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"ESG AND CORPORATE FINANCE"

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ABSTRACT

It is known that issues of sustainability and responsible investing play an important role both in the corporate world and in society. This article discusses the concept of ESG investing, which has gained popularity and importance relatively recently. Describes the impact of high / efficient ESG performance on corporate finance, in particular on the financial performance of UK companies. The significance of each of the ESG sub-factors is described based on the works of other researchers. It also analyzed the changes in the corporate world that occurred during and after COVID-19.

The purpose of this study is to clarify the importance and necessity of investing sustainably in ESG by supporting qualitative arguments and quantitative data with calculations and assumptions. Basic data comes from Bloomberg terminal and Yahoo Finance. To carry out this calculation, the event investigation method was applied, which consists of four event windows. The calculations were carried out in R Studio. Key results were obtained using the regression method.

I. INTRODUCTION

Responsible consumption is fast becoming the norm in all developed countries. Now this phenomenon has come to the world of finance. ESG factors and responsible investing are one of the main trends for 2020-2021. Since today the environmental, social and corporate governance issues are proving to be key factors in ensuring the sustainable development not only of companies, but also of states, regions, modern society as a whole.

It was once thought that the only investment criterion was the company's economic efficiency. In recent decades, economists have taken the ESG criteria seriously. In particular, investors have become louder about their expectations on issues such as employee health and safety, stakeholder relationships, and operational and strategic business sustainability. Investors do not give up on the profit on their investments, but they are increasingly interested in the price at which this profit was obtained.

There are obvious reasons for the growing interest in the topic of ESG - problems with the environment, global warming, sharp increase of problems of social and economic inequality. Here, ESG is the abbreviation of Environmental, Social and Governance factors. When making a decision to invest money in a particular company, an investor analyzes these three components of activity, each of which consists of sub-factors. But first, it is worth explaining when and where this term came from and how it acquired such significance today. ESG's origins date back to socially responsible investing (SRI), when money was not invested in environmentally and socially irresponsible companies. Since the identification of companies producing weapons, tobacco and other harmful and dangerous goods, protests have begun against investments in these and similar organizations. A similar movement took place in the 1960s and 1970s in light of the Vietnam War after refusing to support companies that somehow financed the war. For the first time, they started talking about responsible consumption in those years, and in 1992 its basic principles were formulated (Robb Report, 2021):

- minimization of the use of natural resources;
- reduction of the amount of waste;
- separate collection of garbage;
- transition to renewable energy sources and others.

As is well known, responsible consumption cannot exist without responsible production. Nowadays, it is important for many consumers that the goods they buy are produced in accordance with the above principles. Responsible investment, in other words, ESG investment, has become

one of the steps in this direction. In a broad sense, ESG is a business activity carried out in compliance with the principles of sustainable development, which implies a responsible attitude to the environment (E - environment), society (S - social) and management standards (G - governance). Responsible investment is carried out taking into account ESG factors and allows you to minimize, first of all, environmental, social risks, corporate governance risks, as well as possible financial risks.

It is worth noting the main difference between SRI and ESG is that investing based on ESG criteria, in addition to opposing unethical business, also makes financial sense, that is, ESG factors indirectly speak about the attractiveness of an asset from a financial point of view. As a rule, companies with high ESG scores have strong corporate governance; accordingly, they timely adjust strategies and adapt them to changing realities. On the one hand, it may seem that the ESG is contrary to the basic rule of economics - maximizing profits, due to the increase in costs while adhering to the ESG policy. However, given that this provides sustainability in the long term, these doubts should disappear. In addition, these companies often represent technology industries. As a result, the profitability of investments in them is often not inferior, and sometimes exceeds investments in traditional companies. Jon Hale observes that as of the end of October 2020, 25 out of 26 ESG ETFs outperformed similar traditional ETFs (Hale J., 2021).

From the point of view of risks, the universality and the need to take into account ESG in investment is explained by the fact that the classical concept of risk includes only financial components, while ESG-risk also covers non-financial ones. In other words, by including ESG in the analysis of an asset, we can better understand whether the predicted return is consistent with the risk that the investor is taking. It was once thought that the only investment criterion was the company's economic efficiency. However, in recent decades, with the proliferation of ESG criteria, this has begun to change. It is no longer enough for a company to simply demonstrate rapid and sustainable growth: its reputation plays an important role. It is important for public opinion whether the company is polluting the environment, whether it uses child labor, whether it is noticed in bribes. A socially responsible investor must consider all of these factors (Robertson C., 2019).

Of course, unlike the impact on financial outcomes, there is no doubt that increasing the efficiency of ESG certainly has a positive impact on society. Even if the impact on financial performance for all firms has not yet been proven, both individual and institutional investors are willing to invest in ESG in order to make a positive contribution to the development of society, expecting results in the long term. Despite the united intentions, due to the large financial commitments, the financial consequences of investing in ESG are significant for institutional investors. Therefore, it is necessary to find out whether ESG has a positive effect on the financial results of firms or not. And this is the purpose of this study.

II. LITERATURE REVIEW

The literature review is divided into two main parts. In the main part of the work, ESG subfactors and their meanings are presented, supported by theories and opinions of researchers. The second part of the work talks about the role of ESG in modern realities and changes in the financial performance of companies during and after COVID-19. Further, in the methodological part, calculations are made for British companies in accordance with the ESG principles and sustainable development policy using event research and regression methodology. In addition, the differences in the financial performance of companies with ESG by industry, etc.

2.1. Impact of selected ESG sub-factors on company's financial results

Since the beginning of 1970s, a lot of works on the themes of socially responsible investing and ESG had been written. In many of these studies, the issue was the impact of ESG on the company's financial performance. However, even on the basis of these studies, it has not been possible to reach a consensus on this connection.

ESG indicators of the company are based on the company's performance, taking into account sub-factors E, S and G. This topic, i.e., the influence of each of these ESG sub-factors on the company's financial performance, was an important topic for the study. The fragmentation of the results of these studies leaves the topic still open for further, more in-depth study. Of course, all ESG factors are important to any organization, as there must be a balance to achieve sustainability. At the same time, in international practice, it is assumed that the significance of factors for a particular company may differ depending on the sector. These are the so-called materiality maps. For example, environmental factors play a special role in the energy sector, social factors in the service sector, and corporate governance factors in finance (MSCI, 2020). Let's consider what each of them consists of.

The environmental component of ESG reflects the company's impact on the environment, both positively and negatively. The environmental factor includes:

- Climate change - the company's policies, plans and disclosures about it;
- Use of renewable energy sources, including wind and solar;
- Use and conservation of water resources;
- Methods for recycling and safe disposal;
- Depletion of resources and alternative solutions to solve the problem;
- Biodiversity and land use;
- Waste-pollution and carbon emissions;
- Air and water pollution;
- Deforestation;
- Opportunities in Green Building, Renewable Energy and Clean tech.

The importance of environmental factors separately has been highlighted in the works of several authors. Among the first who highlighted the importance of this factor were Friede et al. (2005), according to whom, the environmental sub-factor was defined as the factor with the highest number of positive relationships in comparison with the rest of the sub-factors. Caroline Flammer (2013) also spotlighted Environmental (E) factor as important one. Meanwhile, it's known that CSR is such a precursor of ESG (Alva, 2020). This work differs from other ones by being one of the firsts, where were provided empirical evidence on how the relationship between environmental CSR (ESG) and stock prices has evolved over time. Here examined how shareholders' reactions depend on corporate environmental performance companies that are "eco-friendly" and/or "eco-harmful". In their work, Andreas G.F. Hoepner et al. note the significant importance of the environmental factor in comparison with socio-economic factors, due to the urgency of environmental problems in the world at the moment. They also determined that participation in environmental, social and governance (ESG) issues benefits shareholders by reducing the risk of losses for companies. Using their own database and implementing a difference in differences (DiD) model, they provided evidence to support this hypothesis. In addition, they found that measurable risk effects varied depending on the success of the interaction and the topic of the interaction. Interaction turns out to be most effective in reducing the risk of negative consequences when solving environmental problems (primarily, climate change). Considering the assumptions

of all authors, one can understand that over time their opinions have not changed, but only supplemented each other, in accordance with new events and research methods.

Of course, there is also the opposite judgment, according to which the environmental factor should not be taken as a basis when identifying the influence of ESG factors on the company's financial performance. Because, when moving to sustainable business practices, companies are faced with a difficult choice between environmental and economic performance, i.e. benefit. After all, it is known that the transition to environmental friendliness includes the use of renewable energy sources, clean technologies, production with minimal and non-toxic waste, and also requires a lot of effort and money. Accordingly, companies wishing to improve their environmental performance will one way or another face financial difficulty. And this, in turn, contradicts the aforementioned profit maximization theory.

The social component of ESG reflects the culture and values of the company, the problems in work and working conditions that affect both employees and customers and society as a whole. The importance of this factor was confirmed in his work by Edmans (2011), according to which there is a clear positive relationship between employee satisfaction with their work and the financial condition of the company, i.e. long-term stock returns. The social factor includes:

- Human rights;
- Health and safety;
- Gender policy;
- Treatment of employees - fair pay, benefits and bonuses;
- Working conditions and workplace safety;
- Employee engagement and staff turnover / churn.
- Training and development of employees.
- Child labor;
- Chemical safety;
- Product safety and quality;
- Privacy and Data Security.

In the study of changes in the financial performance of British firms, this study found the greatest positive influence of 2 of the 8 identified ESG factors. They both belong to a social sub-factor - it is the presence of women on the board; and the total salary paid to managers. The importance of the first factor can be explained by the fact that now more than ever women want to contribute to change, and most importantly, to improve the world, to participate in solving global problems such as climate change and to help other women in business and have a positive impact on society. According to UBS, as of 2020, 88% of female business owners have already chosen social investment, and 92% believe that sustainable investment can change the world (UBS, 2020).

In addition, the social subfactor is extensively discussed in McWilliams and Siegel (2006), who found that a firm's positive reputation is directly correlated with positive economic value. According to their research, the products of companies with a positive reputation inspire confidence among consumers, are of high quality and are in high demand. Therefore, today companies are trying to produce environmentally friendly products with a natural composition, with the least harm to the health of people and the planet as a whole.

The reputation of a company also depends on its attitude towards employees, on the correct structure and competent management. Companies with a well-structured personnel policy and fair

treatment of employees, as a rule, have lower employee turnover and highly qualified, committed professionals. This kind of good and fair treatment of employees and their involvement in the work improves business operations. Arguments in favor of paying special attention to social factors include avoiding the fight against negative press reviews and lawsuits that can be caused by neglect of worker safety in the workplace; avoiding the hassle of unhappy, unhealthy, or stressed employees who are more likely to perform poorly; timely awareness of the psychological and physical condition of employees, which will help to avoid unforeseen risks. Dissatisfied employees will not be loyal, they will not provide excellent customer service, and even more so, they will not come up with new innovative ideas for the company. Also, there is a high probability that they will quit their jobs. This will lead to high employee turnover, which in turn forces the company to spend more money on hiring, training and hiring new employees.

The corporate component of ESG reflects the management aspect, that is, the company's interaction with various stakeholders, effective management of its business (Rotonti J., 2021). The managerial factor includes:

- Diversity and structure of government;
- Ownership and control;
- Bribery and corruption;
- Business ethics;
- Compliance with the law;
- Transparency of communication with shareholders;
- Shareholder rights;
- Remuneration of managers;
- Tax strategy and its transparency.

It should be noted that according to a study by the CFA Institute (2019), the country considered in this work - the UK - is one of those countries where the integration of ESG issues has become firmly established in investment practice. At the same time, as follows from the respondents' answers, the inclusion of corporate governance factors in investment analysis is much more systematic in comparison with environmental or social factors. Respondents expect that by 2022 the inclusion of environmental and social factors in investment practices will be more systematic and will be observed almost twice as often.

