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Influence of ESG controversies on stock returns

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Abstract

Over the last few years, there seems to be a movement towards an increase in interest in climate change and corporate social responsibility. This is reflected partly in the rise of Environmental, Social, Responsibility (ESG) ratings and managed funds. With a rise in interest, controversies regarding ESG controversies are bound to be brought to light. Hence, this paper considers the sensitivity of stock price to ESG controversy events. Multiple models are considered to form a quantification of Abnormal Returns (AR). From these Average Abnormal Returns (AAR) over all the events are constructed. A significant decrease in the Cumulative Average Abnormal Return (CAAR) is found in a five-day time window around an ESG controversy event; the effects of the event and company characteristics on the final influence of the controversy are also studied. This is done by regressing the characteristics of the event and company on the Cumulative Abnormal Returns (CAR) the event causes in the time window of five days prior to five days after the event. None of the researched characteristics are found to be significant.

Contents

1 Introduction

In recent years, with the adoption of the Paris Climate Agreement and the United Nations Sustainable Development Goals (SDGs) in 2015, sustainability and social issues have been high on the agenda. It is becoming increasingly common for Environmental, Social, and Governance (ESG) factors to be included in the ranking and valuation of companies in the financial sector. This follows initiatives such as the United Nations Principles for Responsible Investment (UN PRI), which have led companies to consider ESG policies and issues as an aspect distinct from their corporate social responsibility (CSR) UNPRI (2018)). The growing influence of ESG on financial markets can best be seen by the increase in the total value of responsible investment assets in the US. From 2014 to 2018, these assets grew at a compound rate of 16% to reach 11.995 trillion dollars (Cui and Docherty (2020)). We are expected to continue to see this growing influence of ESG.

Analysis of the interaction between ESG and corporate financial performance (CFP) typically involves two approaches. First is the simulated back-test method, where a portfolio is created on ESG criteria, or highly rated ESG firms are compared with lower-rated firms. Overall the findings are consistent with a positive impact. For example, in most cases improving ESG outcomes results in a higher firm value (Yu et al. (2018)). The stocks with higher ESG ratings also tend to have a lower stock crash risk (Murata and Hamori (2021)). It also seems that steering away from stocks with a high level of controversy increases performance (De Franco (2020)). Giese et al. (2019) find that their portfolio strategy based on the ESG tilt, the wish to tilt towards higher ESG companies, and the momentum strategy outperforms the MSCI World Index from 2007 to 2015. However, during non-crisis periods, ESG-based ETFs tend to underperform compared to conventional mutual funds (Nofsinger and Varma (2014)). Mixed results are found by Friede et al. (2015) regarding performance results of ESG stocks. Limkriangkrai et al. (2017) do not find any significant relation between CFP and the ESG rating of a company.

The second approach compares the performance of ESG managed funds with conventional funds (Friede et al. (2015); Niblock et al. (2020);Humphrey et al. (2012)). However, according to Friede et al. (2015), this approach is thought to provide a less reliable measure of the pure ESG effect. Friede et al. (2015) and Humphrey et al. (2012) both find that ESG managed funds do not under-perform comparing to conventional ones.

Overall, high ESG ratings tend to lead to more stable processes at the firm level, and a negative correlation between highly ESG-rated companies and their future crash risk is found by Kim et al. (2014). On a national level, it also seems beneficial to have companies with higher ESG ratings. Encouraging the adoption of ESG practices at the firm level appears to improve macroeconomic performance (Zhou et al. (2020)).

Less researched is the impact of ESG news events on firms. Media sentiment seems to influence the way a stock is priced. For example, Tetlock (2007) shows that strongly negative media sentiment predicts a downward movement in stock in the following weeks. This effect should, however, be mean reverting. This same property is found for ESG news – Cui and Docherty (2020) suggests that the growth of ESG investing might create a market inefficiency. Salience theory suggests that investors overweight the extreme probabilities associated with salient events. Hence after a negative announcement, the stock will drop significantly and returns to the mean. The mean returning property is supported by Aouadi and Marsat (2018), they even find that ESG controversies positively affect the firm value. Since the company implicated in the scandal will enjoy more publicity and become better known (succès de scandale). On the flip side, strong value seems to decline in the long run with many controversies (Gloßner (2018)). Only negative ESG news significantly influences the stock price (Capelle-Blancard and Petit (2019)). Also, Wong and Zhang (2022) finds that firm characteristics matter for the adverse reaction of stock markets to ESG controversies.

These issues inform the research question:

How does ESG news affect a firm's stock performance, and can you model the short-term effect of the news on the abnormal returns?

This study takes an approach similar to that of Capelle-Blancard and Petit (2019). However, the data set used in this paper is more up-to-date than the 2002 to 2010 series used in the earlier study. This paper considers data from March 2020 till December 2021. The prominence of ESG has been rising steadily in the intervening decade, and the number of green and social policies and treaties have increased significantly. In addition to considering more recent data, this study aims to improve estimates of abnormal returns by applying more advanced methods than those used in Capelle-Blancard and Petit (2019).

This paper has the following setup. First, in Section 2 the hypothesises are developed. The hypotheses all relate to the effect that ESG-controversy news events have on a firm his market value. There is also an examination of whether this differs for firm characteristics such as the continent on which a firm is listed, the industry a firm belongs to, and the size of the firm. Secondly, in Section 3 the data used is discussed in depth. The data used in this research are the ESG-controversy events between March 2020 and December 2021, as defined by Thomson Reuters, alongside firm information and the stock prices. Thirdly, in Section 4 the methodology used is explained. This research applies multiple models to the analysis of abnormal returns. The abnormal returns in a time window of five days before an ESG event are studied to capture possible insider trading and combined with the five days after the event to measure cumulative abnormal returns. The cumulative abnormal returns are then regressed upon the characteristics of the used firms and the characteristics of the event. The regression is a naive approach with equally weighted events. Then in Section 5, the results are discussed. The first finding is that the occurrence of an event has a significant negative effect on the cumulative abnormal return. The researched characteristics are found to be insignificant. Finally, in Section 6 the paper is concluded. A conclusion presented is that ESG events do have a significant negative effect on the short-term cumulative abnormal returns of a firm. However, none of the characteristics are found to be significant.

2 Hypotheses Development

In this section, the hypotheses used in this paper are developed. To do this, some definitions need to be given. First and foremost, what is understood by an ESG controversy? An ESG controversy is a subcategory of news events with negative sentiment within an ESG topic. The set of topics used is defined in Section 3.1 in Table 1. The categorization adopted is that used by Thomson Reuters. Second, ESG reputation is defined as the score the company receives from Thomson Reuters, ranging between [0,100]. The reputation is based upon the pillars defined by Refinitiv (2021), with a higher grade being a better reputation. The ESG reputation from Thomson Reuters is a company's relative performance in all ESG pillars across all industries. In the third place, ESG industry reputation is the average ESG reputation of companies in a particular industry.

2.1 Significant Impact

Solomon (2012) shows that positive news coverage of a company can increase the stock price. Jory et al. (2015) finds an increase in stock volatility around the news of a scandal. It seems to be the case; that news affects the stock price, at least in the short run. For ESG news, the common view is that it impacts firm value. For example, Cui and Docherty (2020) state that the stock market overreacts to ESG controversy events. To test whether the ESG controversy events in the used period significantly impact the stock price. The following hypothesis is tested:

ESG controversy events had a negative impact on firms' market value between 1st of March 2020 and 22nd of December 2021.

2.2 Across Industries

The report of UNPRI (2017) finds that ESG factors affect each industry differently. For example, the energy, food and drink, and healthcare sector show positive results for having a high ESG rating. In contrast, a negative impact of ESG factors on returns is seen in the car, banking, durables, and insurance sectors. Wong and Zhang (2022) Find that controversies affect companies in each industry differently. Also, Shynkevich et al. (2015) find that including the sub-industry in the model for predicting the news effect improves the accuracy. There are two views in the literature on how stock prices are affected across different industries; the goodwill hypothesis and the boomerang hypothesis. Hence, this hypothesis is divided into two sub-hypotheses. Therefore, the hypothesis is that the news should affect different industries differently in either case.

2.2.1 Goodwill Industries

First is the "Goodwill Hypothesis". Some industries, especially those with good average ESG reputations, have shown less stock price sensitivity than those with bad average ESG reputations. A company with a good reputation can draw on its "goodwil" and shows limited vulnerability to ESG controversy. At the same time, a company with a bad reputation cannot (Jones et al. (2000)). This leads to the first sub-hypothesis:

ESG controversy effects differ across industries, with the industries with a lower average ESG reputation being less affected by an ESG controversy.

2.2.2 Boomerang Industries

The second is the "Boomerang Hypothesis". Being the best in the class results in the most severe scrutiny when you fail. Specifically, when a company within a high average reputation industry is implicated in a scandal, the result is a large downward move in the stock price Baron and Diermeier (2007). This leads us to the second sub-hypothesis:

ESG controversy effects differ across industries, with the firms in industries with a lower average ESG reputation being more vulnerable to ESG controversies.

2.3 Across ratings

The way a company ESG reputation works has two explanations. The Boomerang and Goodwill hypotheses are explained in Section 2.2.

