000279
	(0.00323)	(0.00301)	(0.00306)	(0.000384)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
Observations	2,856	2,856	2,856	2,856
Adj. R-Squared	0.1842	0.1840	0.1836	0.1831
P-value	0.0001	0.0002	0.0003	0.0004

Note: *, **, and *** refer to 10%, 5%, and 1% significance levels, respectively.

Observing Table VII, we can see that the C*hanges_ESG* variable is positively associated with the stock returns. The higher the stock returns, the higher the impact of the changes in ESG scores. It is positively and significantly associated with the ESG overall score, environmental score, and social score models. In the governance score model, this variable has no significance. Again, this is the same reason already presented earlier, investors believe in the reliability of this governance information, and they can anticipate it since it has been similar over the years.

Interestingly, the Social Score is not statistically significant. However, the changes in the sustainability variable are significant in this model, which means that, once again, the changes in ESG scores are more relevant to the market. It has a more significant impact on the stock returns than the sustainability variables of each year.

Regarding explanatory variables, the conclusions remain the same concerning Table VI. Hence, the earnings per share deflated by price have a negative and significant relationship with stock returns. The changes in earnings per share deflated by price and size are not significant in these models.

4.3. Robustness analysis

In order to assess the robustness of our main results, it will be employed an additional analysis. This analysis studies whether periods of crisis affect the relationship between CSP and market data. According to Capelle-Blancard & Petit (2019) and Gonçalves, Gaio & Ferro (2021), a financial crisis could cause a shift in priorities. Consequently, the CSR concerns are relatively low because investors act more conservatively and defensively, causing these sustainability measures to be irrelevant to the market in these periods.

The financial crisis of 2008 had severe impacts on companies and the years that followed it as well. Thus, it was considered that the years included in the sample from 2010 to 2012 are years still significantly affected by the crisis in which companies are still recovering financially, so these years have been excluded from the sample[1]. Models in Tables IV and VII are re-estimated after excluding from the sample the period from 2010 to 2012. The results are presented in the tables below. It is important to note that there are non tabulated control variables in these tables, as most of them exhibit the same signal as Tables IV and VII. The results of the stock return model also present the results of the variable *EPS_2* because in Table VII it is not significant, and now it has become significant.

Table VIII - Regression results of the share price model regarding the impact of crisis periods

Variables	Share price model			
ESG_score	0.3840***			
	(0.1416)			
Env_score		0.0324		
		(0.0919)		
Soc_score			0.1955*	
			(0.1000)	
Gov_score				0.1333**
				(0.0614)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
Observations	2,500	2,500	2,500	2,500
Adj. R-Squared	0.9656	0.9654	0.9655	0.9655
P-value	0.000	0.000	0.0001	0.0001

Note: *, **, and *** refer to 10%, 5%, and 1% significance levels, respectively.

[1] There is no consensus about the crisis period, but I considered the period between 2008 and 2012, as defined in the European Business Cycle Indicators Technical Paper on 3rd quarter 2016 and Gaio, Gonçalves & Pereira (2021). Considering that the sample of this study begins in 2010, it will be necessary to remove the years 2010 until 2012

Table IX - Regression results of the stock return model regarding the impact of crisis periods

Variables	Stock return model			
ESG_score	0.0018**			
	(0.0009)			
Env_score		0.0012		
		(0.0008)		
Soc_score			0.0010	
			(0.0006)	
Gov_score				0.0002
				(0.0005)
EPS_2	0.4242**	0.4196**	0.4147**	0.4084**
	(0.2004)	(0.2007)	(0.2004)	(0.1993)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
Observations	2,163	2,163	2,163	2,163
Adj. R-Squared	0.1763	0.1759	0.1758	0.1749
P-value	0.000	0.000	0.000	0.000

Note: *, **, and *** refer to 10%, 5%, and 1% significance levels, respectively.

The completed tables are presented in the annex, on appendices VIII and IX.

Table VIII presents the results regarding the price model, where the coefficients of the sustainability variables become statistically significant, except for environmental score, at least at 10% significance level. As expected, the years impacted by the crisis made investors more concerned about financial and economic issues and devalued sustainable issues. Removing these years, sustainability indicators begin to be statistically significant, as shown in Table VIII.