In contrast to the previous authors, Rui Albuquerque et al. (2020) highlighted the special meaning of the ES factors, which highlighted ecological factors as main. This paper shows that during crisis periods like the 2019 global pandemic, stocks with higher ES ratings have significantly higher returns, lower yield volatility, and higher operating profit margins. The authors show that stock prices for firms with high ES scores perform much better than prices for other firms. Stock market performance is especially good during market crashes for stocks with high ES and ad promotion. It is also worth noting that the authors found the E and G scores to be more tangible indicators of a firm's resilience during a crisis, as they reflect a combination of good governance and more lean manufacturing processes.

Among the three dimensions of ESG, David C. Broadstock et al. (2020), considered governance (G) to be the most important factor. This is explained by the fact that while corporate governance risks are similar and significant for all companies, the importance of environmental and social risks depends on the sector / area of the organization. Environmental Factors (E) are now most actively discussed due to widespread interest in climate finance and policy

dissemination from governments, regulators, safety exchanges and associations related to pollution and waste disposal, and environmental disclosure standards (National bureau of economic research, 2020).

There is one important moment: it is not for nothing that each of the articles mentioned above highlights one or two of the three ESG factors. This is partly due to the fact that no company can meet all the requirements in each of the ESG categories, so investors in any case need to decide what is important in each case. Of course, there are studies that have noted the importance of all ESG factors. These include Kempf & Osthoff (2007), Statman & Glushkov (2009), Nofsinger & Varma (2014), Henke (2016), they confirm that investing in ESG-based firms' portfolios can definitely provide productivity gains. Also, Statman and Glushkov (2009) base their analysis on KLD Research & Analytics and conclude that socially responsible investors benefit from performance advantages over traditional investors (Billio M., 2020).

All of the above confirms the special role of ESG factors and an increase in the turnover of investments in ESG. All current and previous studies show that this investment method can reduce portfolio risk, provide competitive investment returns, and improve resilience to crises and other events.

2.2. Changes in company financial results during COVID-19 and after

During world pandemic COVID-19 there were made a lot of researches about ESG-factors' importance, its influence on the world society, connections of the ESG-investing and profitability/crisis at the companies and etc.

One of such researches was made by David C. Broadstock et al. (2020), where explores the role of ESG performance during the market-wide financial crisis in response to the global COVID-19 pandemic. The study also separately looks at China and their components of the CSI300. By using SynTao Green Finance and WIND databases they found that ESG performance is positively associated with the short-term cumulative return on CSI300 stock during the COVID-19 crisis. In doing so, they contributed to the literature by empirically illustrating the resilience of high ESG stocks during the market financial crisis, which is consistent with the view that investors can interpret ESG performance as a signal of future stock returns and / or risk mitigation during a crisis.

It has been proven that ESG investing gains strong importance during crisis situations. An example is the global pandemic of 2020, which led to the financial crisis. There is such a ratio, according to which, during a crisis, ESG indicators increase, and in normal times, on the contrary, they fall. The normal situation should be such that ESG indicators should be taken into account in the activities of all companies and the lives of all people in general.

Wenzhi Ding et al. (2020) also examined the relationship of corporative social responsibility, in other words, corporate immunity, with the COVID-19 pandemic. Firms with stronger financial conditions for 2020, with more cash, less debt, and more profits, were found to have responded better to COVID-19 than peers. It was also found that companies that strengthened their CSR policies and activities before the pandemic demonstrated higher share price dynamics. These results are consistent with the notion that corporate social responsibility builds stakeholder trust, making employees, suppliers and customers more receptive to making adjustments to support business in difficult times. It's a good example of how CSR factors impact stock prices and stock market as well.

The presence of leaders at different levels of the hierarchy, the correct distribution of roles and tasks, the building of trusting and supportive relationships, and the facilitation of the exchange

of knowledge and opinions within the team are all reflections of the corporate culture that makes a company either a winner or a loser in a crisis.

In crisis situations, it becomes clear whether the company is guided by the principles that are spelled out in internal documents and transmitted to employees on a periodic basis, or not. Experience shows, that in many companies, similar values and principles are transmitted, but in fact, not everyone can follow them in adverse conditions. For example, the value of “safety” or “customer focus” - to what extent, in the current situation, companies were able to provide working conditions for their employees, prioritizing their safety, and to what extent they were able to adapt and not lose the declared level of service provided to their customers. In other words, both employees and customers of the company can additionally verify whether the declared values are manifested in life or not (Vafina K., 2020).

It is known that COVID-19 influenced thinking of people. The COVID-19 pandemic has only strengthened the case for investing in ESG. The resulting market turbulence is further evidence that stocks with strong ESG scores are often more resilient / less volatile. The pandemic has also raised public awareness and increased support for social issues falling under the purview of the ESG, such as worker health and safety.

III. METHODOLOGY

Data

The research is based on companies listed on the London stock exchange. Focus will be on their stock return during the stock market crash of the March 2020 and relationship of return with Environment, Social and Governance related factors.

An event study methodology was chosen to study this phenomenon. It has been a popular and widely used approach for years in the finance field. Peterson wrote a comprehensive book explaining Event study methodology. According to Peterson, the event-study methodology is a powerful tool to describe the effect on the financial security's price caused by some specific event through observation of the prices before such event (Peterson, P., 1989).

This methodology is based on the fundamental idea that stock prices represent the forecasted profits value with some deduction. It means that if some event affects the price of the particular stock, that change in the price is a figure of which the investors are expected to gain (Duso, 2010).

An event study aims to understand the response of the market to some specific event by means of scrutiny of stock prices nearby the event. In the studied case it is a stock market crash of the March of 2020. For proper study it is suggested to use several event periods in research. Peterson gives an example of company related announcements which may be released more than one day and it is hard to predict the specific day when an information reaches the market (Peterson, P., 1989).

Normal returns for stock are those which would be derived in a hypothetical scenario where no such event occurs. Normal returns are estimated for a period which is not nearby the event. In case of the research the period is before the actual event.

Among three classes of techniques used to estimate normal returns the market adjusted model was chosen.

It is also important to understand the term “normal return”. The meaning behind this term is that they are returns derived if the event wouldn't happen.

Event study measures

Regarding the historical data on stock prices, the idea was to manually download them company by company from the resources like Yahoo Finance, but the power of R studio libraries which have functions to derive stock prices allowed to do it in a matter of seconds. It speeded up the process and gave opportunity to concentrate on analysis. All detailed information regarding the software, libraries and specific functions used is in appendix. As a baseline index was chosen the Financial Times Stock Exchange 100 Index (FTSE 100) which was also fetched from Yahoo Finance function in R studio.

The source of ESG related data was Bloomberg's website through the university's subscription. The data consists of several factors which is used for analysis for correlation with CAR. Namely they are:

1. Total greenhouse gas emissions intensity as well as CO2 intensity;
2. Social disclosure score is Bloomberg's score. Is part of the ESG data in terms of social disclosure. Minimum score is 0.1 for companies that disclose minimum information. Maximum is 100 for companies that disclose all information required by Bloomberg;
3. Governance disclosure score is Bloomberg's score. Is part of the ESG data in terms of governance disclosure. Minimum score is 0.1 for companies that disclose minimum information. Maximum is 100 for companies that disclose all information required by Bloomberg;
4. Total salary and bonuses paid to executives;
5. ESG disclosure score is a proprietary Bloomberg score based on the extent of a company's Environmental, Social and Governance (ESG) disclosure. The score ranges from 0.1 for companies that disclose minimum amount of ESG data to 100 for those that disclose every data point collected by Bloomberg;
6. Percentage of Women on board of Directors as reported by the company. Europe: Where the company has a Supervisory Board, this is the Percentage of Women on the Supervisory Board. Field is part of the Environmental, Social and Governance (ESG) group of fields.
7. Sustainalytics Rank is an overall percentile rank assigned to the company based on its environmental, social and governance (ESG) total score relative to its industry peers. For the top 1% the percentile is 99%; for the bottom 1% the percentile is 1%. This is Sustainalytics' most comprehensive percentile rank.
8. Sustainalytics Environment Percentile Description is an industry percentile rank for the company's management of its environmental record. For the top 1% the percentile is 99%; for the bottom 1% the percentile is 1%. Environmental performance is determined by the level of environmental preparedness and disclosure in addition to environmental controversies (Bloomberg).

Event windows

For the purpose of more comprehensive analysis and observation of a phenomenon in a wider time range 4 Event windows have been chosen:

Event window 1: 23.03.2020-23.06.2020;

Event window 2: 23.06.2020-23.09.2020;

Event window 3: 23.09.2020-23.12.2020;

Event window 4: 23.03.2020-23.03.2021.

The estimation period is 120 days before the day of the event. The ESG data from Bloomberg was collected for the end of 2019 as the financial year before the event.

Analysis of cumulative abnormal returns

Analysis showed that each event window has different tickers that have minimum and maximum cumulative abnormal return (CAR) values.

For **event window 1** Tullow Oil (TLW.L) showed 128.74% which is the highest CAR value among 273 analyzed companies. At the same event window, the International Personal Finance (IPF.L) showed -164,5% which is the lowest CAR value among 273 analyzed companies. Brief research for possible causes of such results allowed to make the following assumptions:

Tullow Oil (TLW.L) is an independent producer and explorer of oil and gas (2020 Full Year Results, 2021). Since the end of September 2019, the share price of Tullow Oil kept falling until the beginning of March 2020.

Different factors forced price to decline from lower than expected price of oil in Guyana, an announcement of cut of oil previously forecasted oil production level to 30% decline in oil price due to OPEC treaties and coronavirus restrictions. So, the estimation period suggested to model that this company will keep falling in price. But suddenly since mid-March till Mid-June kept showing positive returns. Probably it was due to the decision to sell its stake in jointly-held onshore wells in Uganda to Total and perspectives of oil exploration in Ghana (Nasralla, 2020). Overview of ESG related data didn't show a high ESG disclosure score (just 47.72) but government disclosure score (60.71) as well as Sustainalytics Rank and Environment Percentile were above average 79.38 and 69.07 respectively.

International Personal Finance (IPF.L) is an organization that provides consumer credits in Europe and Mexico. Worse than expected performance could be anxiety of investors amid coronavirus uncertainty. Additionally, the company decided to cancel dividend payments to save cash and restricted lending to avoid liquidity shortage. All of these factors could affect investors mood regarding this stock (Staff, 2020). Brief look at ESG related data showed that despite the government disclosure score (79.9) the rest are relatively low (Social disclosure score - 30.96, ESG disclosure score - 45.23 and % of women on board - 33.33). Low value of total greenhouse gas emissions should not be taken into the account.

For **event window 2** Arrow Global (ARW.L) showed 102.5% which is the highest CAR value among 273 analyzed companies. At the same event window our previous champion Tullow Oil now has the lowest CAR value of - 75.2% among 273 analyzed companies. Brief research for possible causes of such results allowed to make the following assumptions:

Arrow Global (ARW.L) is a company specialized in buying debts from various financial institutions (banks, credit card companies etc.). Michael Green from Stockopedia believes that this outperformance was caused by momentum traders. Of course, the positive trend that Arrow Global's stock in the reviewed event window showed is a positive sign but price momentum is a phenomenon highly related to psychology rather than rationality. That's why at that period cool headed investors supposed to check fundamentals such as the strength of its balance sheet, P/E ratio and undoubtedly on its intrinsic value. The company has a high government disclosure score (78.72) whereas the rest of the ESG related factors are low (Green, 2020).

Tullow Oil (TLW.L) after unexpectedly good performance between March and June became the last in a row by CAR in the second event window. One of the possible causes could be the half year financial report of the company released in that event period. The results point out \$2.7 billion loss attributed to write-offs in Uganda and other operating countries (Serugo, 2020).

For **event window 3** National Express Group (NEX.L) showed 88% which is the highest CAR value among 273 analyzed companies. At the same event window De La Rue (DLAR.L) had the lowest CAR value of - 89.84% among 273 analyzed companies. Brief research for possible causes of such results allowed to make the following assumptions:

According to Reuters, the National Express Group is a transportation company operating in various countries, including the United Kingdom (bus and coach), Germany (railways), North America (school bus), Spain and Morocco (bus and coach) (Reuters Editorial, 2021).