2.3.1 Goodwill ratings

First is the goodwill explanation. Companies with good reputations can "borrow" from their goodwill to offset negative reactions. Hence the hypothesis states:

ESG controversy effects differ across ratings, with the lower ESG rated companies being less affected by an ESG controversy.

2.3.2 Boomerang ratings

Second is the boomerang explanation. Companies with good reputations suffer more from failing to deflect controversy. Hence the hypothesis states:

ESG controversy effects differ across ratings, with the lower ESG rated companies being more affected by an ESG controversy.

2.4 Across sizes

Small companies might profit more from the *succès de scandale* effect, as stated in the research of Gloßner (2018). The assumption is that larger companies are already better known and profit less from public attention than small companies. Therefore the big companies will mostly have a negative effect from controversies. The small companies will experience little to no adverse effect, and a small positive impact from an ESG controversy. This results in the following hypothesis:

Smaller companies experience fewer adverse effects than big companies from ESG controversies.

2.5 Source

Not all sources are created equal. Some sources have more impact than others. Huberman and Regev (2001) show that reporting by the New York Times resulted in a massive spike in the stock price, despite prior publication, five months before, in Nature. It seems probable that similar patterns will be shown for ESG controversies. This results in the following hypothesis:

When a leading financial paper reports an ESG controversy, this will have significantly more effect on the stock price than any other news source publication.

As a proxy for "leading financial paper" Reuters is used. The dataset contains two types of known publishers. The first one is Reuters and the other ones are self-published.

2.6 Across Continents

Park and Jang (2021) show that there is variation in sensitivity to ESG across countries. One important element of how ESG affects stock prices is the attitude toward ESG within a country. Park and Jang (2021) make a differentiation between developed and emerging economies based on attitudes and priorities. Also, De Franco (2020) finds that steering away from stocks with a high controversy rate within Europe or North America increases portfolio performance. The result is not found in corresponding data for the rest of the world, which suggests that stocks listed in North America and Europe are more sensitively exposed to controversies. It seems reasonable to research:

Companies listed in Europe or North America experience more significant adverse reactions towards ESG controversies.

3 Data

There is no universal standard for ESG reporting, although there is a movement starting to standardise ESG reporting. The International Accounting Standards Board(IASB) has proposed the creation of a Sustainability Standards Board (SSB) Barker et al. (2020). The absence of any universal standard gives leeway to opinion. Part of the data, especially the scores, and what is considered a controversy, depends on the definitions and methodology of the company used for the data. Since the scores and controversies are primarily dependent on qualitative judgements, in this paper, the methodology of Refinitiv (2021) is used both for the controversy and score. Refinitiv/Eikon/Thomson Reuters data-set is used because of the excellent reputation the company enjoys for ESG data and its availability. The events used range from the 1st of March 2020 to the 22nd of December 2021. These dates are chosen because of the data access. The rest of this section focuses on a more in-depth view of the data.

3.1 Events

The events considered are shown in Table 1.

Type	**#Observations**
Recent Anti-Competition Controversy	254
Recent Shareholder Rights Controversies	152
Recent Environmental Controversies	117
Recent Consumer Controversies	110
Recent Business Ethics Controversies	109
Recent Privacy Controversies	62
Recent Wages Working Condition Controversies	58
Recent Intellectual Property Controversies	54
Recent Tax Fraud Controversies	46
Recent Employee Health & Safety Controversies	43
Recent Diversity Opportunity Controversies	41
Recent Responsible Marketing Controversies	39
Recent Customer Health & Safety Controversies	36
Recent Public Health Controversies	27
Recent Accounting Controversies Count	25
Recent Human Rights Controversies	20
Recent FDA Warning Letters	18
Recent Mgt Compensation Controversies	16
Recent Insider Dealings Controversies	16
Recent Critical Countries Controversies	8
Recent Product Access Controversies	7
Recent Child Labor Controversies	6
Total	1264

Table 1: All of the events used sorted by type

These events are found across 802 publicly traded companies worldwide. The companies will receive a more in-depth review in Section 3.2. Only the recent events are considered since these should cover all the events found by Thomson Reuters within that year. Examples for each type of event can be found in the appendix.

3.2 Companies

The companies used are publicly traded companies with at least one controversy listed by Reuters from the list of controversies seen in Table 1 between 1 March 2020 and 22 December 2021. This is a list of 802 companies, with the descriptive statistics as seen in Table 2. ESG is rated on a scale from 1 to 100 based on the ESG pillars used by the rating companies. Each company weights pillars differently; in this instance, the method of Refinitiv (2021) is used. The total assets in 2021 in USD are also retrieved from the Thomson Reuters database. Most companies are in North America, accounting for about half of the data set. Europe accounts for another third, and Asia for sixth. The remaining companies are variously located (see Appendix). In addition to the company info, stock prices are also obtained from Datastream. These give the company's average price throughout the day, beginning on the 1st of March 2020 and ending on the 22nd of December 2021.

Variable	Mean	Std. Dev.	Min	Max	Median
ESG rating	57.65	21.65	1.41	94.79	59.77
Total Assets (USD)	2.56e10	4.6e10	1.97e6	2.92e11	6.34e9

Table 2: Descriptive statistics of the companies

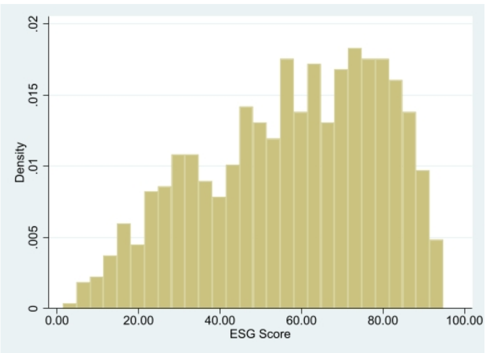

Figure 1: Distribution of ratings

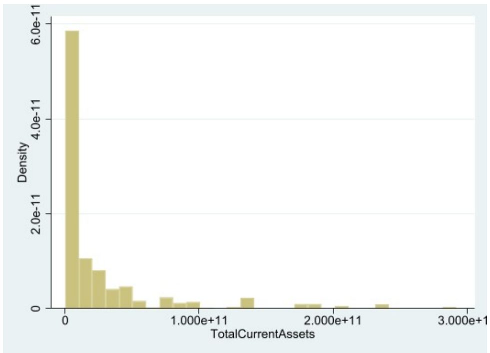

Figure 2: Distribution of assets

3.3 Data Across Industries

To research if the effect of the events differs across industries, the Industry Classification Benchmark (ICB) industry name is used to categorize the companies by sector. The ICB industry name is a categorization method of Reuters. The number of companies that belong to each industry can be seen in Figure 3. This categorization is then used in the regression to assess whether the industry a company belongs to has a significant effect on the CAR see Section 4.3.

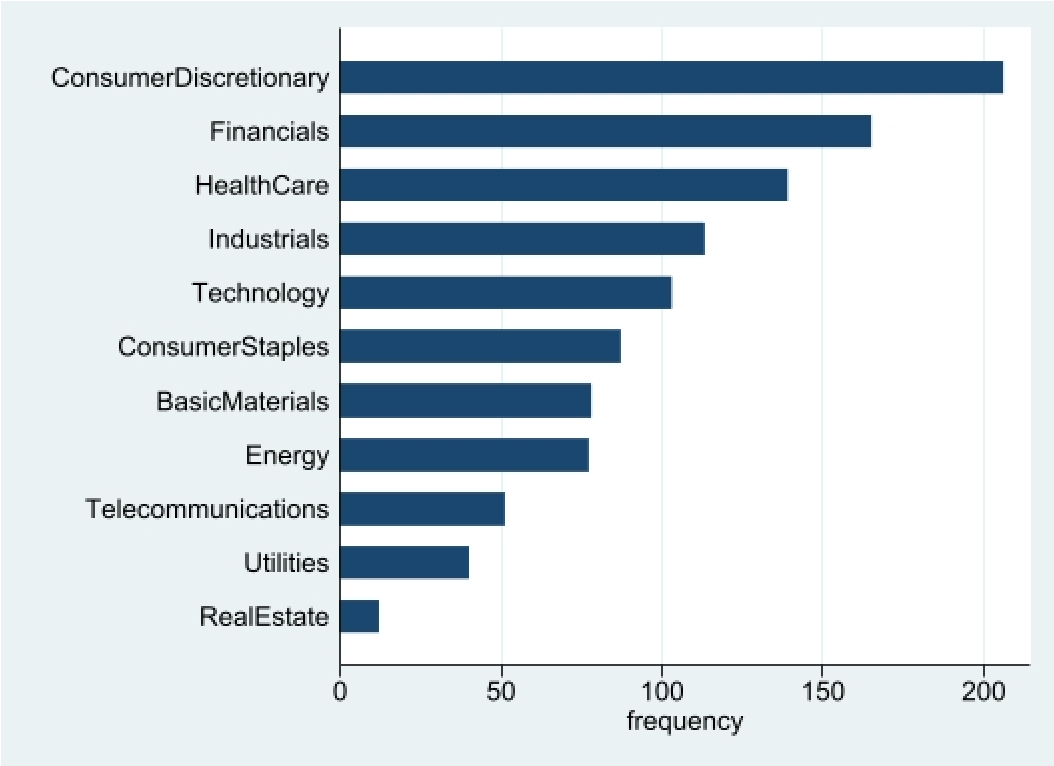

Figure 3: The frequency of the industry to which companies in the dataset belong.