Regarding the return model, differences are less significant. Removing the financial crisis years, we have only the ESG overall score statistically significant. This means that the environmental score that was statistically significant in the model of Table VII becomes insignificant. So, considering the effects of the crisis, investors value the impact of sustainability on the share price more than on the stock returns. The variable *EPS_2*, which represents the changes in earnings per share deflated by price, becomes statistically significant, as shown in Table IX, at 5% significance level.

These results align with the previous literature, which find that in the financial crisis periods, CSR has no significant impact for investors because they are concerned about other issues, such as financial and economic aspects (Capelle-Blancard & Petit, 2019).

5. CONCLUSION

This study has the main objective of analysing the association between CSR and market data, such as share prices and stock returns, for firms from the STOXX Europe 600 Index for the 2010-2019 time-period. Two samples of 381 and 379 firms were used to study this relationship for share prices and stock returns, respectively.

Regarding the share price model, this analysis shows that the association between the ESG scores and prices is very weak or absent, considering that the association between these variables is positive, being in line with the previous literature (Reverte, 2016; Torre et al. 2020; and Miralles-Quirós et al., 2018), but it is not statistically significant. In the price model with the indirect effects of ESG, the association between ESG overall score and share prices is statistically significant, as the association between Governance Score and share prices. However, the variable that measures changes in ESG is statistically significant in all the models, meaning that investors give more value to an analysis of indicator variations than to a one-year sole indicator.

On the other hand, this study points to a positive association between stock returns and CSR, in line with Torre et al. (2020), Kaspereit & Lopatta (2016), and Setyahuni & Handayani (2020). However, this association is only statistically significant using the ESG overall score and Environmental Score. The Social Score is not statistically significant, consistent with the study of Miralles-Quirós et al. (2018). The Governance Score is not statistically significant, following the study conducted by Setyahuni & Handayani (2020). Adding the variable that measures changes in ESG, I can conclude that the association between this variable and CSR is statistically significant in all models, except for Governance Score. Once again, this leads us to conclude that investors value more the changes in ESG than the isolated measure.

In both prices and returns models, the ESG overall score is the CSR measure that is more relevant to investors, being in line with the study of Rajesh (2020) and Setyahuni & Handayani (2020).

Interestingly, the Governance Score model has no significance in general. This result is because firms of this sample are big firms, and thus (good) governance is endogenous, and in which investors believe in the reliability of this governance information, and they can anticipate it since it has been similar over the years.

Assessing the robustness of the main results and extending them, the financial crisis impact on ESG performance was analysed. Excluding the years affected by this financial crisis, the associations between CSR and stock prices are all positive and statistically significant, except for the Environmental Score, which means that in these years investors were more concerned about other issues and the sustainability disclosure was more irrelevant. On the other hand, applying the same process in the return model, only the ESG overall score is statistically significant.

This study is important and innovative for several reasons, offering new conclusions to investors. Firstly, this is the first study analysing the relationship between ESG scores changes and market data in a European context. The previous studies only consider static sustainability indicators and do not consider their changes, which is a crucial point of this study. It also provides evidence on the association between each of the three components of the ESG score and market data, which is a little-studied topic, mainly in Europe. This study further examines how the financial crisis can impact the relationship between CSR and market data. In the years that were impacted by this financial crisis, investors seemed less concerned about sustainability issues.

The main limitation of this study has to do with the other factors that can influence the disclosure of sustainability information, such as the type of industries. According to De Klerk et al. (2015), the higher levels of CSR in firms operating in environmentally-sensitive industries are associated with higher share prices than firms operating in other industries (i.e., energy and utilities sectors) are associated with higher share prices and CSR levels of companies operating in other industries. Second, the ESG measurement used in this study was from Refinitiv, and it can differ from other database providers, which may impact regression results (Setyahuni & Handayani, 2020).

This study can be further developed for future research, exploring how different types of industries can impact the association between CSR and market data. Future research might also go even further on the changes of the ESG score analysis, studying the impact

variation from industry to industry and how the impact changes and how does the impact vary from one sustainability measure to another. Finally, future research should expand the empirical evidence on the value relevance of each ESG pillar to other stock markets (Miralles-Quirós et al., 2018).