Manika Preamsingh from Motley Fool says that even though 2020 was a bad year for businesses, National Express managed to make progress in contracts and was able to generate £900 million of revenue. The contracts are long term and the geography includes Portugal, North America and the United Kingdom. Company has a good ESG regarding CO2 emissions (as low as 349,8) thanks to 29 electric powered buses in the West Midlands. There are plans for hydrogen-powered buses as well. The company claims to have a zero-carbon emissions fleet by 2030 (The Motley Fool UK, 2021).

In contrast to the National Express Group the **De La Rue** (DLAR.L) is performing the worst (by CAR) among all the companies in analysis in the given event window. De La Rue is considered as the largest producer of national currencies (more than 150). Travellers cheques, vouchers are printed as well. De La Rue has been struggling for a few years. The company couldn't renew the contract for passport printing and the post-Brexit UK passport will be printed by another company, Venezuelan central bank fail to pay for banknote printing. In November 2020 to cut its costs the company announced the timeline to close its plants in Gateshead in Tyne and Wear. All of these might cause investors to sell and not buy this company's shares. The company shows environment friendly indicators in ESG but the rest of indexes are quite low.

For **event window 4** Tullow Oil (TLW.L) showed 530.45% which is the highest CAR value among 273 analyzed companies. At the same event window, the Dunelm Group (DNLM.L) showed -589,82% which is the lowest CAR value among 273 analyzed companies. Brief research for possible causes of such results allowed to make the following assumptions:

Tullow Oil in the long run showed that it is a profitable chip for long-term investors with patience but for momentum traders it is a risky one. As stated in their annual sustainability report the company focuses on producing low cost oil in environmentally and socially safe ways. ESG Carbon dioxide intensity score for the company is quite low (656,74). Higher crude oil prices and new explored fields have also contributed to better than expected returns (Sustainability Report 2020 Tullow Oil Plc, 2021).

Dunelm Group is a retail company specializing in homeware, furniture and other home related goods. The company struggled from coronavirus causing strict restrictions forced to close its locations. Before the market crash from the end of 2019 up to February 2020 the stock kept growing and the market crash dropped the price by 50%. Even though distance work from home influenced people to increase spending on homeware in June, fear of recession in Great Britain and uncertainty with jobs will keep forcing people to tighten their belts. The company shows environment friendly indicators in ESG but the rest of indexes are quite low.

Accounting data are derived from Yahoo finance for the annual financial report for 2019 and from Finbox.com for market capitalization data. All of these data were utilized as control variables. Our control variables are Tobin's q, Market capitalization (as Firm size), Dividends paid, Leverage, Cash, Return on equity (ROE). Dividends paid and Cash are directly available from the financial reports for use, whereas Tobin's q, Leverage, and ROE are calculated separately. Size is derived from a special graph showing monthly market capitalization for a specific company.

Running separate regression for each ESG related index for each window showed that only percentage of women on board and salaries to executives are statistically significant. It was a reason to include those two indexes as independent variables along with control variables.

Overall, the dataset contained 273 observations (companies). 4 regression analyses were completed individually for chosen 4 event windows. Event window 1 (during a market crash and the following 3 months) shows a strong relationship with total salaries and bonuses paid to executives. The representation of women on board and financials as control variables do not show such relation to abnormal returns. Three months after the market crash (Event window 2) percentage of women on board started influencing abnormal returns although the significance was not as strong as for salaries paid to executives for EW1. Financial indicators again didn't show signs of influence on abnormal returns of the analyzed companies. Half a year after the market crash, the percentage of women on board starts playing an even bigger role than in the previous period. At this period majority of financial indicators starts influencing abnormal returns of the companies, namely, dividends paid, leverage, cash, and ROE. The last event window covering the whole year after the market crash shows no influence of attenuation of the influence on the company's performance. At this period none of the ESG factors has an influence on abnormal returns. In a long run, fundamental ratios as Tobin's q and ROE shows the influence on companies' performance. Interesting to notice that through all periods the influence of company size is not visible.

	<i>Event window 1</i>	<i>Event window 2</i>	<i>Event window 3</i>	<i>Event window 4</i>
<i>Percentage of Women on Bd</i>	0,002619543	-0,00259*	-0,00345**	0,001183
<i>Tot Sal & Bns Pd to Execs</i>	1,2726E-08***	-3,8E-09	1,04E-10	1,02E-08
<i>Tobin's q</i>	0,005314156	-0,00055	0,00198	0,070762**
<i>Size (Market cap)</i>	1,2367E-12	-9,1E-13	-6,9E-14	-4,2E-12
<i>Dividends Paid</i>	-3,55369E-11	1,46E-11	-5E-11*	-6,9E-11
<i>Leverage</i>	-0,007896811	0,004033	0,025528**	0,082579
<i>Cash</i>	-1,9888E-12	4,88E-13	-3,2E-12**	4,77E-12
<i>ROE</i>	0,014368873	0,010541	-0,13313**	-0,8652***
<i>R Square</i>	0,17076414	0,090994	0,091182	0,090798
<i>Adjusted R Square</i>	0,145635781	0,063449	0,063642	0,063247
<i>Observations</i>	273	273	273	273

*p < .1; **p < .05; ***p < .01.

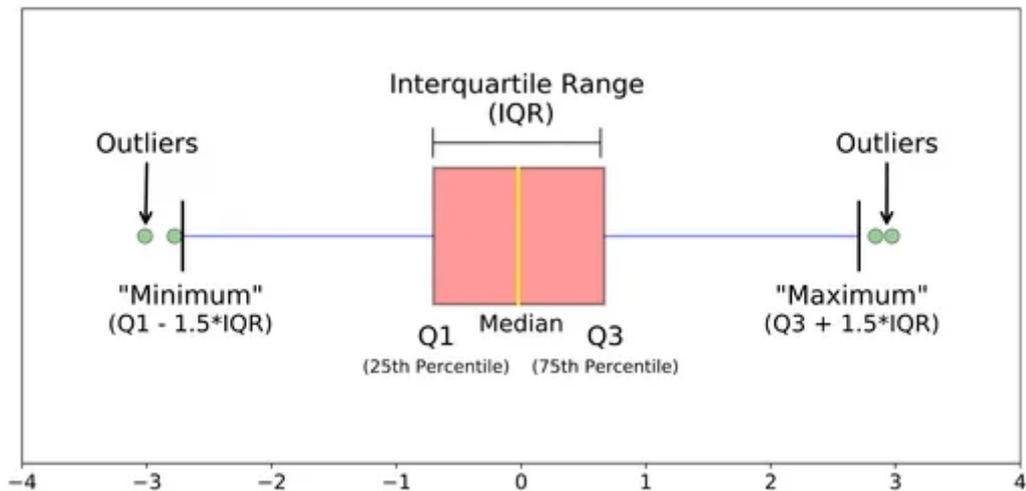
Since now we have our dependent Y variable which is CAR. We also have a set of ESG related X independent variables.

Let's continue with univariate analysis.

Univariate data analysis is a special quantitative method to look to the variable itself in isolation in order to know it thoroughly. Since it is a continuous variable, we can measure a centrality (mean and median) and the spread (min, max, quantiles, standard deviation).

Let's quickly stop on the meaning each of them:

- **Mean** is a simple average of all values in the given dataset, which we get by adding all your cases and dividing the sum by the number of cases. Here is worth mentioning that it is extremely sensitive to outliers, the extreme values that are significantly different from the main mass of the values and is closer to either maximum or minimum values. It is less crucial for big dataset rather than for small one where the mean is more sensitive to outliers.
- **Minimum and maximum values** are two borders (excluding outlier) of the dataset which identify the extreme values related to this dataset. It gives us a sense of the floor and ceiling of the set of given values.
- **Outlier** is considered as a value from a dataset that is numerically distant from the major part of the values. It easily can be seen at the boxplot. It will be above minimum or maximum of the boxplot.

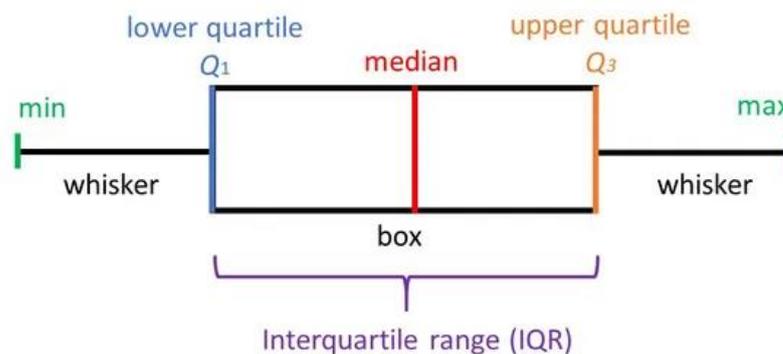


Picture A. Box plot and outliers

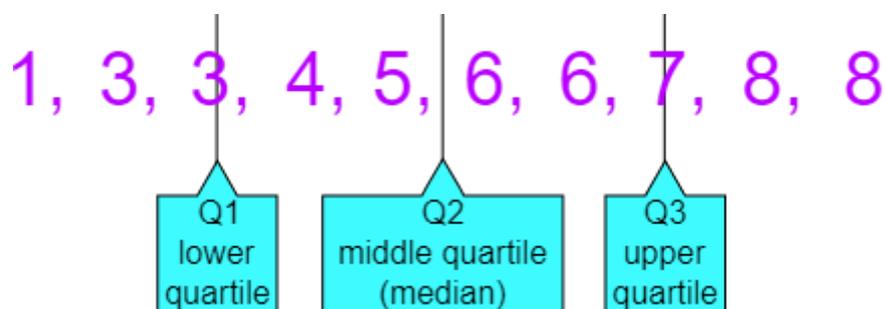
- **Standard deviation** is used to understand the dispersion of the values compared to the mean. Imagine the mean of the dataset and the data point, in case the points are further from the mean then subsequently they have a higher deviation (in either direction), in opposite, if they are closer to the mean, then they have a lower deviation. If you consider a stock with high standard deviation, then this stock is considered as a volatile, whereas blue-stock chip is characterized by stability hence, with relatively low volatility. Here is a nuance to consider: standard deviation takes an above-average return as a risk even though it is good for an investor.

There is no such category as “good” or “bad” standard deviation but it can be measured by coefficient of variance (CV) which is calculated as a Standard deviation/mean. As a rule of thumb we consider $CV < 1$ as a low and $CV \geq 1$ as a high.

- **Quartile** divides data points into four parts of about the same size. To form quartiles we need to order the data from the least to the biggest in an order. There are three main quartile that we calculate by summary() function of R:
 - **The first Q1 quartile** is a middle number which is located between minimum (excluding outlier) and median. Imagine that quarter or 25% of the data is located below this point.
 - **Median** (also called the 50th percentile) is the middle value when all our values are placed in numerical order. If you have five values and you put them in numerical order, the third value will be the median. When you have an even number of values, you'll have to take the average of the middle two values to get the median. So, if you have 6 values, the average of values 3 and 4 will be the median. The median is also a lot less sensitive to outliers than the mean. While it can be more time intensive to calculate, the median is preferable in most cases to the mean for this reason. It gives us a more accurate picture of where the middle of our distribution sits in most cases.
 - **The third Q3 quartile** is a middle number which is located between median and maximum (excluding outlier). Imagine that three fourth or 75% of the data is located below this point.