3.4 Data fama-french factor models

To estimate the abnormal returns, the Capital Asset Pricing Model (CAPM), the three-factor model Fama and French (1996), and the five-factor model Fama and French (2015) are used. These models need factor information retrieved from the website of French (2022).

4 Methodology

Two steps are used in order to research the effect of ESG controversies and different characteristics on the stock price. First, the direct impact of the ESG controversy on stock price is analysed utilising an event study methodology. Then the characteristics of the controversy and or firms are added. This is similar to the approach taken by Capelle-Blancard and Petit (2019), Krüger (2015), and MacKinlay (1997).

4.1 Cumulative Abnormal Returns

To calculate the abnormal returns, the "normal" returns need to be estimated. To do this, multiple models will be used. First the CAPM model, then the three-factor model Fama and French (1996), and afterwards the five-factor model Friede et al. (2015). The difference between the expected returns at the time of the event and the real returns is considered the Abnormal Returns (AR). The models for the AR hence given by:

$$AR^i_{j,t} = R_{j,t} - E[R_{j,t}]^* \tag{1}$$

Where $AR^i_{j,t}$ measures the stock price response to event i, for company j, at time t. $E[R_{j,t}]^*$ are the expected returns of the company j at time t. These expected returns are determined by the methods previously described. The first method used is CAPM and is given by:

$$E[R_{j,t}] = RF_t + \beta_j(E[R_m] - RF_t) \tag{2}$$

Where the RF_t is the risk free rate at time t, β_j is the β of the stock, and $(E[R_m] - RF_t)$ is the market risk premium. Then three-factor model model is given by:

$$E[R_{j,t}] = RF_t + \alpha_{i,t} + \beta_1(R_{Mt} - RF_t) + \beta_2 SMB_t + \beta_3 HML_t + \varepsilon_{i,t} \tag{3}$$

With SMB being small minus big, the difference between the return spread of the stocks with large and small capitalisation, HML high minus low regarding the difference between spread for companies with a high book to market ratio versus those with a low book to market ratio. Finally, the five-factor model is given by:

$$E[R_{j,t}] = RF_t + \alpha_{i,t} + \beta_1(R_{Mt} - RF_t) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 RMW_t + \beta_5 CMA_t + \varepsilon_{i,t} \tag{4}$$

In addition to the three-factor model variables, RMW, the return spread between profitable and unprofitable companies, and CMA, the return spread between aggressive and conservative investing companies, are also added. All the parameters are estimated based on the 60 days before the event window starts. Capelle-Blancard and Petit (2019) states that this measure is the most representative of a stock.

The abnormal returns are aggregated over the (2n+1)-day period around the event. With the n days before the event, to the account for possible insider information, and n days after the event.

$$CAR^i_{j,t}[-n, n] = \sum_{\tau=t-n}^{t+n} AR^i_{j,\tau} \tag{5}$$

With τ being the moment of the event and $[-n, n]$ the window around the event. The days before the event are incorporated to cope with the possibility of insider trading.

4.2 Significant impact events

To assess whether the events have a significant effect on the stock returns. The average abnormal returns (AAR) for each day in the time window around the event are calculated, and the cumulative average abnormal return (CAAR) for both is tested if they differ significantly from 0.

The AAR from all the events is calculated by:

$$AAR_{\tau} = \frac{1}{N} \sum_{i=1}^{N} AR^{i}_{j,\tau} \tag{6}$$

The AAR_{τ} is the average abnormal return over all the events at time τ in the time window $[-n, n]$.

The cumulative average abnormal return (CAAR) is used to assess whether $CAR^{i}_{j,s,t}[-n, n]$ differs significantly from 0. The CAAR is formed by:

$$CAAR_{t}[-n, n] = \sum_{\tau=t-n}^{t+n} AAR_{\tau} \tag{7}$$

If the CAAR does differ significantly from zero, then the collection of events is likely to have at least a significant short-term impact on the stock returns.

4.3 Regression of hypotheses

To determine the effect of each characteristic on the stock price, the regression-based approach is adopted in Capelle-Blancard and Petit (2019). This would result in:

$$CAR^{i}_{j,t}[-n, n] = \alpha + \gamma x_i + \Lambda' Y^{i}_{j,t} + \varepsilon_{i,j,t} \tag{8}$$

Where $CAR^{i}_{j,t}[-n, n]$ is the cumulative abnormal return for company j, at time t, for event i. These cumulative abnormal returns are centered over a $(2n + 1)$-day period – see equation 5. The γ is the parameter for Reuters, which is a dummy that indicates if the controversy is published by Reuters. The $\Lambda' Y^{i}_{j,t}$ are company-specific measurements at the time of the event for the event. The parameter Λ is given by:

$$\Lambda = [\lambda_1, \lambda_2, \lambda_3, ..., \lambda_{13}] \tag{9}$$

In the next subsections each of the parameters will be further specified. Note that the $CAR^{i}_{j,s,t}$ are formed by three models as mentioned in Section 4.1.

4.3.1 Across Ratings

The CAR is regressed upon the rating of the company which is a number between [0,100]. This will control whether the score has a significant effect on the CAR. This variable is represented by parameter λ_1.

4.3.2 Across Industries

After the reputation of an industry is determined (a rating between [0,1]), depending on the average ESG ratings within the industry. The reputation will be determined based on a rolling window of each year. The CAR is regressed on the industry reputation. Industry reputation is a categorical variable, and hence is included in the regression by using multiple dummies. This variable is represented by λ_2 till λ_{11}, since there are 11 categories of industries used.

4.3.3 Across Sizes

The logarithm of a company's total assets is the regressor to control the hypotheses for size. This is represented by λ_{12}

4.3.4 Across Continents

The continents are used as a dummy to represent whether a company is listed in the continent. This paper differentiates between two continents due to data availability. North-America & Europe, versus the rest of the world. This variable is represented by λ_{13}.

4.3.5 Across Source

This is a dummy with 1 when the source is Thomson Reuters and 0 when the source is another party. This is done because all the other parties are either self-reported or less highly regarded information sources. The parameter of this variable is represented by γ.

5 Results

In this section, the results of the study will be evaluated. A subsection is dedicated to every hypothesis of Section 2.

5.1 Results significant impact

For all used models, CAAR on a $[-5, 5]$ time window is significantly lower than 0. This can be seen in Figures 4, 5 and 6.

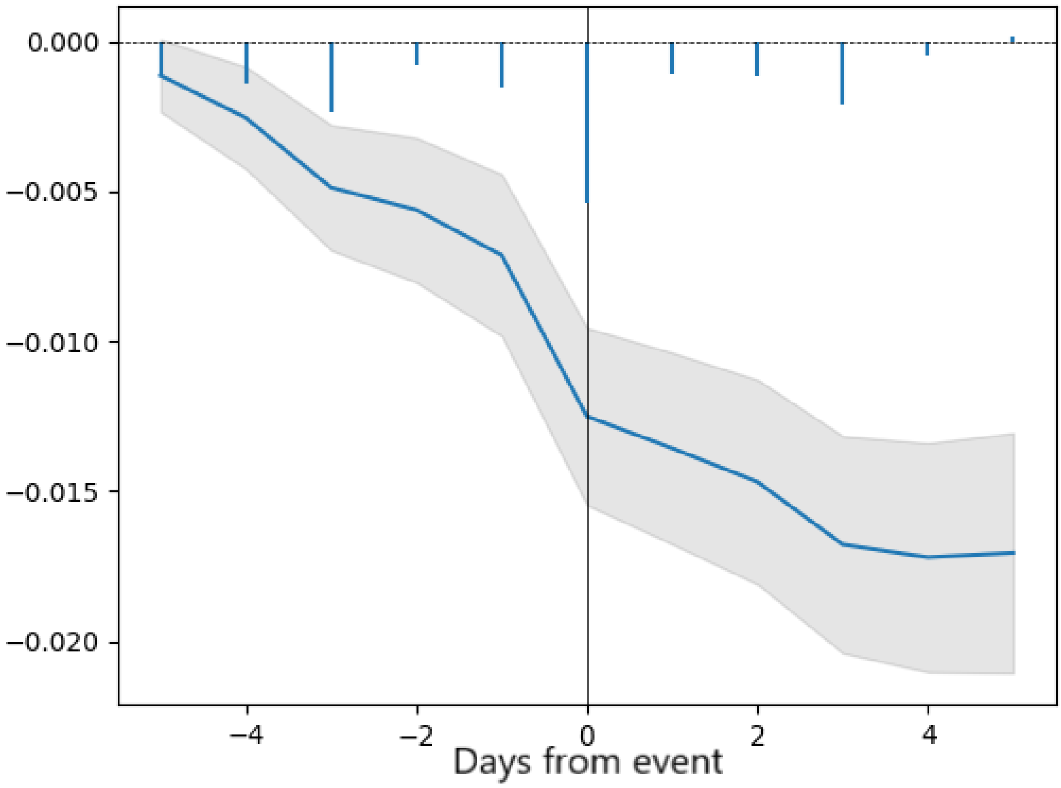

Figure 4: **CAAR and AAR with the CAPM model as basis for the expected returns see equation** (2)
The blue bars are the average abnormal returns, the blue line is the cumulative average abnormal returns, and the grey area surrounding the blue line is the 95% interval. The y-axis represents the days from the event, with 0 being the day of the event. The x-axis represents the size of the abnormal returns

In Figure 4, the results of the study are presented visually where day 0 is the day of the event. We can see that five days before and five days after the event, the CAAR is significantly lower. Furthermore, we see that on the day of the announcement of the controversy, the highest negative difference of the AAR is on the day of the event. This is shown by the blue bar. Table 3 shows the same result in numerical terms.