REFERENCES

Acabado, D. R., Branca, A. S., Catalão-Lopes, M., & Pina, J. P. (2020). Do Distinct CSR Categories have Distinct Determinants? The Roles of Market Structure and Firm Size. *European Management Review*, *17*(1), 5–17. https://doi.org/10.1111/emre.12341

Alsayegh, M. F., & Rahman, R. A. (2020). Corporate Economic , Environmental , and Social Sustainability Performance Transformation through ESG Disclosure. *Sustainability (Switzerland)*, *12*. https://doi.org/10.3390/su12093910

Artiach, T., Lee, D., Nelson, D., & Walker, J. (2010). The determinants of corporate sustainability performance. *Accounting and Finance*, *50*(April 2009), 31–51. https://doi.org/10.1111/j.1467-629X.2009.00315.x

Aureli, S., Gigli, S., Medei, R., & Supino, E. (2020). The value relevance of environmental, social, and governance disclosure: Evidence from Dow Jones Sustainability World Index listed companies. *Corporate Social Responsibility and Environmental Management*, *27*(1), 43–52. https://doi.org/10.1002/csr.1772

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

Barth, M. E., & Clinch, G. J. (2005). Scale Effects in Capital Markets-Based Accounting Research. *SSRN Electronic Journal*, *650*. https://doi.org/10.2139/ssrn.201228

Capelle-Blancard, G., & Petit, A. (2019). Every Little Helps? ESG News and Stock Market Reaction. *Journal of Business Ethics*, *157*(2), 543–565. https://doi.org/10.1007/s10551-017-3667-3

Chauhan, Y., & Kumar, S. B. (2019). The value relevance of nonfinancial disclosure: Evidence from foreign equity investment. *Journal of Multinational Financial Management*, *52–53*, 100595. https://doi.org/10.1016/j.mulfin.2019.100595

Chiu, A. A., Chen, L. N., & Hu, J. C. (2020). A study of the relationship between corporate social responsibility report and the stock market. *Sustainability (Switzerland)*, *12*(21), 1–18. https://doi.org/10.3390/su12219200

Consolandi, C., Eccles, R. G., & Gabbi, G. (2020). How material is a material issue? Stock returns and the financial relevance and financial intensity of ESG materiality. *Journal of Sustainable Finance and Investment*, *0*(0), 1–24. https://doi.org/10.1080/20430795.2020.1824889

Cooper, S. M., & Owen, D. L. (2007). Corporate social reporting and stakeholder accountability: The missing link. *Accounting, Organizations and Society*, *32*(7–8), 649–667. https://doi.org/10.1016/j.aos.2007.02.001

Cordazzo, M., Bini, L., & Marzo, G. (2020). Does the EU Directive on non-financial information influence the value relevance of ESG disclosure? Italian evidence. *Business Strategy and the Environment*, *29*(8), 3470–3483. https://doi.org/10.1002/bse.2589

De Klerk, M., de Villiers, C., & van Staden, C. (2015). The influence of corporate social responsibility disclosure on share prices: Evidence from the United Kingdom. *Pacific Accounting Review*, *27*(2), 208–228. https://doi.org/10.1108/PAR-05-2013-0047

Deng, X., & Cheng, X. (2019). Can ESG indices improve the enterprises' stock market performance?-An empirical study from China. *Sustainability (Switzerland)*, *11*(17). https://doi.org/10.3390/su11174765

Gonçalves, A. T. C. (2015). Essays on financial reporting under financial crisis (Doctoral dissertation, Universidade de Lisboa (Portugal)).

Gonçalves, T., Gaio, C., & Costa, E. (2020). Committed vs opportunistic corporate and social responsibility reporting. *Journal of Business Research*, 115, 417-427. https://doi.org/10.1016/j.jbusres.2020.01.008

Gonçalves, T., Gaio, C., & Ferro, A. (2021). Corporate Social Responsibility and Earnings Management: Moderating Impact of Economic Cycles and Financial Performance. *Sustainability*, 13(17), 9969. https://doi.org/10.3390/su13179969

Gonçalves, T., Gaio, C., & Lélis, C. (2020). Accrual mispricing: Evidence from European sovereign debt crisis. *Research in International Business and Finance*, *52*(September 2019), 101111. https://doi.org/10.1016/j.ribaf.2019.101111

Gaio, C., Gonçalves, T., & Pereira, A. (2021). Financial Crisis and Impairment Recognition in Non-Financial Assets. *Review of Business Management*, 23(2), 370-387. https://doi.org/10.7819/rbgn.v23i2.4108

Gonçalves, T., & Coelho, G. (2019). Earnings management during mergers and acquisitions—European evidence. *European Journal of Economics, Finance and Administrative Sciences*, 102, 22-43.