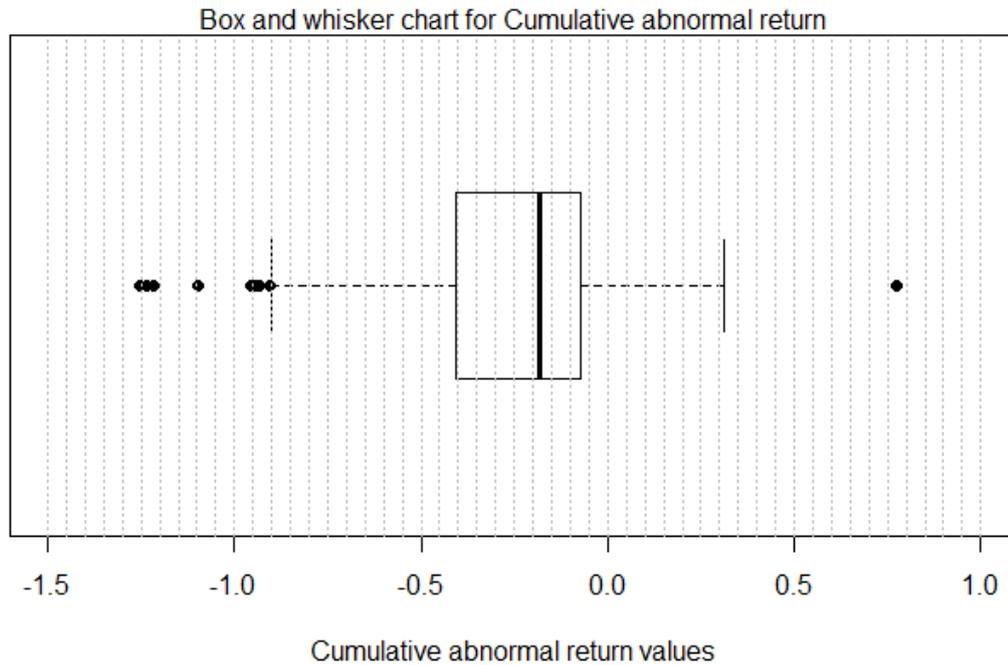
Picture A. Boxplot and explanation of the parts (Source: <https://www.simplypsychology.org/boxplots.html>)



Picture B. Scheme of quartiles (source: <https://www.mathsisfun.com/data/quartiles.html>)

The summary function can show the Min., 1st Qu., Median, Mean, 3rd Qu., Max. values. For standard deviation we need to use a special sd function. We will also draw a boxplot to see the distribution and identify whether there are major outliers which may affect the whole graph.

Cumulative abnormal returns (CAR):



Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	Std_dev
-0.9	-0.40756	-0.18443	-0.24969	-0.07465	0.3	0.2746509

We used modified boxplot to make visualization better: horizontal view instead of standard vertical, added vertical lines to a graph to make estimation of the value a way easier.

We can see that the mean is closer to the bottom (minimum) and the whisker is shorter on top of the box, hence, the distribution is negatively skewed (left-skewed). Thanks to \$out function from boxplot.stats, we displayed outliers for CAR. We have 9 outlier values (8 of the are below minimum whisker and 1 only above):

```
[1] -1.2514930 -0.9555847 -1.2334750 -1.0997797 -0.9310362 -1.2183574
```

```
[7] -0.9070952 -0.9428935 0.7729600.
```

Boxplot has a bottom whisker of -0.9 and maximum value of about 0.3.

Let's simply describe the data. Approximately 25% of the dataset is below about -0.41 (Q1) and above -0.9 (minimum). Then, approximately 50% of the dataset are below -0.18 (median). Let's move on. Approximately 75% of the dataset are below -0.07 (Q3). It means that the performance of the majority of the companies in the dataset was negative and their performance was worse than expected if the event wouldn't happen.

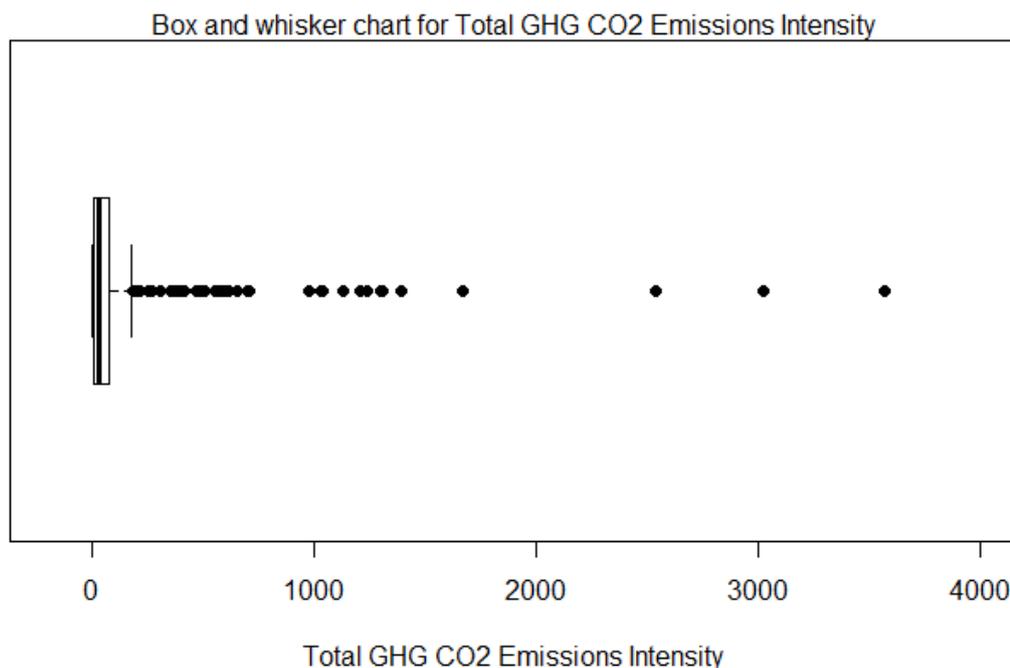
The coefficient of variance (CV) is 1.1, so the dispersion is considered high. It means that cumulative abnormal return throughout the dataset is different from average with relatively high volatility. It gives us a sense that the stocks' reaction was not homogeneous but differed significantly.

Range between minimum and Q1	Range between Q1 and median	Range between median and Q3	Range between Q3 and maximum
$-0.41 - (-0.9) = 0,49$	$-0.18 - (-0.41) = 0.23$	$-0.07 - (-0.18) = 0.11$	$0.3 - (-0.07) = 0.37$

We also calculated the interquartile range and can make the following conclusions (note that we do not consider outliers):

- 1) For companies with cumulative abnormal return (CAR) below 41% the spread was within 49 points, which constitutes about 25% of our dataset. We consider it as a sign that the negative magnitude caused by the event was very different for companies falling under this interval.
- 2) About 25% companies in the dataset had a relatively insignificant negative effect caused by the event ($-0.18 < CAR < -0.07$) and the spread was within only 11 points.
- 3) Approximately 25% companies in the dataset performed better than expected and their cumulative abnormal gains ranged within 37 points and the highest CAR was 30%.

Total greenhouse gas (GHG) CO2 Emissions Intensity



Thanks to outliers, which we counted 39, it's nearly impossible to recognize the extreme of the lower whisker, the lower 'hinge', the median, the upper 'hinge' and the extreme of the upper whisker. Thanks to boxplot.stats function we derived this data from the boxplot:

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	Std_dev
-2.334	6.857	27.315	145.401	75.527	176.85	401.0363

The outliers which caused this issue are the following:

[1] 3565.9319 3021.9695 2535.2686 1667.3384 1388.1613 1303.9907 1297.6744
 [8] 1237.7531 1203.0527 1132.9049 1037.9613 1029.7943 978.2214 705.7894
 [15] 701.4849 656.7394 611.7990 600.6871 586.7440 566.8227 551.1839
 [22] 506.5098 488.2979 468.7605 466.5111 411.7429 407.1432 384.5762
 [29] 366.3149 349.8449 310.5378 268.6318 252.3382 214.9050 213.6849
 [36] 201.4452 198.0797 192.6567 181.4189

Once again used modified boxplot to make visualization better: horizontal view instead of standard vertical, added vertical lines to a graph to make estimation of the value a way easier.

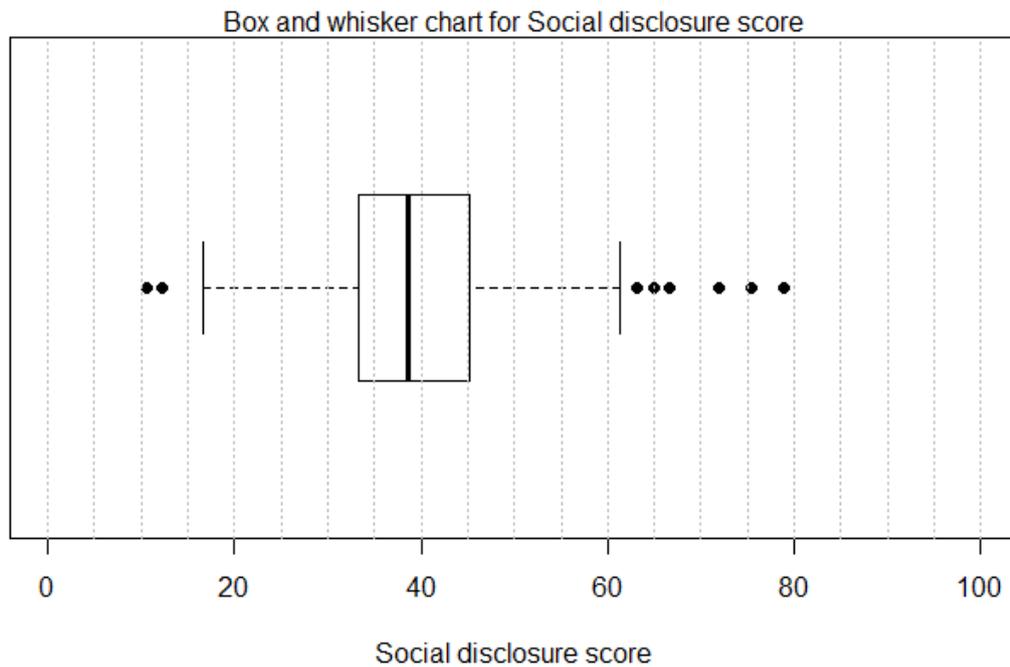
Anyway, we can see that the mean is closer to the top (maximum) and the whisker is shorter on the bottom of the box, hence, the distribution is positively skewed (right-skewed).

Boxplot has a bottom extreme whisker of -2.334 and maximum value of 176.85.

Let's simply describe the data. Approximately 25% of the dataset is below 6.857 (Q1) and above -2.334 (minimum). Then, approximately 50% of the dataset are below 27.315 (median). Let's move on. Approximately 75% of the dataset is below 75.527 (Q3). It means that the total greenhouse gas (GHG) CO2 Emissions Intensity of the companies in the dataset is relatively low compared to the top 25%. Needless to say that outliers producing a way more GHG.

The coefficient of variance (CV) is 2.76, so the dispersion is considered high. It means that total greenhouse gas (GHG) CO2 Emissions Intensity throughout the dataset is different from average with relatively high volatility. It gives us a sense that the total greenhouse gas (GHG) CO2 Emissions Intensity for companies is not homogeneous but differs significantly.