Days from event	AAR	S.E. AAR	CAAR	S.E. CAAR	T-stat	P-value
-5	-0.001	0.001	-0.001	0.001	-1.196	0.232
-4	-0.001	0.001	-0.003 *	0.001	-1.903	0.057
-3	-0.002	0.001	-0.005 ***	0.002	-2.981	0.003
-2	-0.001	0.001	-0.006 ***	0.002	-2.977	0.003
-1	-0.002	0.001	-0.007 ***	0.002	-3.379	0.001
0	-0.005	0.001	-0.013 ***	0.002	-5.416	0.000
1	-0.001	0.001	-0.014 ***	0.002	-5.441	0.000
2	-0.001	0.001	-0.015 ***	0.003	-5.510	0.000
3	-0.002	0.001	-0.017 ***	0.003	-5.934	0.000
4	-0.000	0.001	-0.017 ***	0.003	-5.774	0.000
5	0.000	0.001	-0.017 ***	0.003	-5.457	0.000

Table 3: **AAR and CAAR results of the CAPM model for expected returns see equation** (2)
* being significant on the 90%*, and 99%*** confidence interval. The index 0 denotes the day the event occurred.

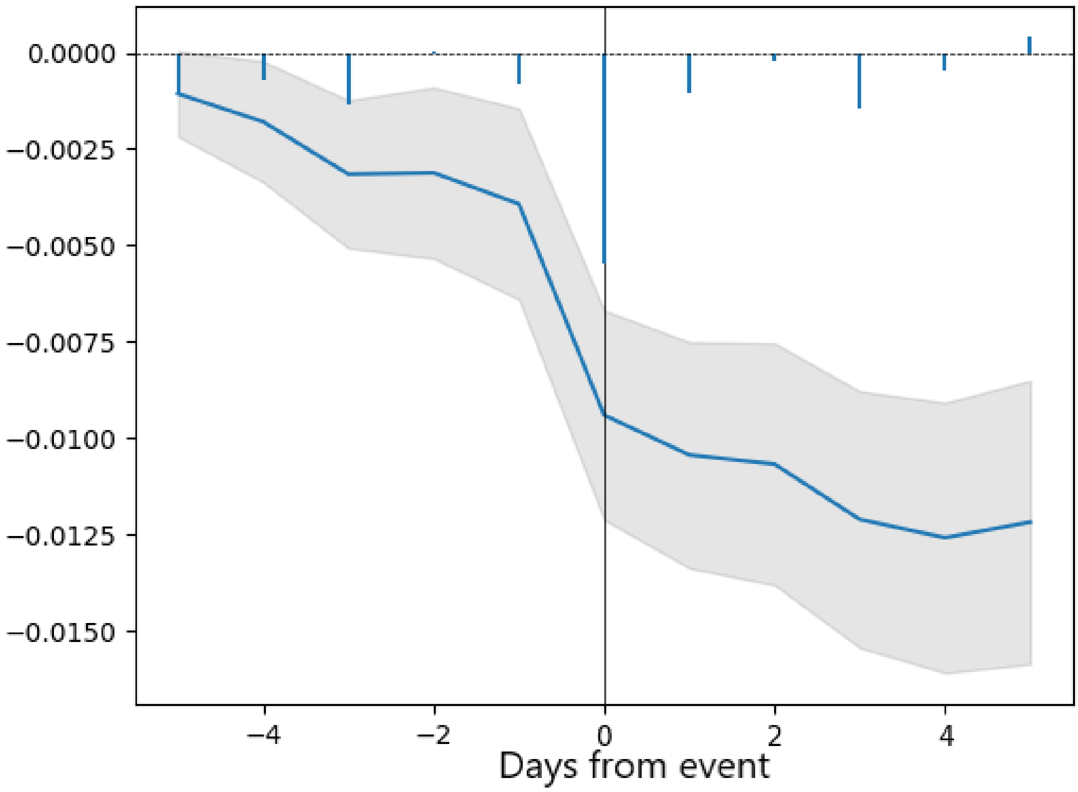

Figure 5: **CAAR and AAR with the FAMA three-factor model as basis for the expected returns see equation** (3)
The blue bars are the abnormal returns, the blue line is the CAAR, and the grey area surrounding the blue line is the 95% interval. The y-axis represents the days from the event with 0 being the day of the event. The x-axis represents the size of the abnormal returns.

In Figure 5 the results of the study are visually presented, where day 0 is the day of the event. We can see that five days before and five days after the event, the CAAR is significantly lower. Furthermore, we see that on the day of the announcement of the controversy, the deepest low dive is on the day of the controversy. Again, the same results are shown in numerical form in Table 4. We see a similar type of trend as is shown in the CAPM.

Days from event	AAR	S.E. AAR	CAAR	S.E. CAAR	T-stat	P-value
-5	-0.001	0.001	-0.001	0.001	-1.230	0.219
-4	-0.001	0.001	-0.002	0.001	-1.462	0.144
-3	-0.001	0.001	-0.003 **	0.001	-2.102	0.036
-2	0.000	0.001	-0.003 *	0.002	-1.800	0.072
-1	-0.001	0.001	-0.004 **	0.002	-2.026	0.043
0	-0.005	0.001	-0.009 ***	0.002	-4.434	0.000
1	-0.001	0.001	-0.01 ***	0.002	-4.557	0.000
2	-0.000	0.001	-0.011 ***	0.002	-4.360	0.000
3	-0.001	0.001	-0.012 ***	0.003	-4.664	0.000
4	-0.000	0.001	-0.013 ***	0.003	-4.597	0.000
5	0.000	0.001	-0.012 ***	0.003	-4.243	0.000

Table 4: **AAR and CAAR results of the FAMA three factor model for the expected returns see equation** (3)
* being significant on the 90%*, 95% **, and 99%*** confidence interval. The index 0 denotes the day the event occurred.

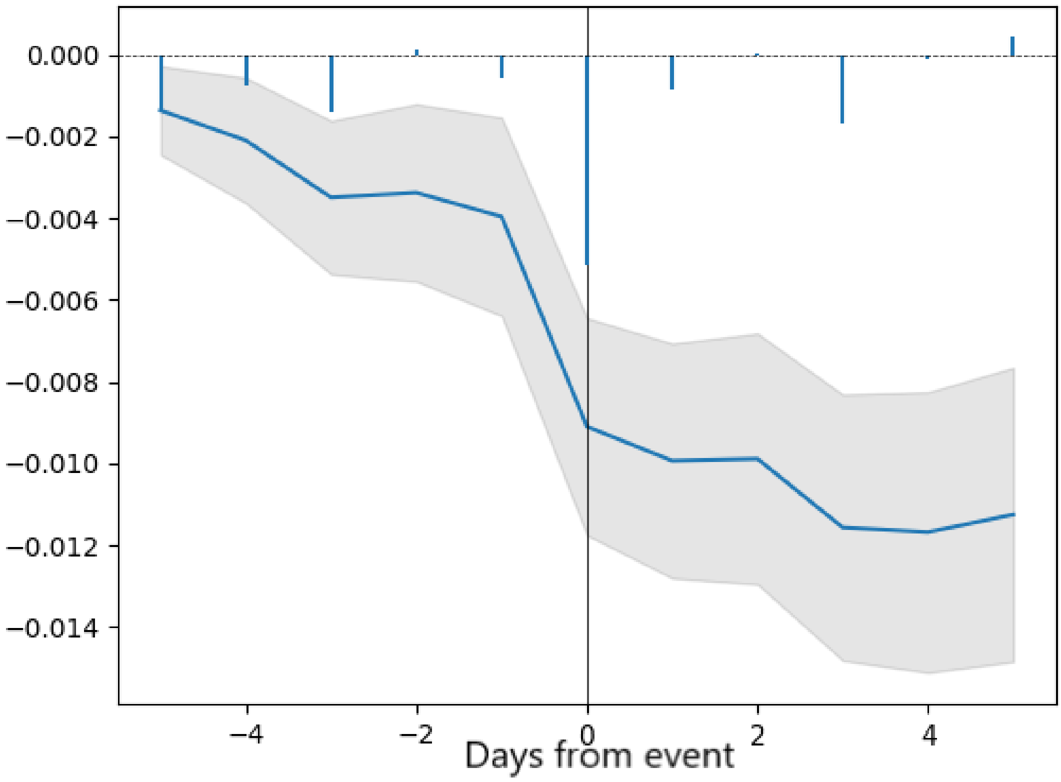

Figure 6: **CAAR and AAR with the FAMA five-factor model model as the basis for the expected returns. See equation** (4)
The bars are the abnormal returns, the blue line is the CAAR, and the grey area surrounding the blue line is the 95% interval. The y-axis represents the days from the event with 0 being the day of the event. The x-axis represents the size of the abnormal returns

In Figure 6, the results of the study are presented visually, where day 0 is the day of the event. We can see that five days before and five days after the event, the CAAR is significantly lower. Furthermore, we see that on the day of the announcement of the controversy, the deepest low dive in terms of AAR is on the day of the controversy. Around the fifth day, the stocks seem to be raising again. In Table 5 the same results are presented numerically. In addition, we see a similar trend to that shown in the CAPM and factor models.