Gonçalves, T., Pimentel, D., & Gaio, C. (2021). Risk and Performance of European Green and Conventional Funds. *Sustainability*, 13(8), 4226. https://doi.org/10.3390/su13084226

Grewal, J., Riedl, E. J., & Serafeim, G. (2019). Market reaction to mandatory nonfinancial disclosure. *Management Science*, *65*(7), 3061–3084. https://doi.org/10.1287/mnsc.2018.3099

Hassel, L., Nilsson, H., & Nyquist, S. (2005). The value relevance of environmental performance. *European Accounting Review*, *14*(1), 41–61. https://doi.org/10.1080/0963818042000279722

Iatridis, G. E. (2013). Environmental disclosure quality: Evidence on environmental performance, corporate governance and value relevance. *Emerging Markets Review*, *14*(1), 55–75. https://doi.org/10.1016/j.ememar.2012.11.003

Jadoon, I. A., Ali, A., Ayub, U., Tahir, M., & Mumtaz, R. (2020). The impact of sustainability reporting quality on the value relevance of corporate sustainability performance. *Sustainable Development*, *August*, 1–21. https://doi.org/10.1002/sd.2138

Kaspereit, T., & Lopatta, K. (2016). The value relevance of SAM's corporate sustainability ranking and GRI sustainability reporting in the European stock markets. *Business Ethics*, *25*(1), 1–24. https://doi.org/10.1111/beer.12079

Kim, Y., Li, H., & Li, S. (2014). Corporate social responsibility and stock price crash risk. *Journal of Banking and Finance*, *43*(1), 1–13. https://doi.org/10.1016/j.jbankfin.2014.02.013

KPMG. (2017). The KPMG Survey of Corporate Responsibility Reporting 2017. *SpringerBriefs in Computer Science*, *0*(9783319212562), 105–113. https://doi.org/10.1007/978-3-319-21257-9_7

Landau, A., Rochell, J., Klein, C., & Zwergel, B. (2020). Integrated reporting of environmental, social, and governance and financial data: Does the market value integrated reports? *Business Strategy and the Environment*, *29*(4), 1750–1763. https://doi.org/10.1002/bse.2467

Limkriangkrai, M., Koh, S. K., & Durand, R. B. (2017). Environmental, Social, and Governance (ESG) Profiles, Stock Returns, and Financial Policy: Australian Evidence. *International Review of Finance*, *17*(3), 461–471. https://doi.org/10.1111/irfi.12101

Mervelskemper, L., & Streit, D. (2017). Enhancing Market Valuation of ESG Performance: Is Integrated Reporting Keeping its Promise? *Business Strategy and the Environment*, *26*(4), 536–549. https://doi.org/10.1002/bse.1935

Miralles-Quirós, M. M., Miralles-Quirós, J. L., & Gonçalves, L. M. V. (2018). The value relevance of environmental, social, and governance performance: The Brazilian case.

Sustainability (Switzerland), *10*(3). https://doi.org/10.3390/su10030574

Miralles-Quirós, M. M., Miralles-Quirós, J. L., & Redondo-Hernández, J. (2019). The impact of environmental, social, and governance performance on stock prices: Evidence from the banking industry. *Corporate Social Responsibility and Environmental Management*, *26*(6), 1446–1456. https://doi.org/10.1002/csr.1759

Murata, R., & Hamori, S. (2021). ESG Disclosures and Stock Price Crash Risk. *Journal of Risk and Financial Management*, *14*(2), 70. https://doi.org/10.3390/jrfm14020070

Nekhili, M., Nagati, H., Chtioui, T., & Rebolledo, C. (2017). Corporate social responsibility disclosure and market value: Family versus nonfamily firms. *Journal of Business Research*, *77*(July 2016), 41–52. https://doi.org/10.1016/j.jbusres.2017.04.001

OHLSON, J. A. (1995). Earnings, Book Values, and Dividends in Equity Valuation. *Contemporary Accounting Research*, *11*(2), 661–687. https://doi.org/10.1111/j.1911-3846.1995.tb00461.x