Social disclosure score



Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	Std_dev
16.65	33.3	38.5	39.72	45.25	61.40351	10.51

We can see that the mean is closer to the top (maximum) and the whisker is shorter on bottom of the box, hence, the distribution is positively skewed (right-skewed). Boxplot has a bottom extreme whisker of 16.65 and maximum value of 61.40. There are outliers affecting the plot:

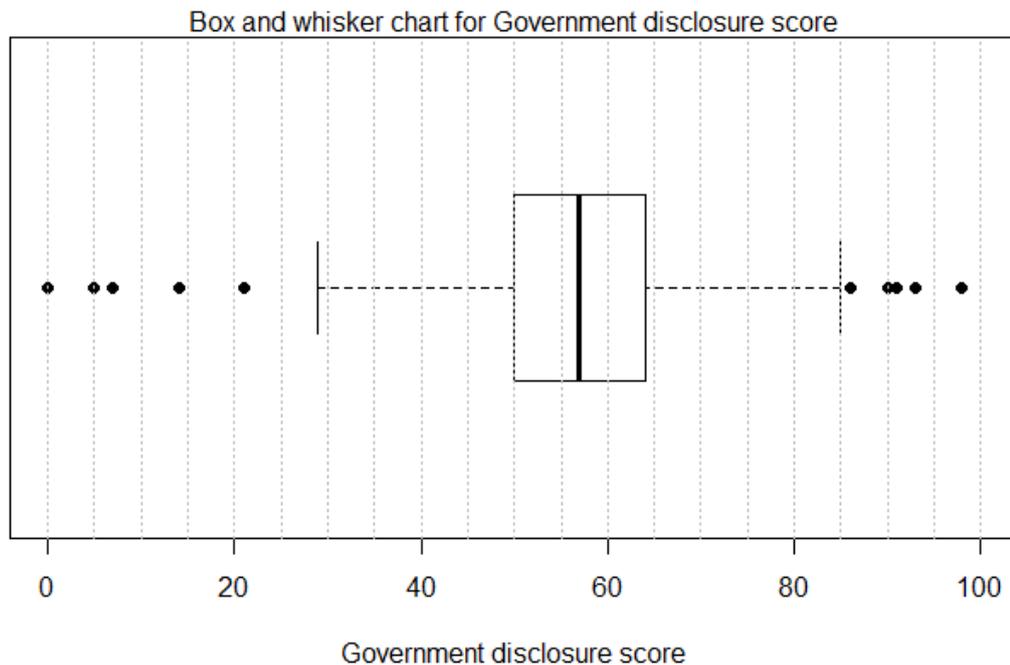
[1] 66.66666 75.43860 78.94736 71.87500 12.28070 63.15789 64.91228 66.66666

[9] 10.55018.

Let's simply describe the data. Approximately 25% of the dataset is below 33.3 (Q1) and above 16.65 (minimum). Then, approximately 50% of the dataset are below 38.5 (median). Let's move on. Approximately 75% of the dataset is below 45.25 (Q3).

The coefficient of variance (CV) is 0,26, so the dispersion is considered low. It means that the social disclosure score throughout the dataset is different from average with relatively low volatility. It gives us a sense that the social disclosure score for companies is quite homogeneous.

Government disclosure score



Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	Std_dev
37.5	53.57	57.14	61.51	66.07	84.29	12.18

We can see that the mean is closer to the top (maximum) and the whisker is shorter on the bottom of the box, hence, the distribution is positively skewed (right-skewed). There are 23 outliers affecting the plot:

```
[1] 91.81216 90.54786 85.55087 90.54786 90.54786 84.97893 84.97893
[8] 90.54786 85.55087 91.81216 85.55087 84.97893 85.55087 90.54786
[15] 90.54786 91.81216 90.54786 90.54786 90.54786 91.81216 90.54786
[22] 85.55087 84.97893
```

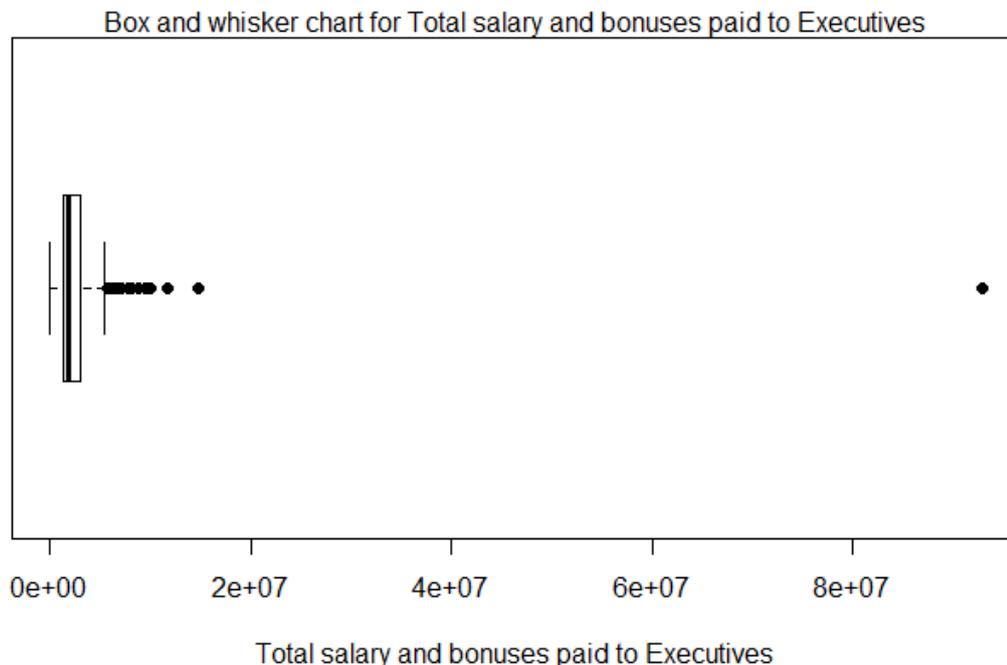
Boxplot has a bottom extreme whisker of 37.5 and maximum value of 84.29.

Let's simply describe the data. Approximately 25% of the dataset is below 53.57 (Q1) and above 37.5 (minimum). Then, approximately 50% of the dataset are below 57.14 (median). Let's move on. Approximately 75% of the dataset is below 66.07 (Q3).

The coefficient of variance (CV) is 0,2, so the dispersion is considered low. It means that the government disclosure score throughout the dataset is different from average with relatively low

volatility. It gives us a sense that the government disclosure score for companies is quite homogeneous.

Total salary and bonuses paid to executives



The box plot is not informative. Thanks to R studio build in functions we can derive important data. We can see that the mean is closer to the top (maximum) and the whisker is shorter on the bottom of the box, hence, the distribution is positively skewed (right-skewed). There are 18 outliers affecting the plot:

```
[1] 14782000 6671000 8165000 92 947 000 7216000 9567000 7146000
[8] 6805000 7938000 5980000 6125000 6770000 11809000 5831000
[15] 7821000 9997000 8905000 6 838 000
```

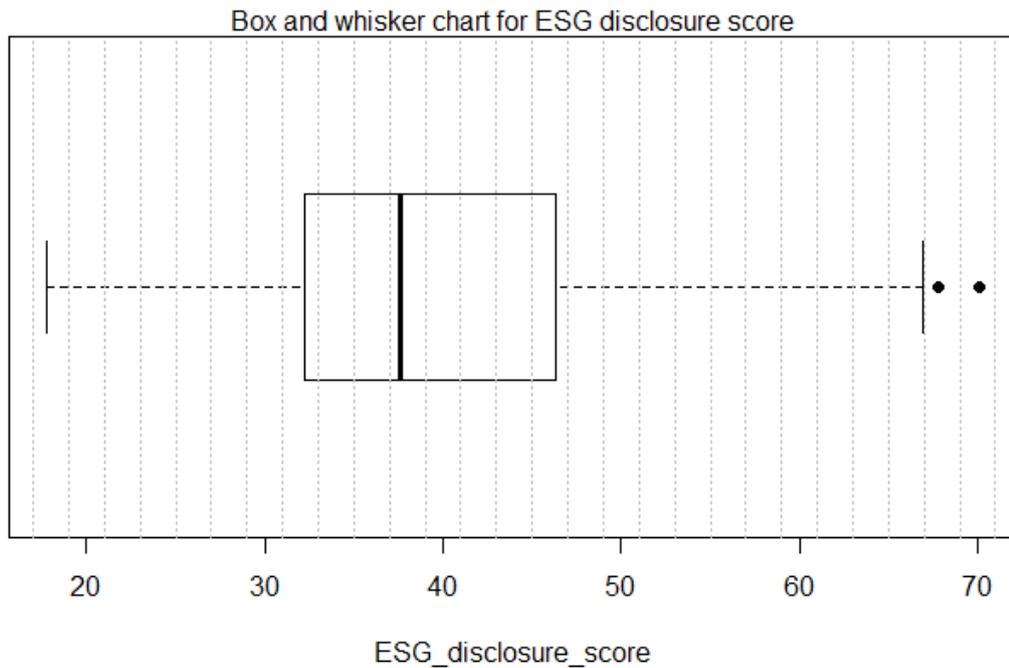
Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	Std_dev
1 534	1 301 000	1 924 200	2 827 633	3 112 000	5 422 000	5 796 866

Boxplot has a bottom extreme whisker of 1534 and maximum value of 84.29.

Let's simply describe the data. Approximately 25% of the dataset is below 1 301 000 (Q1) and above 1 534 (minimum). Then, approximately 50% of the dataset are below 1 924 200 (median). Let's move on. Approximately 75% of the dataset is below 3 112 000 (Q3).

The coefficient of variance (CV) is 2,05, so the dispersion is considered high. It means that the total salary and bonuses paid to executives throughout the dataset is different from average with relatively high volatility. It gives us a sense that the total salary and bonuses paid to executives for companies is not homogeneous but differs significantly.

ESG disclosure score



We can see that the mean is closer to the top (maximum) and the whisker is shorter on the bottom of the box, hence, the distribution is positively skewed (right-skewed). There are 18 outliers affecting the plot:

[1] 67.75978 70.12448

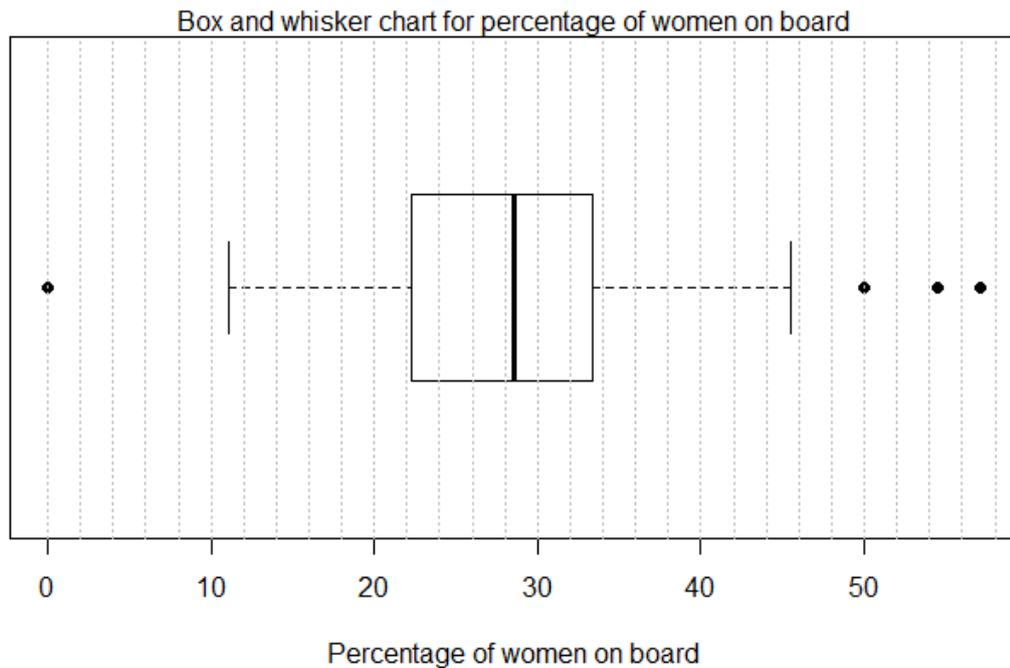
Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	Std_dev
17.77	32.23	37.60	39.74	46.28	66.94	10.31

Boxplot has a bottom extreme whisker of 37.5 and maximum value of 84.29.

Let's simply describe the data. Approximately 25% of the dataset is below 32.23 (Q1) and above 17.77 (minimum). Then, approximately 50% of the dataset are below 37.6 (median). Let's move on. Approximately 75% of the dataset is below 46.28 (Q3).

The coefficient of variance (CV) is 0,26, so the dispersion is considered low. It means that the ESG disclosure score throughout the dataset is different from average with relatively low volatility. It gives us a sense that the ESG disclosure score for companies is quite homogeneous.