Days from event	AAR	S.E. AAR	CAAR	S.E. CAAR	T-stat	P-value
-5	-0.001	0.001	-0.001	0.001	-1.606	0.108
-4	-0.001	0.001	-0.002 *	0.001	-1.748	0.080
-3	-0.001	0.001	-0.003 **	0.001	-2.380	0.017
-2	0.000	0.001	-0.003 **	0.002	-1.992	0.046
-1	-0.001	0.001	-0.004 **	0.002	-2.092	0.036
0	-0.005	0.001	-0.009 ***	0.002	-4.386	0.000
1	-0.001	0.001	-0.01 ***	0.002	-4.434	0.000
2	0.000	0.001	-0.01 ***	0.002	-4.128	0.000
3	-0.002	0.001	-0.012 ***	0.003	-4.554	0.000
4	-0.000	0.001	-0.012 ***	0.003	-4.363	0.000
5	0.000	0.001	-0.011 ***	0.003	-4.006	0.000

Table 5: **AAR and CAAR results of the FAMA five factor model for the expected returns see equation** (4)
* being significant on the 90%*, 95% **, and 99%*** confidence interval. The index 0 denotes the day the event occurred.

5.2 Results regression of hypotheses

In this section, the results of the hypothesis are presented for the three models used to predict the AR. The CAPM, FAMA three-factor model, and FAMA five-factor model. The base case is an event in a company listed on a continent that is neither Europe nor North America, by self-report and in the basic materials industry.

There were 28 outliers due to extreme market movement, a CAR[-5,5] of roughly -0.3 or lower or more than 0.3. This is approximately two standard deviations from the mean of all the CAR[-5,5]s. These were all marked, see the Appendix Table 12, from these outliers eight have been removed. Since these outliers were considered anomalies, the reason behind the removal can be found in the Appendix Table 13 and Section 5.3. In the Appendix all the models can be found with all the adaptions to the outliers. These outliers completely skew the estimations. Since, this paper mostly focuses on the less exceptional scale of controversy, they are not included.

5.2.1 CAPM

OLS Regression Results CAPM

Dependent variable	CAR[-5,5]			White Standard Errors
	coef	**S.E.**	**t-statistic**	**p-value**
Intercept(α)	-0.1284	0.0537	-2.39	0.0170
log(Assets)(λ_{12})	0.0049	0.0027	1.85	0.0650
ESG(λ_1)	0.0001	0.0002	0.61	0.5450
Developed(λ_{13})	-0.0096	0.0080	-1.21	0.2280
ConsumerDiscretionary (λ_2)	0.0036	0.0140	0.26	0.7980
ConsumerStaples (λ_3)	0.0121	0.0129	0.94	0.3500
Energy (λ_4)	0.0017	0.0144	0.12	0.9040
Financials (λ_5)	0.0438	0.0454	0.96	0.3360
HealthCare (λ_6)	0.0003	0.0171	0.02	0.9860
Industrials (λ_7)	0.0140	0.0155	0.90	0.3670
RealEstate (λ_8)	0.0598	0.0445	1.34	0.1790
Technology (λ_9)	-0.0031	0.0152	-0.21	0.8370
Telecommunications (λ_{10})	-0.0111	0.0206	-0.54	0.5890
Utilities(λ_{11})	-0.0149	0.0152	-0.98	0.3250
Reuters (γ)	0.0012	0.0068	0.18	0.8610

Number of obs	=	909
F(14, 894)	=	1.35
Prob >F	=	0.1741
R-squared	=	0.0249
Root MSE	=	.10527

Table 6: The regression of all the characteristics on the CAR[-5,5], as explained in equation (8), with the expected returns formed by equation (2). The full regression with all the characteristics of the regression can be found in the Appendix

Table 6 shows that only the $Intercept(\alpha)$ has a significant effect on the 95% scale for the CAPM model.

The $log(Assets)(\lambda_{12})$ as a proxy for size is not significant on a 95% scale, but on a 90%; a 1% increase in company size would lead to a 0.0049 increase on the CAR[-5,5]. This suggests that the larger a company is, the less negative influence on the stock price arises from an ESG controversy.

When Thomson Reuters (γ) publishes about a controversy, there seems to be a small positive effect on the CAR[5,5] on average; this will result in a 0.0012 increase in the CAR[-5,5]. However, this result is not significant.

The influence of a company's ESG-score (λ_1) is minimal, with an effect of 0.0001. This effect is insignificant. Even when the variable is clustered into three categories (Laggard, Average, and Leader(as defined by MSCI)), the variable does not significantly impact the clustered ratings have been tested but not further pursued.

For the variables indicating continent "*Developed*(λ_{13})", North America and Europe against the World, we find no significant effect.

Furthermore, we see no significant difference between the base case of a company in the basic materials industry to any other type of industry (λ_{2-11}).

The R-squared of the model is also reasonably low, indicating that the model does not explain the variance in the residuals very well. Aside from the R-squared, the F probability is also not smaller than 0.05, caused by the insignificant industry indicators. This is also found in both other models.

5.2.2 Fama Three-Factor model

OLS Regression Results FAMA three-factor model

Dependent variable	CAR[-5,5]			White Standard Errors
	coef	**S.E.**	**t-statistic**	**p-value**
Intercept (α)	-0.1091	0.0533	-2.05	0.041
log(Assets) (λ_{12})	0.0042	0.0027	1.58	0.115
ESG (λ_1)	0.0001	0.0002	0.28	0.783
Developed (λ_{13})	-0.0099	0.0080	-1.25	0.212
ConsumerDiscretionary (λ_2)	0.0117	0.0136	0.86	0.391
ConsumerStaples (λ_3)	0.0106	0.0129	0.82	0.410
Energy (λ_4)	0.0024	0.0144	0.17	0.868
Financials (λ_5)	0.0278	0.0400	0.70	0.487
HealthCare (λ_6)	0.0056	0.0166	0.34	0.736
Industrials (λ_7)	0.0120	0.0145	0.82	0.410
RealEstate (λ_8)	0.0619	0.0478	1.29	0.196
Technology (λ_9)	0.0077	0.0150	0.52	0.606
Telecommunications (λ_{10})	-0.0083	0.0220	-0.38	0.706
Utilities (λ_{11})	-0.0104	0.0150	-0.70	0.486
Reuters (γ)	0.0006	0.0064	0.10	0.924

Number of obs	=	909
F(14, 894)	=	0.93
Prob >F	=	0.5272
R-squared	=	0.0187
Root MSE	=	0.10227

Table 7: The regression of all the characteristics on the CAR[-5,5] such as explained in equation (8) with the expected returns formed by equation (3). The full regression can be found in the Appendix.

For the Fama three-factor model results, found in Table 7, we find results along the same line as the CAPM model in Section 5.2.1. Again, we see that only the $intercept(\alpha)$ is significant on a 95% scale.

However, the $log(Assets)(\lambda_{12})$ are not even significant on a 90% scale anymore. The $log(Assets)(\lambda_{12})$ have, on average, a positive effect of about 0.0042 on the $CAR[-5,5]$ for every percentage point a company increases in Assets; this is not significant, however.

This paper finds no significant variation by the continent on which a company is found.(λ_{13})

Again, there is no reason to assume that the industry a company performs in affects the $CAR[-5,5]$ if a controversy occurs. (λ_{2-11})

Also, no significant difference in whether the publisher is Reuters or self-reporting (γ) is found.

Finally, the ESG reputation of the company does not contribute significantly to the impact an ESG controversy has on the returns(λ_1).

5.2.3 Fama Five-Factor Model

OLS Regression Results FAMA Five-Factor model

Dependent variable	CAR[-5,5]			White Standard Errors
	coef	**S.E.**	**t-statistic**	**p-value**
Intercept (α)	-0.1126	0.0538	-2.09	0.037
log(Assets) (λ_{12})	0.0043	0.0027	1.60	0.109
ESG (λ_1)	0.0000	0.0002	0.08	0.933
Developed (λ_{13})	-0.0072	0.0082	-0.88	0.378
ConsumerDiscretionary (λ_2)	0.0137	0.0137	0.99	0.321
ConsumerStaples (λ_3)	0.0140	0.0128	1.09	0.274
Energy (λ_4)	0.0053	0.0144	0.37	0.715
Financials (λ_5)	0.0302	0.0396	0.76	0.445
HealthCare (λ_6)	0.0062	0.0169	0.37	0.712
Industrials (λ_7)	0.0136	0.0146	0.93	0.352
RealEstate (λ_8)	0.0621	0.0501	1.24	0.216
Technology (λ_9)	0.0133	0.0151	0.88	0.380
Telecommunications (λ_{10})	-0.0027	0.0216	-0.13	0.899
Utilities (λ_{11})	-0.0060	0.0149	-0.40	0.686
Reuters (γ)	0.0006	0.0067	0.09	0.928

Number of obs	=	909
F(14, 894)	=	0.87
Prob >F	=	0.5906
R-squared	=	0.0166
Root MSE	=	.10455

Table 8: The regression of all the characteristics on the CAR[-5,5], as explained in equation (8) with the expected returns formed by equation (4). The full regression can be found in the Appendix.