Oncioiu, I., Popescu, D. M., Aviana, A. E., Şerban, A., Rotaru, F., Petrescu, M., & Marin-Pantelescu, A. (2020). The role of environmental, social, and governance disclosure in financial transparency. *Sustainability (Switzerland)*, *12*(17), 1–16. https://doi.org/10.3390/SU12176757

Ota, K. (2005). The Value-Relevance of Book Value, Current Earnings, and Management Forecasts of Earnings. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.280876

Rajesh, R. (2020). Exploring the sustainability performances of firms using environmental, social, and governance scores. *Journal of Cleaner Production*, *247*, 119600. https://doi.org/10.1016/j.jclepro.2019.119600

Refinitiv. (2020). Environmental, Social and Governance (ESG) Scores from Refinitiv. *ESG Scores Methodology*, *June*, 18. https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/esg-scores-methodology.pdf

Reverte, C. (2016). Corporate social responsibility disclosure and market valuation: evidence from Spanish listed firms. *Review of Managerial Science*, *10*(2), 411–435. https://doi.org/10.1007/s11846-014-0151-7

Setyahuni, S. W., & Handayani, R. S. (2020). On the value relevance of information on environmental, social, and governance (ESG): An evidence from Indonesia. *Journal of Critical Reviews*, *7*(12), 50–58. https://doi.org/10.31838/jcr.07.12.09

Starks, L. T. (2009). EFA keynote speech: “corporate governance and corporate social responsibility: What do investors care about? What should investors care about?". *Financial Review*, *44*(4), 461–468. https://doi.org/10.1111/j.1540-6288.2009.00225.x

Tamimi, N., & Sebastianelli, R. (2017). Transparency among S&P 500 companies: an analysis of ESG disclosure scores. *Management Decision*, *55*(8), 1660–1680. https://doi.org/10.1108/MD-01-2017-0018

Torre, M. La, Mango, F., Cafaro, A., & Leo, S. (2020). Does the ESG index affect stock return? Evidence from the Eurostoxx50. *Sustainability (Switzerland)*, *12*(16). https://doi.org/10.3390/SU12166387

Wang, K. T., & Li, D. (2016). Market Reactions to the First-Time Disclosure of Corporate Social Responsibility Reports: Evidence from China. *Journal of Business Ethics*, *138*(4), 661–682. https://doi.org/10.1007/s10551-015-2775-1

Wang, M., Qiu, C., & Kong, D. (2011). Corporate Social Responsibility, Investor Behaviors, and Stock Market Returns: Evidence from a Natural Experiment in China. *Journal of Business Ethics*, *101*(1), 127–141. https://doi.org/10.1007/s10551-010-0713-9

Woodward, D., Edwards, P., & Birkin, F. (2001). Some evidence on executives’ views of corporate social responsibility. *British Accounting Review*, *33*(3), 357–397. https://doi.org/10.1006/bare.2001.0165

APPENDICES

Appendix A - Sample composition by country

Country	Share price model		Stock return model	
	Number	Percentage (%)	Number	Percentage (%)
Austria	49	1,54%	42	1,47%
Belgium	86	2,71%	80	2,80%
Cyprus	7	0,22%	6	0,21%
Denmark	124	3,90%	104	3,64%
Finland	114	3,59%	99	3,46%
France	507	15,96%	454	15,89%
Germany	333	10,48%	289	10,11%
Ireland	72	2,27%	59	2,06%
Italy	112	3,53%	102	3,57%
Jersey	3	0,09%	4	0,14%
Luxembourg	18	0,57%	16	0,56%
Netherlands	159	5,00%	143	5,00%
Norway	72	2,27%	63	2,20%
Poland	20	0,63%	17	0,59%
Portugal	27	0,85%	24	0,84%
Spain	145	4,56%	124	4,34%
Sweden	271	8,53%	238	8,33%
Switzerland	251	7,90%	248	8,68%
United Kingdom	807	25,40%	746	26,10%
Total	3177	100,00%	2858	100,00%