Percentage of women in board



We can see that the mean is closer to the bottom (minimum) and the whisker is shorter on the top of the box, hence, the distribution is negatively skewed (left-skewed). There are 13 outliers affecting the plot:

```
[1] 0.0000 0.0000 0.0000 0.0000 54.5455 50.0000 50.0000 0.0000
[9] 0.0000 0.0000 50.0000 50.0000 57.1429
```

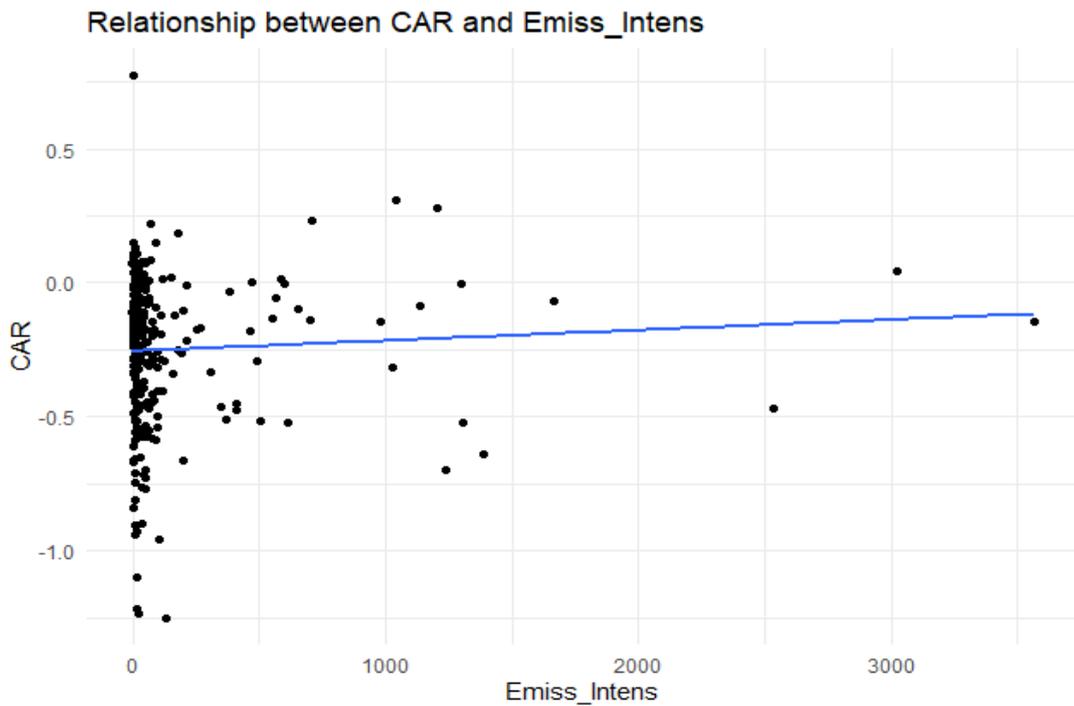
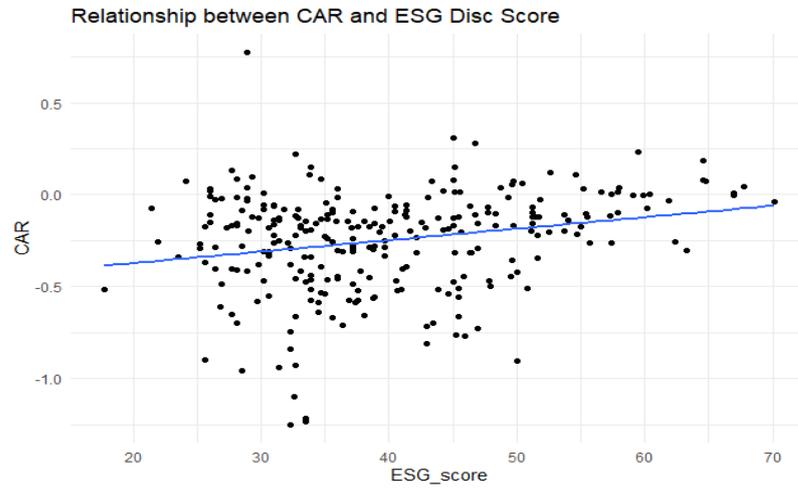
Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	Std_dev
11.11	22.22	28.57	28.37	33.33	45.45	10.69

Boxplot has a bottom extreme whisker of 11.11 and maximum value of 45.45.

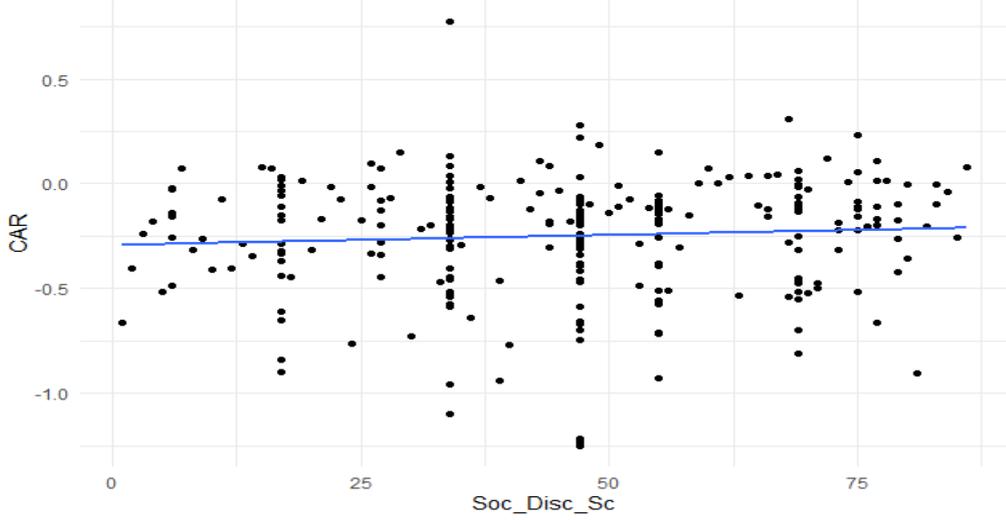
Let's simply describe the data. Approximately 25% of the dataset is below 22.22 (Q1) and above 11.11 (minimum). Then, approximately 50% of the dataset are below 28.57 (median). Let's move on. Approximately 75% of the dataset is below 33.33 (Q3).

The coefficient of variance (CV) is 0.37, so the dispersion is considered low. It means that the percentage of women on board throughout the dataset is different from average with relatively low volatility. It gives us a sense that the percentage of women on board for companies is quite homogeneous.

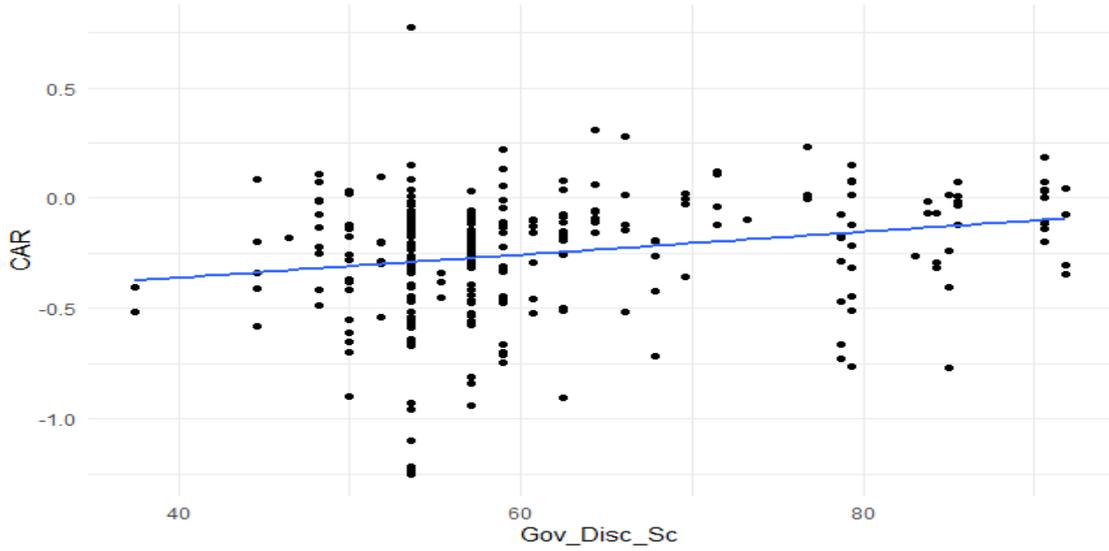
The pictures below graphically illustrate the relationship between CAR and individual ESG factors.



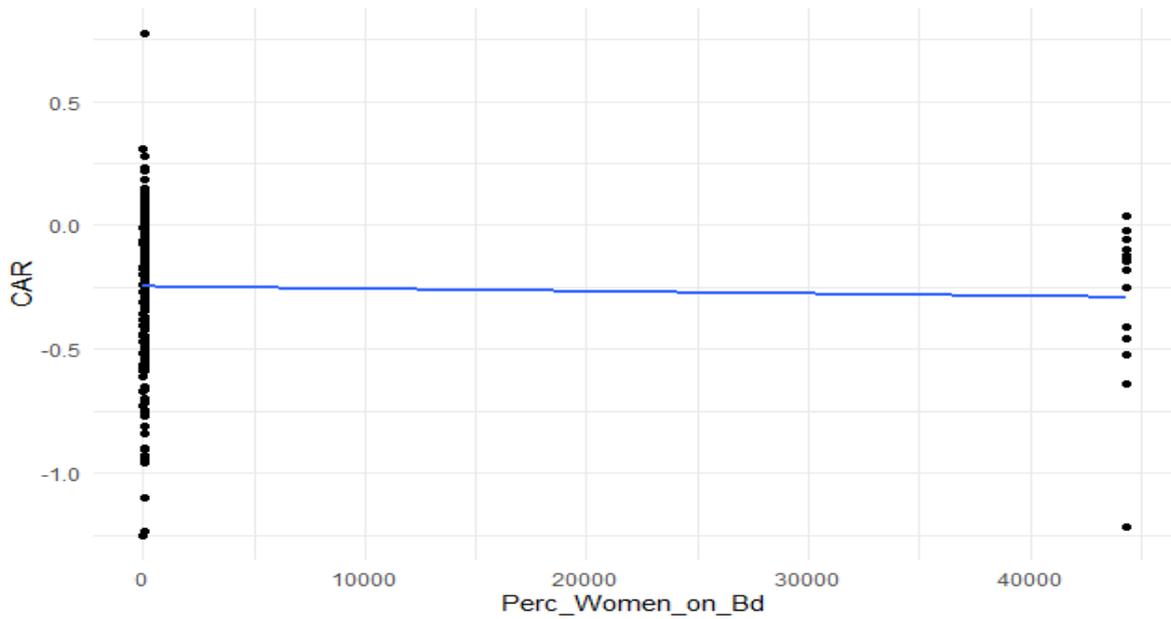
Relationship between CAR and Soc_Disc_Sc



Relationship between CAR and Gov_Disc_Sc



Relationship between CAR and Perc_Women_on_Bd



The next, we will use correlation plots to see the relationship between two variables.