For the Fama five-factor model, the results are shown in Table 8. The interpretations of the effects are consistent with those of the previous two sections. This model finds significant effects in $Intercept(\alpha)$ once more.

First, the log(Assets) (λ_{12}) shows a significant result on the 90% scale but not on the 95%. A 1% increase in the company assets increases the CAR[-5,5] by approximately 0.0043 on average. This suggests that larger companies are less affected by an ESG controversy.

Secondly, Reuters as a publication source still is insignificant, as in the previous two models for estimating the abnormal returns (γ).

Thirdly, for the continents *developed*(λ_{13}), suggesting that there is no distinguishable difference between Europe & North America and the Rest of the World when it comes to listings for ESG controversies. Then, the ESG score does not seem to affect the CAR significantly. In the previous two models, this variable was also found to be insignificant(λ_1). Finally, once more, the industry for a company does not affect how the ESG controversy affects the returns (λ_{2-11}).

5.3 Removal of Extreme Events

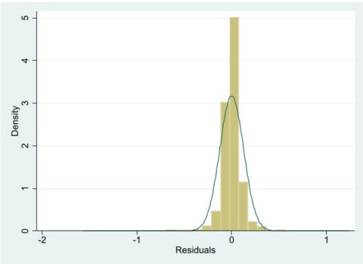

Figure 7: CAPM residual distribution with outlier

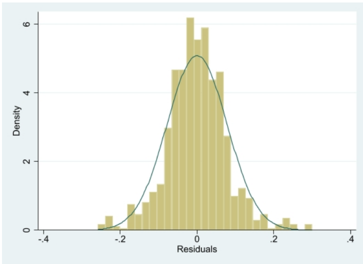

Figure 8: CAPM residual distribution without outliers

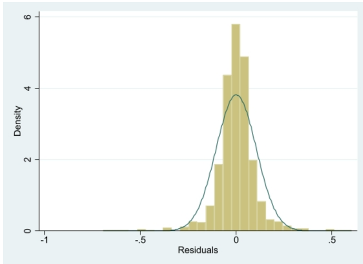

Figure 9: CAPM residual distribution without clear anomalies

As mentioned in Section 4.3 thirty outliers are marked, and eight outliers are removed from the models. For the CAPM model, this moves the Skewness from -1.5 to -0.47. The Kurtosis decreases from 43.5 to 11.8. The removed outliers can be found in the Appendix alongside all the distributional changes of the residuals. In Figures **??**, 9 and **??** the effect of this on the residuals can be seen. Removing outliers is seldom desirable, but in this case, the outliers consist of exceptional Black Swan events such as the 'Gamestop' (GME) hype and the Wirecard Fraud. These outliers are probably best considered a separate class, distinct from the "normal" ESG controversies, and would merit special attention. Interestingly, most of these marked outliers companies appear multiple times in the data set. This suggests that one approach might be to add a controversy counter to the regression. This, however, falls outside of the scope of this research. These outliers completely drive the model. In the Appendix, all regressions are shown. The ones with and without any outlier and without the absolute Black Swan events are shown.

6 Conclusion

This paper examines the effect ESG controversies have on short-term stock returns and considers the effect of specific characteristics of companies on the observed outcomes. In support of this analysis, multiple models for predicting Abnormal Returns are used to create the Cumulative Abnormal Returns in the window around the event. The Cumulative Abnormal Returns are then regressed upon the characteristics of the event.

In line with Capelle-Blancard and Petit (2019), this research finds that ESG-Controversy events have a significant impact and, on average, a negative effect on the stock returns. Depending on the model used for the Abnormal Returns, this is an effect of between 1.1% and 1.7% for the five-day window around the stock.
Moreover, we see that the ESG rating a company has, does not significantly impact the stock return in the window around the event. Neither in a linear sense the ESG rating nor in a clustered (Laggard, Average, Leader) sense the ESG rating has a significant impact. The size of a company seems to impact the CAR around the event on average, with a larger company, less negatively affected by the event than a smaller company. This effect is not significant on the 95% scale for any of the used models.
The continent on which a company is listed does not significantly impact the event's effect on the returns.
Further, initial reporting by Reuters, rather than by self-reporting, does not have a significant effect on the CAR.
Finally, it appears to be the case that the industry a company operates in, does not change the way an ESG controversy affects the short-term returns of a company's stock price.

Further research could explore many avenues. In this paper, all news is weighted equally important, making it possible to overweight certain extreme outliers. Estimations of correct responses would likely benefit from the addition of some way of quantifying news responses. Traditionally, we know that publishing quarterly earnings and dividend news influences short-term returns. A control for when this type of news coincides with controversy might benefit the model. Also, the effect of multiple events from the same company is excluded from consideration. It is conceivable that repeated mentions of an event may produce a more significant response. Another pursuit could be adding the hype effect of social media. Finally, the longer-term impact of controversies might be an exciting avenue to explore.

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Appendix

A. Info about the data

Continent	Number of Observations
Europe	316
North America	579
South America	35
Oceania	42
Asia	176
Africa	15

Table 9: Where are companies

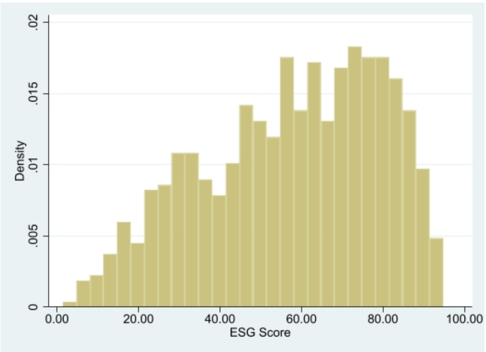

Figure 10: Distribution of ESG

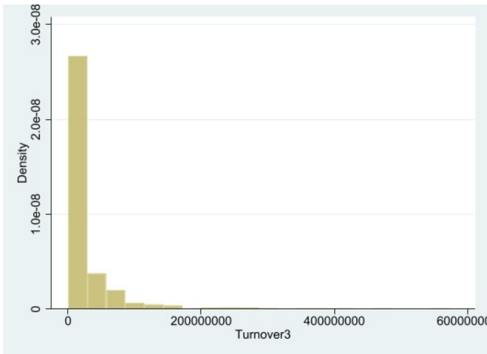

Figure 11: Distribution of turnover.

ESG Rating	Companies
A	212
B	310
C	208
D	72
E	0
F	0

Table 10: ratings ESG companies

CAAR[-5,5]	Mean	Std. dev.
CAPM	-.0151	.1429
FAMA3	-.0136	.1408
FAMA5	-.0112	.1338

Table 11: Summary statistics of each Cumulative Abnormal Average Return for all of the used models

Company	**Date**	**Company**	**Date**
MYR.AX	2021-07-16	VXRT.OQ	2020-11-02
IRBR3.SA	2020-06-03	BLUE.OQ	2021-02-22
HUR.L	2021-06-30	EAR.OQ	2021-10-28
CMMC.TO	2021-05-26	XCUR.OQ	2021-12-27
GME.N	2021-02-22	REKR.OQ	2021-09-02
GME.N	2021-02-11	HDIL.NS	2019-12-11
DAL.N	2020-06-01	000063.SZ	2020-03-20
LC.N	2021-08-04	1024.HK	2021-10-26
DASH.N	2021-12-01	CLUBQ.PK	2021-03-10
ENDP.OQ	2021-07-30	TEUM.PK	2019-10-30
AHCO.OQ	2021-04-20	AXSM.OQ	2021-08-16
SPPI.OQ	2021-08-13	WDIG.H	2020-06-25
SPPI.OQ	2021-06-10	WDIG.H	2020-07-02
MRNA.OQ	2021-10-08	WDIG.H	2020-07-10
RETA.OQ	2021-12-13	WDIG.H	2020-07-16

Table 12: Outliers marked due to extreme market movement (-0.3 <CAR or CAR> 0.3, roughly around two standard errors from the mean of the CAR), most of the outliers are very explainable to be removed and are worthy of research themselves. The exact ones can be seen in Table 13 However, they fall outside the scope of this research since they are likely not to be "normal" ESG controversies. Interestingly some are found more often in the dataset, implying that the count of ESG controversies within a short amount of time should be researched. For example the 4 Wirecard events (WDIG.H), there was a huge scandal around this time about this company. The extreme movement in the GME events is also a very interesting research, it is one of the so called meme stocks.

Company	**Date**	**Reason**
HUR.L	2021-06-30	At the time the restructuring of debt was mostly canceled. English court declined this restructuring for the first time in a groundbreaking ruling. in history.
GME.N	2021-02-22	Never seen before event (memestock), very high volatile movement due to actions of Redditors.
GME.N	2021-02-11	”
WDIG.H	2020-06-25	Abnormality see Wirecard fraud.
WDIG.H	2020-07-02	”
WDIG.H	2020-07-10	
WDIG.H	2020-07-16	”

Table 13: Outliers removed due to extreme market movement (-0.3 < car or car> 0.3, roughly around two standard deviations from the mean). In combination with the assessment of the individual outlier.