Appendix B - Sample composition by economic sector

Economic Sector	Share price model		Stock return model	
	Number	Percentage (%)	Number	Percentage (%)
Basic Materials	442	13,91%	383	13,40%
Consumer Cyclicals	571	17,97%	509	17,81%
Consumer Non-Cyclicals	346	10,89%	325	11,37%
Energy	145	4,56%	148	5,18%
Healthcare	320	10,07%	267	9,34%
Industrials	651	20,49%	595	20,82%
Real Estate	177	5,57%	153	5,35%
Technology	339	10,67%	299	10,46%
Utilities	186	5,85%	179	6,26%
Total	3177	100,00%	2858	100,00%

Appendix C - Share price model variables definition

Dependent variables		
$P_{i,t}$	Share price of firm i at time t	Reverte (2016)
Explanatory variables		
ESG_score	ESG overall score obtained from Refinitiv database	Author
Env_score	Environmental score obtained from Refinitiv database	Author
Soc_score	Social score obtained from Refinitiv database	Author
Gov_score	Governance score obtained from Refinitiv database	Author
Control variables		
BVPS	Equity available to common shareholders / number of outstanding shares	Miralles-Quirós et al., 2019; Reverte, 2016; Setyahuni & Handayani, 2020; Torre et al., 2020
EPS	Net income of the year / number of outstanding shares of its common stock	Miralles-Quirós et al., 2019; Reverte, 2016; Setyahuni & Handayani, 2020; Torre et al., 2020
ROA	Net income of the year / total assets	Artiach et al. (2010)
Lev	Total debt / Total equity	Alsayegh & Rahman (2020)
Size	Natural logarithm of company's total assets	Setyahuni & Handayani, 2020
Indeps	EPS * ESG Score	Reverte (2016)
Indbvps	BVPS * ESG Score	Reverte (2016)
Changes_ ESG	$(ESG_t - ESG_{t-1}) \,/\, ESG_{t-1}$	Author
Industry	Industry dummy variable based on economic sector classification of Refinitiv	
Year	Year dummy variable	
Country	Country dummy variable	

Appendix D - Stock return model variables definition

Dependent variables		
$R_{i,t}$	Annualized returns of firm i at time t	Setyahuni and Handayani (2020)
Explanatory variables		
ESG_score	ESG overall score obtained from Refinitiv database	Author
Env_score	Environmental score obtained from Refinitiv database	Author
Soc_score	Social score obtained from Refinitiv database	Author
Gov_score	Governance score obtained from Refinitiv database	Author
Control variables		
EPS_1	Earnings per share for period t deflated by P_{t-1}	Setyahuni & Handayani, 2020
EPS_2	Annual changes in earnings per share deflated by P_{t-1}	Setyahuni & Handayani, 2020
Size	Natural logarithm of company's total assets	Setyahuni & Handayani, 2020
Changes_ ESG	$(ESG_t - ESG_{t-1}) \,/\, ESG_{t-1}$	Author
Industry	Industry dummy variable based on economic sector classification of Refinitiv	
Year	Year dummy variable	
Country	Country dummy variable	

Appendix E - Price model Pearson Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Price	1.00												
(2) ESG_score	-0.029*	1.00											
(3) Env_score	0.01	0.840***	1.00										
(4) Soc_score	-0.01	0.891***	0.707***	1.00									
(5) Gov_score	-0.071***	0.666***	0.324***	0.381***	1.00								
(6) ROA	0.065***	-0.180***	-0.178***	-0.128***	-0.131***	1.00							
(7) EPS	0.843***	0.03	0.047***	0.050***	-0.032*	0.086***	1.00						
(8) BVPS	0.810***	0.01	0.048***	0.02	-0.048***	-0.064***	0.858***	1.00					
(9) Leverage	-0.072***	0.096***	0.122***	0.090***	0.00	-0.261***	-0.043**	-0.083***	1.00				
(10) Size	0.138***	0.441***	0.385***	0.423***	0.260***	0.051***	0.124***	0.074***	0.034*	1.00			
(11) Changes_ESG	0.01	-0.072***	-0.098***	-0.079***	0.01	0.031*	0.066***	0.030*	-0.046***	-0.092***	1.00		
(12) Indbvps	0.741***	0.183***	0.184***	0.170***	0.084***	-0.079***	0.819***	0.945***	-0.068***	0.126***	0.03	1.00	
(13) Indeps	0.783***	0.163***	0.151***	0.168***	0.074***	0.059***	0.958***	0.809***	-0.029*	0.172***	0.075***	0.852***	1.00