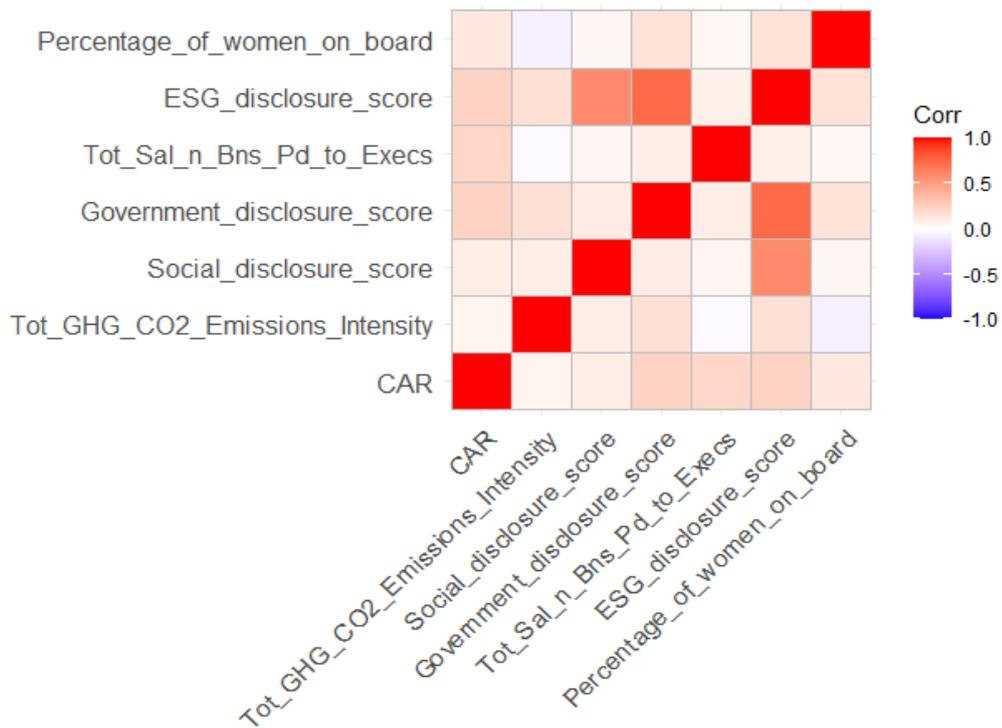
```
r <- cor(PlotDF, use="complete.obs")
```

	CAR
CAR	1.00
Tot_GHG_CO2_Emissions_Intensity	0.06
Social_disclosure_score	0.09
Government_disclosure_score	0.23
Tot_Sal_n_Bns_Pd_to_Execs	0.21
ESG_disclosure_score	0.23
Percentage_of_women_on_board	0.12

For interpretation of the derived information we turn to Ratner who calls the coefficient between 0 to 0.3 as a weak positive linear relationship through a shaky linear rule (Rather, 2009). So far all of our ESG related scores have weak positive correlation to CAR.

The next we use the ggcorrplot function in the ggcorrplot package to visualize these correlations.

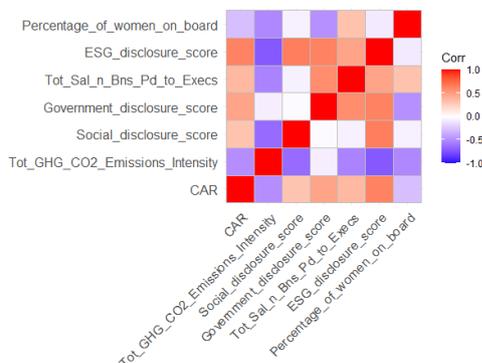
```
ggcorrplot(r)
```



Next, let's analyze the effect of ESG to the CAR of the companies by industries. We have chosen several industries from the dataset which have relatively a lot of representatives in the dataset. They are: Trading Companies & Distributors (10), Specialty Retail (13), Professional Services (7), Oil, Gas & Consumable Fuels (7), Media (10), Equity Real Estate Investment Trusts (REITs) (18).

Oil, Gas & Consumable Fuels:

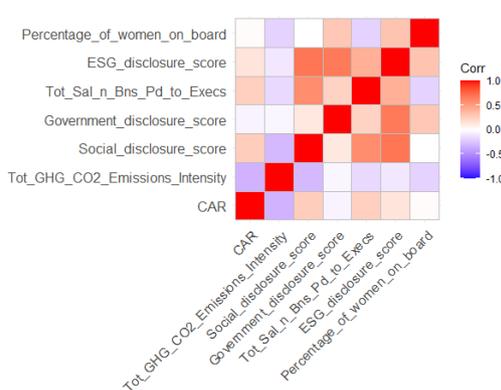
	CAR
CAR	1.00
Tot_GHG_CO2_Emissions_Intensity	-0.49
Social_disclosure_score	0.31
Government_disclosure_score	0.47
Tot_Sal_n_Bns_Pd_to_Execs	0.37
ESG_disclosure_score	0.63
Percentage_of_women_on_board	-0.28



Now, the situation has changed. We notice a moderate negative linear relationship of CAR with Total greenhouse gas emissions intensity (-0.49). There are way more positive linear relationships with government disclosure scores (0.47), total salaries and bonuses paid to executives (0.37) and *the strongest one with ESG disclosure score (0.63)*. Gender equality doesn't play much role according to the figures: the percentage of women on board has a negative weak linear relationship with CAR.

Equity Real Estate Investment Trusts (REITs)

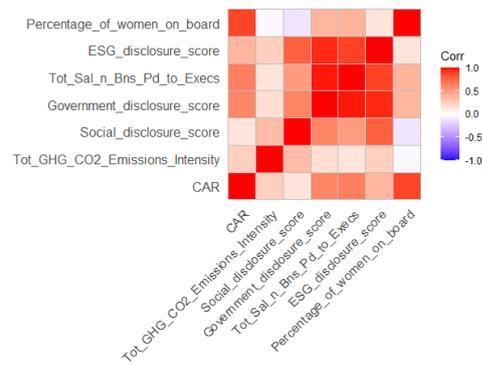
	CAR
CAR	1.00
Tot_GHG_CO2_Emissions_Intensity	-0.33
Social_disclosure_score	0.26
Government_disclosure_score	-0.05
Tot_Sal_n_Bns_Pd_to_Execs	0.25
ESG_disclosure_score	0.14
Percentage_of_women_on_board	0.02



Only total greenhouse CO2 emissions intensity has negative moderate (-0.33 - just slightly higher than weak) linear relationship with CAR. The rest have a weak relationship and no need to be paid attention at.

Professional services

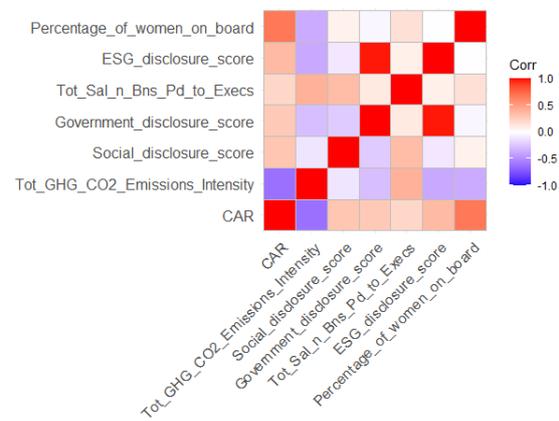
	CAR
CAR	1.00
Tot_GHG_CO2_Emissions_Intensity	0.25
Social_disclosure_score	0.14
Government_disclosure_score	0.61
Tot_Sal_n_Bns_Pd_to_Execs	0.65
ESG_disclosure_score	0.38
Percentage_of_women_on_board	0.88



For this industry percentage of women on board have a strong linear relationship with CAR (0.88) which is interesting. Government disclosure score and total salaries and bonuses to executives have a moderate positive linear relationship.

Trading Companies & Distributors

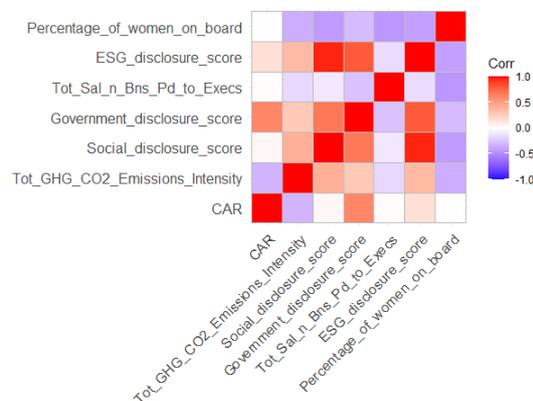
	CAR
CAR	1.00
Tot_GHG_CO2_Emissions_Intensity	-0.62
Social_disclosure_score	0.30
Government_disclosure_score	0.28
Tot_Sal_n_Bns_Pd_to_Execs	0.21
ESG_disclosure_score	0.36
Percentage_of_women_on_board	0.68



Only two indexes have a moderate impact on linear relationship with CAR of the companies in this sector even though it is in the opposite directions: they are total greenhouse CO2 emissions intensity (negative 0.62) and percentage of women on board (positive 0.68). They rest have only weak linear relationships with CAR and don't worth mentioning.

Media

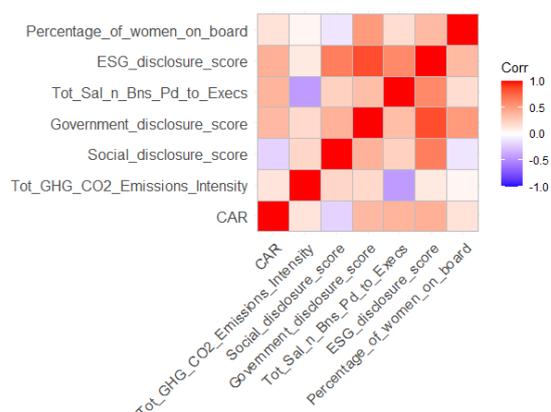
	CAR
CAR	1.00
Tot_GHG_CO2_Emissions_Intensity	-0.32
Social_disclosure_score	0.04
Government_disclosure_score	0.61
Tot_Sal_n_Bns_Pd_to_Execs	0.01
ESG_disclosure_score	0.16
Percentage_of_women_on_board	-0.01



Only government disclosure score moderately positively affects (0.61) linear relationship with CAR of the companies in Media industry.

Specialty Retail

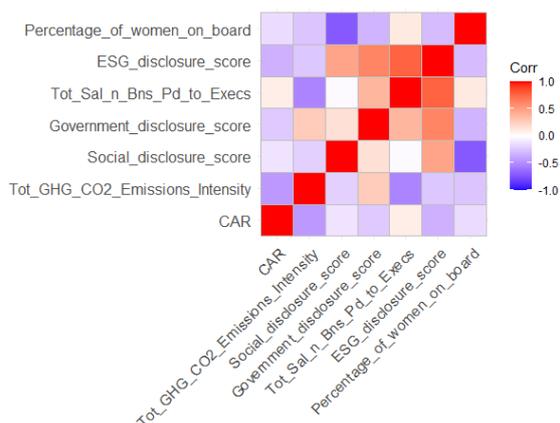
	CAR
CAR	1.00
Tot_GHG_CO2_Emissions_Intensity	0.14
Social_disclosure_score	-0.19
Government_disclosure_score	0.37
Tot_Sal_n_Bns_Pd_to_Execs	0.39
ESG_disclosure_score	0.41
Percentage_of_women_on_board	0.15



There is just a relatively low moderate linear relationship of Government disclosure score (0.37), total salary and bonuses paid to executives (0.39) as well as ESG disclosure score (0.41).

Food Products

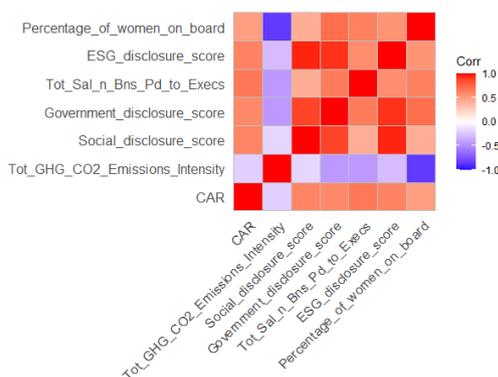
	CAR
CAR	1.00
Tot_GHG_CO2_Emissions_Intensity	-0.44
Social_disclosure_score	-0.12
Government_disclosure_score	-0.23
Tot_Sal_n_Bns_Pd_to_Execs	0.09
ESG_disclosure_score	-0.34
Percentage_of_women_on_board	-0.15



There are moderate negative linear relationships with total greenhouse gas CO2 emissions intensity (negative 44) and ESG disclosure score (negative 34).