Event	**Example**
Recent Privacy Controversies	VW says data breach at vendor impacted 3.3 million people in North America
Recent Responsible Marketing Controversies	Minnesota sues Exxon, Koch and API for being 'deceptive' on climate change
Recent Product Access Controversies	Airline apologises to woman after threatening to offload her for wearing inappropriate attire
Recent FDA Warning Letters	U.S. opens probe into Teslas Autopilot over emergency vehicle crashes
Recent Mgt Compensation Controversies	J&J investor calls on shareholders to reject CEO Gorsky's pay
Recent Shareholder Rights Controversies	Tesco to settle final shareholder claims over 2014 accounting scandal
Recent Insider Dealings Controversies	Brazil regulator accuses Marfrig CEO of insider trading
Recent Accounting Controversies Count	Standard Chartered fined GB46.5m by Bank of England over reporting failures
Recent Business Ethics Controversies	Former CEO of Brazil's Braskem pleads guilty in U.S. bribery case
Recent Tax Fraud Controversies	Google to pay GB183m in back taxes to Irish government
Recent Anti-Competition Controversy	Spain issues $148 million fine on rail cartel involving Siemens, Nokia
Recent Critical Countries Controversies	EU firms can scrap Iran deals if U.S. sanctions costs too high, EU top court says
Recent Intellectual Property Controversies	Chemours Files Second Lawsuit Against AGC, Inc. for Infringement of HFO-1234yf Patent
Recent Consumer Controversies	ABN AMRO compensates consumers who paid too much interest on revolving consumer credits with floating rates
Recent Customer Health & Safety Controversies	Bayer reaches $2 bln deal over future Roundup cancer claims
Recent Environmental Controversies	Big banks are propping up the coal industry as it keeps on pumping out toxic emissions in some parts of the world
Recent Wages Working Controversies	DoorDash pays $5 mln to settle San Francisco worker misclassification probe
Recent Diversity Opportunity Controversie	Becton, Dickinson and Co. to pay $100,000 in pay discrimination settlement
Recent Employee Health & Safety Controversies	New York accuses Amazon of backsliding over worker safety, seeks monitor
Recent Human Rights Controversies	Group seeks import ban on Apple gear over forced labor
Recent Child Labor Controversies	Carlsberg India probes find 'potential improper payments', child labour
Recent Public Health Controversies	13 U.S. refineries exceeded emissions limits for cancer-causing benzene in 2020

Table 14: Examples of controversies

B. Regressions without outlier removal

OLS Regression Results CAPM

Dependent variable	CAR[-5,5]			White Standard Errors
	coef	**S.E.**	**t-statistic**	**p-value**
Intercept (α)	-0.1059	0.0620	-1.710	0.088
log(Assets) (λ_{12})	0.0036	0.0030	1.170	0.242
ESG(λ_1)	0.0003	0.0002	1.230	0.219
Developed (λ_{13})	-0.0104	0.0086	-1.200	0.229
ConsumerDiscretionary (λ_2)	-0.0038	0.0155	-0.240	0.809
ConsumerStaples (λ_3)	0.0132	0.0131	1.010	0.314
Energy(λ_4)	0.0217	0.0232	0.940	0.350
Financials(λ_5)	0.0470	0.0457	1.030	0.304
HealthCare (λ_6)	0.0023	0.0173	0.130	0.895
Industrials (λ_7)	0.0160	0.0156	1.020	0.306
RealEstate (λ_8)	0.0603	0.0448	1.350	0.179
Technology (λ_9)	0.0007	0.0154	0.040	0.966
Telecommunications (λ_{10})	-0.0100	0.0207	-0.480	0.630
Utilities (λ_{11})	-0.0119	0.0154	-0.770	0.442
Reuters(γ)	-0.0089	0.0092	-0.960	0.335

textbfNumber of obs	=	912	**Skewness**	=	-1.503
F(14, 897)	=	1.41	**Kurtosis**	=	43.45
Prob \textgreater F	=	0.1412	**Prob JB**	=	0.000
R-squared	=	0.0213	**AIC**	=	-1164.274
Root MSE	=	0.1268	**BIC**	=	-1092.039
			Log Likelihood	=	597.1369

Table 15: OLS Regression Results CAPM including the outliers as shown in table 12, the dependent variable is the CAAR[-5,5]

OLS Regression Results FAMA3

Dependent variable	CAR[-5,5]			White Standard Errors
	coef	**S.E.**	**t-statistic**	**p-value**
Intercept (α)	-0.0865	0.0618	-1.40	0.162
log(Assets) (λ_{12})	0.0028	0.0030	0.93	0.355
ESG(λ_1)	0.0002	0.0002	0.95	0.340
Developed (λ_{13})	-0.0107	0.0086	-1.24	0.215
ConsumerDiscretionary (λ_2)	0.0152	0.2800	0.78	-0.026
ConsumerStaples (λ_3)	0.0117	0.0131	0.90	0.370
Energy(λ_4)	0.0225	0.0232	0.97	0.333
Financials(λ_5)	0.0311	0.0403	0.77	0.441
HealthCare (λ_6)	0.0076	0.0168	0.45	0.652
Industrials (λ_7)	0.0140	0.0147	0.95	0.340
RealEstate (λ_8)	0.0624	0.0482	1.29	0.196
Technology (λ_9)	0.0116	0.0153	0.75	0.451
Telecommunications (λ_{10})	-0.0072	0.0221	-0.32	0.745
Utilities (λ_{11})	-0.0073	0.0152	-0.48	0.630
Reuters(γ)	-0.0095	0.0090	-1.05	0.293

Number of obs	=	912	**Skewness**	=	1.876
F(14, 897)	=	0.96	**Kurtosis**	=	49.303
Prob \textgreater F	=	0.497	**Prob JB**	=	0.000
R-squared	=	0.0149	**AIC**	=	-1191.327
Root MSE	=	0.1249	**BIC**	=	-1119.093
			Log Likelihood	=	610.6637

Table 16: OLS Regression Results FAMA3 including the outliers as shown in table 12, the dependent variable is the CAAR[-5,5]

OLS Regression Results FAMA5

Dependent variable	CAR[-5,5]			White Standard Errors
	coef	**S.E.**	**t-statistic**	**p-value**
Intercept (α)	-0.0846	0.0619	-1.36	0.173
log(Assets) (λ_{12})	0.0028	0.0031	0.93	0.353
ESG(λ_1)	0.0001	0.0002	0.41	0.679
Developed (λ_{13})	-0.0061	0.0085	-0.72	0.474
ConsumerDiscretionary (λ_2)	0.0116	0.0141	0.82	0.410
ConsumerStaples (λ_3)	0.0147	0.0129	1.14	0.253
Energy(λ_4)	0.0244	0.0233	1.05	0.296
Financials(λ_5)	0.0308	0.0398	0.77	0.439
HealthCare (λ_6)	0.0066	0.0170	0.39	0.698
Industrials (λ_7)	0.0147	0.0147	1.00	0.317
RealEstate (λ_8)	0.0622	0.0504	1.23	0.218
Technology (λ_9)	0.0158	0.0153	1.04	0.300
Telecommunications (λ_{10})	-0.0017	0.0217	-0.08	0.938
Utilities (λ_{11})	-0.0048	0.0150	-0.32	0.749
Reuters(γ)	-0.0047	0.0074	-0.64	0.522

textbfNumber of obs	=	912	**Skewness**	=	.0768
F(14, 897)	=	0.83	**Kurtosis**	=	25.03165
Prob \textgreater F	=	0.636	**Prob JB**	=	0.000
R-squared	=	0.013	**AIC**	=	-1347.807
Root MSE	=	0.11463	**BIC**	=	-1275.573
			Log Likelihood	=	688.9037

Table 17: OLS Regression Results FAMA5 including the outliers as shown in table 12, the dependent variable is the CAAR[-5,5]

C. Regressions with outlier removal

OLS Regression Results CAPM

Dependent variable	CAR[-5,5]			White Standard Errors
	coef	**S.E.**	**t-statistic**	**p-value**
Intercept (α)	-0.1202	0.0410	-2.93	0.003
log(Assets) (λ_{12})	0.0053	0.0021	2.51	0.012
ESG (λ_1)	-0.0001	0.0002	-0.62	0.533
Developed (λ_{13})	0.0002	0.0067	0.02	0.981
ConsumerDiscretionary (λ_2)	-0.0063	0.0130	-0.49	0.626
ConsumerStaples (λ_3)	0.0063	0.0124	0.51	0.608
Energy (λ_4)	-0.0030	0.0139	-0.21	0.831
Financials (λ_5)	-0.0046	0.0251	-0.18	0.854
HealthCare (λ_6)	0.0106	0.0131	0.81	0.416
Industrials (λ_7)	0.0008	0.0137	0.06	0.953
RealEstate (λ_8)	0.0234	0.0386	0.6	0.545
Technology (λ_9)	-0.0108	0.0137	-0.79	0.432
Telecommunications (λ_{10})	0.0026	0.0140	0.19	0.852
Utilities (λ_{11})	-0.0222	0.0148	-1.51	0.133
Reuters (γ)	-0.0028	0.0056	-0.49	0.624

textbfNumber of obs	=	887	**Skewness**	=	0.132
F(14, 872)	=	1.33	**Kurtosis**	=	4.466
Prob \textgreater F	=	0.1815	**Prob JB**	=	0.000
R-squared	=	0.0220	**AIC**	=	-1968.297
Root MSE	=	0.07912	**BIC**	=	-1896.48
			Log Likelihood	=	999.1487