**** p<0.01, ** p<0.05, * p<0.1*

Appendix F - Return model Pearson Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Return	1.00								
(2) ESG_score	-0.061***	1.00							
(3) Env_score	-0.063***	0.843***	1.00						
(4) Soc_score	-0.039**	0.893***	0.710***	1.00					
(5) Gov_score	-0.045**	0.674***	0.334***	0.396***	1.00				
(6) EPS_1	-0.058***	0.182***	0.132***	0.168***	0.139***	1.00			
(7) EPS_2	0.075***	-0.037**	-0.039**	-0.02	-0.035*	0.250***	1.00		
(8) Size	-0.00	0.454***	0.391***	0.430***	0.287***	-0.01	-0.03	1.00	
(9) Changes_ESG	0.03	-0.02	-0.036*	-0.02	0.00	0.082***	0.087***	-0.01	1.00

**** p<0.01, ** p<0.05, * p<0.1*

Appendix G - Hausman test results

```
Test:  Ho:  difference in coefficients not systematic

              chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =     1371.04
            Prob>chi2 =      0.0000
```

Appendix H - Price model robustness analysis (taking into consideration financial crisis)

VARIABLES				
Constant	-75.3209	-67.3553	-30.5577	-117.6983
	(728.4272)	(725.8215)	(718.6726)	(723.8199)
ESG_score	0.3840***			
	(0.1416)			
Env_score		0.0324		
		(0.0919)		
Soc_score			0.1955*	
			(0.1000)	
Gov_score				0.1333**
				(0.0614)
EPS	-0.0658	-0.2018	-0.1568	-0.1729
	(5.9615)	(5.9557)	(5.9533)	(5.9606)
BVPS	0.3393	0.1752	0.2337	0.2669
	(0.9279)	(0.9381)	(0.9337)	(0.9336)
ROA	31.2789	31.5328	28.9442	33.0270
	(21.1335)	(21.2127)	(20.9295)	(21.0548)
Leverage	-1.7798***	-1.8877***	-1.8907***	-1.8499***
	(0.6096)	(0.6384)	(0.6180)	(0.6226)
Size	6.2438	6.9055	4.8444	8.8028
	(31.3451)	(31.3455)	(30.8905)	(31.1570)
Indeps	-0.0567	-0.0544	-0.0553	-0.0547
	(0.0912)	(0.0909)	(0.0910)	(0.0910)
Indbvps	-0.0199	-0.0179	-0.0187	-0.0189
	(0.0124)	(0.0124)	(0.0124)	(0.0123)
Changes_ESG	-1.1668	3.6297	1.8906	0.5877
	(4.0374)	(4.8300)	(3.9277)	(4.6602)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
Observations	2,500	2,500	2,500	2,500
Adj. R-Squared	0.9656	0.9654	0.9655	0.9655
P-value	0.0000	0.0000	0.0001	0.0001

Note: *, **, and *** refer to 10%, 5%, and 1% significance levels, respectively.

Appendix I - Return model robustness analysis (taking into consideration financial crisis)

VARIABLES				
Constant	-9.6679	-9.1885	-9.3267	-9.8419
	(6.7379)	(6.7039)	(6.7222)	(6.7853)
ESG_score	0.0018**			
	(0.0009)			
Env_score		0.0012		
		(0.0008)		
Soc_score			0.0010	
			(0.0006)	
Gov_score				0.0002
				(0.0005)
EPS_1	-0.7394***	-0.7292***	-0.7315***	-0.7042***
	(0.1409)	(0.1408)	(0.1410)	(0.1403)
EPS_2	0.4242**	0.4196**	0.4147**	0.4084**
	(0.2004)	(0.2007)	(0.2004)	(0.1993)
Size	0.4197	0.4007	0.4069	0.4314
	(0.2900)	(0.2888)	(0.2895)	(0.2921)
Changes_ESG	-0.0187	-0.0081	-0.0105	-0.0051
	(0.0262)	(0.0274)	(0.0276)	(0.0286)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
Observations	2,163	2,163	2,163	2,163
Adj. R-Squared	0.1763	0.1759	0.1758	0.1749
P-value	0.0000	0.0000	0.0000	0.0000

Note: *, **, and *** refer to 10%, 5%, and 1% significance levels, respectively.