Banks

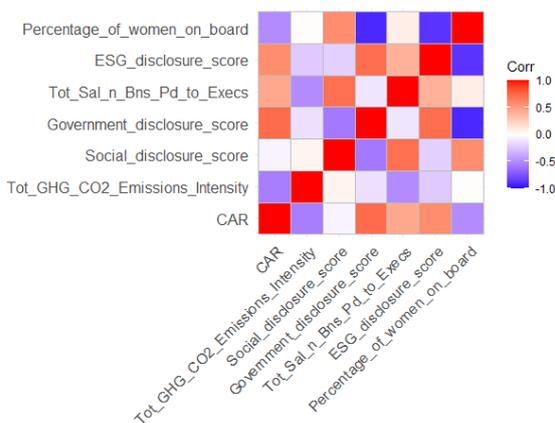
	CAR
CAR	1.00
Tot_GHG_CO2_Emissions_Intensity	-0.21
Social_disclosure_score	0.62
Government_disclosure_score	0.60
Tot_Sal_n_Bns_Pd_to_Execs	0.68
ESG_disclosure_score	0.63
Percentage_of_women_on_board	0.50



So far it is the most interesting industry in our analysis. Only total greenhouse gas emissions intensity has a weak linear relationship with the CAR of banking industry. The rest have moderate, and the most important, the upper tier one.

Chemicals

	CAR
CAR	1.00
Tot_GHG_CO2_Emissions_Intensity	-0.56
Social_disclosure_score	-0.05
Government_disclosure_score	0.73
Tot_Sal_n_Bns_Pd_to_Execs	0.45
ESG_disclosure_score	0.58
Percentage_of_women_on_board	-0.50



Beside social disclosure score, the chemical industry stock's CAR has a moderate linear relationship with the rest of the indexes although with different directions.

IV. CONCLUSIONS

The timeframe immediately after the United Kingdom's market crash was in the main focus of the research and thus event window 1 was thoroughly studied. For event window 1 the Cumulative abnormal return throughout the dataset is different from the average with relatively high volatility. It gives a sense that the stocks' reaction was not homogeneous but differed significantly.

For companies with cumulative abnormal return (CAR) below 41%, the spread was within 49 points, which constitutes about 25% of our dataset. Supposedly it is a sign that the negative magnitude caused by the event was very different for companies falling under this interval. About 25% of companies in the dataset had a relatively insignificant negative effect caused by the event ($-0.18 < CAR < -0.07$) and the spread was within only 11 points.

Approximately 25% of companies in the dataset performed better than expected and their cumulative abnormal gains ranged within 37 points and the highest CAR was 30%.

Analysis of a whole bunch of the companies with their cumulative abnormal returns without dividing by industry shows that there is only a weak positive linear relationship with ESG related

indexes. The strongest among weak are government disclosure score (0.23) and ESG disclosure score (0.23).

When it comes to correlation analysis by industry the picture is as following: 1) Oil and gas, chemicals, and banking industry CAR have an upper-tier moderate positive linear relationship with ESG disclosure score. Probably during crisis investors to these industries have more trust in the companies which are open and ready to disclose more data. 2) Professional services industry CAR has a strong positive and trading companies and distributors have an upper-tier moderate positive linear relationship with the percentage of women on board. These industries require artistic skills and creative approaches, so investors trust that women are better in managing this firms in the time of turbulence. 4) Interesting to note exactly the same correlation coefficient of 0.50 with different directions for chemicals (negative direction) and banks (positive direction). It means that more women on the board is good for banking and is bad for the chemical industry. 5) The most interesting industry in the analysis is banking. Only total greenhouse gas emissions intensity has a weak linear relationship with the CAR of the banking industry. The rest have moderate, and the most important, the upper-tier one. Of course, we noticed that total greenhouse gas emissions are more important for the chemical and oil and gas industry rather than (negative linear relationship) than for food companies. But the surprise was that trading companies CAR has the highest negative linear relationship with the total greenhouse gas emissions among analyzed ones (-0.62). This matter needs to be studied in further research.

Media, professional services, and oil and gas companies are more sensitive to government disclosure scores than the others.

Again, having a linear relationship of CAR with any ESG indexes doesn't mean a causal relationship where the ESG index influences CAR directly. But it gives an idea to look deeper at this matter and make a comprehensive study.

Running separate regression for each ESG related index for each window showed that only the percentage of women on board and salaries to executives are statistically significant. It was a reason to include those two indexes as independent variables along with control variables. Overall, the dataset contained 273 observations (companies). 4 regression analyses were completed individually for chosen 4 event windows. Event window 1 (during a market crash and the following 3 months) shows a statistically significant (p -value $< .01$) relationship with total salaries and bonuses paid to executives. It is important to note that the magnitude of the coefficient is very small ($1.2726E-08$). Probably it is because investors trust that highly paid top-management can help companies to survive in times of economic turbulence. The representation of women on board and financials as control variables do not show such relation to abnormal returns. It means that investors tend to judge the performance based on their psychological perception rather than based on fundamental indicators.

Three months after the market crash (Event window 2) percentage of women on board (p -value $< .1$) started influencing abnormal returns although the significance was not as strong as for salaries paid to executives for EW1. The magnitude of the coefficient is negative. One probable explanation for this phenomenon might be the perception of investors that man's psychology can more adequately respond to the challenges dictated by the crisis time. Financial indicators again didn't show signs of influence on abnormal returns of the analyzed companies. Again, it means that shortly after the crash the investors tend to judge the performance based on their psychological perception rather than based on fundamental indicators. Half a year after the market crash, the percentage of women on board starts playing an even bigger role (p -value $< .05$) than in the

previous period (with a higher coefficient and negative sign). Again, the same assumption as in the previous period. At this period majority of financial indicators starts influencing abnormal returns of the companies, namely, dividends paid, leverage, cash, and ROE. It means that the psychological component begins to recede giving way to reasoning. The last event window covering the whole year after the market crash shows no influence of attenuation of the influence on the company's performance. At this period none of the ESG factors has an influence on abnormal returns. In a long run, fundamental ratios as Tobin's q and ROE shows the influence on companies' performance. It means that the psychological component totally vanishes and gives a way to reasoning and cool-headed analysis. Interesting to notice that through all periods the influence of company size is not visible. Probably it is because the time of untouchable holy cows and too-big-to-fail companies passed away irrevocably. Thus, the size of the company does not give any warranty from bankruptcy.

The main conclusion is that ESG related factors play a role during the first 6 months after the crisis but their influence attenuates the further the date of the actual event. In this study, investors in the long term pay attention to the fundamentals of financial performance. While in other cases the opposite may happen, i.e. it is possible that with the passage of time and the development of ESG, in the long run investors will rely on ESG factors.

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Appendix

Event window 1

R Square	0,17076414
Adjusted R Square	0,145635781
Standard Error	0,317799031
Observations	273

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95,0 %</i>	<i>Upper 95,0%</i>
Intercept	0,367110521	0,05427656	6,763702835	8,62461E-11	0,473980551	0,26024	0,47398	0,26024
Percentage of Women on Bd	0,002619543	0,001916662	1,366721283	0,172875463	0,001154347	0,006393	0,00115	0,006393
Tot Sal & Bns Pd to Execs	1,2726E-08***	3,39138E-09	3,752450198	0,000215328	6,0484E-09	1,94E-08	6,05E-09	1,94E-08
Tobin's q	0,005314156	0,007153357	0,742889753	0,45820896	0,008770737	0,019399	0,00877	0,019399
Size (Market cap)	1,2367E-12	1,00929E-12	1,225310611	0,221550253	7,5059E-13	3,22E-12	7,5E-13	3,22E-12
Dividends Paid	3,55369E-11	3,06266E-11	1,160330752	0,246962389	9,58404E-11	2,48E-11	9,6E-11	2,48E-11
Leverage	0,007896811	0,012842977	0,614873887	0,539167613	0,033184512	0,017391	0,03318	0,017391

Cash	- 1,9888E- 12	1,48352E -12	- 1,340599 448	0,181202 98	- 4,90983E -12	9,32E- 13	- 4,9E- 12	9,32E- 13
ROE	0,014368 873	0,063290 621	0,227030 056	0,820576 074	- 0,110249 757	0,1389 88	- 0,110 25	0,1389 88

Event window 2

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0,301653
R Square	0,090994
Adjusted R Square	0,063449
Standard Error	0,229418
Observations	273

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	8	1,390939	0,173867	3,30341	0,001294
Residual	264	13,89503	0,052633		
Total	272	15,28597			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>
Intercept	0,170399	0,039182	4,348907	1,96E-05	0,09325
Percentage of Women on Bd	-0,00259*	0,001384	-1,86873	0,062768	-0,00531
Tot Sal & Bns Pd to Execs	-3,8E-09	2,45E-09	-1,56903	0,117838	-8,7E-09
Tobin's q	-0,00055	0,005164	-0,10598	0,915679	-0,01072
Size (Market cap)	-9,1E-13	7,29E-13	-1,25211	0,211639	-2,3E-12
Dividends Paid	1,46E-11	2,21E-11	0,66215	0,508453	-2,9E-11
Leverage	0,004033	0,009271	0,43505	0,663882	-0,01422
Cash	4,88E-13	1,07E-12	0,456126	0,648674	-1,6E-12
ROE	0,010541	0,045689	0,230715	0,817715	-0,07942

Event window 3

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0,301963
R Square	0,091182
Adjusted R Square	0,063642
Standard Error	0,281111
Observations	273

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	8	2,09309	0,261636	3,310881	0,001266
Residual	264	20,86212	0,079023		
Total	272	22,95521			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>
Intercept	0,178158	0,048011	3,710808	0,000252	0,083626
Percentage of Women on Bd	-0,00345**	0,001695	-2,03551	0,042798	-0,00679
Tot Sal & Bns Pd to Execs	1,04E-10	3E-09	0,034759	0,972298	-5,8E-09
Tobin's q	0,00198	0,006328	0,312857	0,754637	-0,01048
Size (Market cap)	-6,9E-14	8,93E-13	-0,07699	0,938691	-1,8E-12
Dividends Paid	-5E-11*	2,71E-11	-1,83816	0,067162	-1E-10
Leverage	0,025528**	0,01136	2,247088	0,025461	0,003159
Cash	-3,2E-12**	1,31E-12	-2,42005	0,016194	-5,8E-12
ROE	-0,13313**	0,055984	-2,37792	0,018123	-0,24336

Event window 4

SUMMARY
OUTPUT

<i>Regression Statistics</i>	
Multiple R	0,301328
R Square	0,090798
Adjusted R Square	0,063247
Standard Error	1,412799
Observations	273

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	8	52,62381	6,577976	3,295579	0,001323
Residual	264	526,9441	1,996		
Total	272	579,5679			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95,0%</i>	<i>Upper 95,0%</i>
Intercept	-0,67063	0,24129	2,77934	0,005839	-1,14573	0,19553	1,14573	0,19553
Percentage of Women on Board	0,001183	0,008521	0,138842	0,889681	-0,01559	0,01796	0,01559	0,01796
Total Salaries & Bonuses Paid to Executives	1,02E-08	1,51E-08	0,674459	0,50061	-2E-08	3,99E-08	-2E-08	3,99E-08
Tobin's q Size (Market cap)	0,070762**	0,031801	2,225176	0,026915	0,008147	0,133378	0,008147	0,133378
Dividends Paid	-4,2E-12	4,49E-12	0,93325	0,351542	-1,3E-11	4,65E-12	-1,3E-11	4,65E-12
Leverage	-6,9E-11	1,36E-10	0,50345	0,615066	-3,4E-10	2E-10	-3,4E-10	2E-10
Cash	0,082579	0,057094	1,446361	0,149262	-0,02984	0,194997	0,02984	0,194997
ROE	4,77E-12	6,6E-12	0,723714	0,469882	-8,2E-12	1,78E-11	-8,2E-12	1,78E-11
	0,8652**	0,281363	3,07502	0,002326	-1,4192	-0,3112	-1,4192	-0,3112