Table 18: OLS Regression Results CAPM excluding the outliers as shown in table 12, the dependent variable is the CAAR[-5,5]

OLS Regression Results FAMA3

Dependent variable	CAR[-5,5]			White Standard Errors
	coef	**S.E.**	**t-statistic**	**p-value**
Intercept (α)	-0.0932	0.0421	-2.21	0.027
log(Assets) (λ_{12})	0.0041	0.0022	1.86	0.063
ESG (λ_1)	-0.0001	0.0002	-0.65	0.519
Developed (λ_{13})	-0.0005	0.0068	-0.08	0.937
ConsumerDiscretionary (λ_2)	0.0047	0.0128	0.37	0.712
ConsumerStaples (λ_3)	0.0054	0.0125	0.43	0.664
Energy (λ_4)	-0.0009	0.0139	-0.07	0.946
Financials (λ_5)	-0.0116	0.0267	-0.43	0.665
HealthCare (λ_6)	0.0131	0.0134	0.97	0.33
Industrials (λ_7)	0.0011	0.0133	0.08	0.935
RealEstate (λ_8)	0.0275	0.0439	0.63	0.531
Technology (λ_9)	0.0016	0.0136	0.12	0.908
Telecommunications (λ_{10})	0.0087	0.0139	0.63	0.529
Utilities (λ_{11})	-0.0165	0.0146	-1.13	0.259
Reuters (γ)	-0.0061	0.0056	-1.08	0.279

Number of obs	=	891	**Skewness**	=	0.069
F(14, 894)	=	1.05	**Kurtosis**	=	4.712
Prob \textgreater F	=	0.4037	**Prob JB**	=	0.000
R-squared	=	0.0158	**AIC**	=	-1952.314
Root MSE	=	0.08023	**BIC**	=	-1880.429
			Log Likelihood	=	991.157

Table 19: OLS Regression Results FAMA3 excluding the outliers as shown in table 12, the dependent variable is the CAAR[-5,5]

OLS Regression Results FAMA5

Dependent variable	CAR[-5,5]			White Standard Errors
	coef	**S.E.**	**t-statistic**	**p-value**
Intercept (α)	-0.1039	0.0414	-2.51	0.012
log(Assets) (λ_{12})	0.0046	0.0021	2.13	0.033
ESG (λ_1)	-0.0002	0.0002	-0.98	0.327
Developed (λ_{13})	0.0020	0.0069	0.28	0.776
ConsumerDiscretionary (λ_2)	0.0063	0.0127	0.50	0.620
ConsumerStaples (λ_3)	0.0084	0.0123	0.69	0.492
Energy (λ_4)	0.0013	0.0138	0.09	0.925
Financials (λ_5)	-0.0084	0.0270	-0.31	0.757
HealthCare (λ_6)	0.0084	0.0131	0.64	0.524
Industrials (λ_7)	0.0022	0.0134	0.17	0.867
RealEstate (λ_8)	0.0263	0.0464	0.57	0.571
Technology (λ_9)	0.0054	0.0137	0.39	0.695
Telecommunications (λ_{10})	0.0128	0.0137	0.93	0.353
Utilities (λ_{11})	-0.0125	0.0145	-0.86	0.390
Reuters (γ)	-0.0061	0.0057	-1.07	0.283

Number of obs	=	889	**Skewness**	=	-0.011
F(14, 874)	=	1.01	**Kurtosis**	=	4.645
Prob \textgreater F	=	0.4372	**Prob JB**	=	0.000
R-squared	=	0.0160	**AIC**	=	-1939.13
Root MSE	=	0.08063	**BIC**	=	1867.278
			Log Likelihood	=	984.5648

Table 20: OLS Regression Results FAMA5 excluding the outliers as shown in table 12, the dependent variable is the CAAR[-5,5]

D. Effects of Outlier Removal as Specified Table 13

OLS Regression Results CAPM

Dependent variable	CAR[-5,5]			White Standard Errors
	coef	**S.E.**	**t-statistic**	**p-value**
Intercept(α)	-0.1284	0.0537	-2.39	0.0170
log(Assets)(λ_{12})	0.0049	0.0027	1.85	0.0650
ESG(λ_1)	0.0001	0.0002	0.61	0.5450
Developed(λ_{13})	-0.0096	0.0080	-1.21	0.2280
ConsumerDiscretionary (λ_2)	0.0036	0.0140	0.26	0.7980
ConsumerStaples (λ_3)	0.0121	0.0129	0.94	0.3500
Energy (λ_4)	0.0017	0.0144	0.12	0.9040
Financials (λ_5)	0.0438	0.0454	0.96	0.3360
HealthCare (λ_6)	0.0003	0.0171	0.02	0.9860
Industrials (λ_7)	0.0140	0.0155	0.90	0.3670
RealEstate (λ_8)	0.0598	0.0445	1.34	0.1790
Technology (λ_9)	-0.0031	0.0152	-0.21	0.8370
Telecommunications (λ_{10})	-0.0111	0.0206	-0.54	0.5890
Utilities(λ_{11})	-0.0149	0.0152	-0.98	0.3250
Reuters (γ)	0.0012	0.0068	0.18	0.8610

Number of obs	=	909	**Skewness**	=	-0.477
F(14, 894)	=	1.35	**Kurtosis**	=	11.870
Prob \textgreater F	=	0.1741	**Prob JB**	=	0.000
R-squared	=	0.0249	**AIC**	=	-1498.188
Root MSE	=	.10527	**BIC**	=	-1426.003
			Log Likelihood	=	764.094

Table 21: CAPM with only specified outliers removed see Table

OLS Regression Results FAMA3

Dependent variable	CAR[-5,5]			White Standard Errors
	coef	**S.E.**	**t-statistic**	**p-value**
Intercept (α)	-0.1091	0.0533	-2.05	0.041
log(Assets) (λ_{12})	0.0042	0.0027	1.58	0.115
ESG (λ_1)	0.0001	0.0002	0.28	0.783
Developed (λ_{13})	-0.0099	0.0080	-1.25	0.212
ConsumerDiscretionary (λ_2)	0.0117	0.0136	0.86	0.391
ConsumerStaples (λ_3)	0.0106	0.0129	0.82	0.410
Energy (λ_4)	0.0024	0.0144	0.17	0.868
Financials (λ_5)	0.0278	0.0400	0.70	0.487
HealthCare (λ_6)	0.0056	0.0166	0.34	0.736
Industrials (λ_7)	0.0120	0.0145	0.82	0.410
RealEstate (λ_8)	0.0619	0.0478	1.29	0.196
Technology (λ_9)	0.0077	0.0150	0.52	0.606
Telecommunications (λ_{10})	-0.0083	0.0220	-0.38	0.706
Utilities (λ_{11})	-0.0104	0.0150	-0.70	0.486
Reuters (γ)	0.0006	0.0064	0.10	0.924

Number of obs	=	909	**Skewness**	=	-0.738
F(14, 894)	=	0.93	**Kurtosis**	=	11.734
Prob \textgreater F	=	0.5272	**Prob JB**	=	0.000
R-squared	=	0.0187	**AIC**	=	-1550.793
Root MSE	=	0.10227	**BIC**	=	-1478.608
			Log Likelihood	=	790.3967

Table 22: FAMA3 with only specified outliers removed see Table

OLS Regression Results FAMA5

Dependent variable	CAR[-5,5]			White Standard Errors
	coef	**S.E.**	**t-statistic**	**p-value**
p-value				
Intercept (α)	-0.1126	0.0538	-2.09	0.037
log(Assets) (λ_{12})	0.0043	0.0027	1.60	0.109
ESG (λ_1)	0.0000	0.0002	0.08	0.933
Developed (λ_{13})	-0.0072	0.0082	-0.88	0.378
ConsumerDiscretionary (λ_2)	0.0137	0.0137	0.99	0.321
ConsumerStaples (λ_3)	0.0140	0.0128	1.09	0.274
Energy (λ_4)	0.0053	0.0144	0.37	0.715
Financials (λ_5)	0.0302	0.0396	0.76	0.445
HealthCare (λ_6)	0.0062	0.0169	0.37	0.712
Industrials (λ_7)	0.0136	0.0146	0.93	0.352
RealEstate (λ_8)	0.0621	0.0501	1.24	0.216
Technology (λ_9)	0.0133	0.0151	0.88	0.380
Telecommunications (λ_{10})	-0.0027	0.0216	-0.13	0.899
Utilities (λ_{11})	-0.0060	0.0149	-0.40	0.686
Reuters (γ)	0.0006	0.0067	0.09	0.928

Number of obs	=	909	**Skewness**	=	-0.477
F(14, 894)	=	1.35	**Kurtosis**	=	11.870
Prob \textgreater F	=	0.1741	**Prob JB**	=	0.000
R-squared	=	0.0249	**AIC**	=	-1498.188
Root MSE	=	.10527	**BIC**	=	-1426.003
			Log Likelihood	=	764.094

Table 23: FAMA5 with only specified outliers removed see Table

E. Effects of outlier removal on residuals

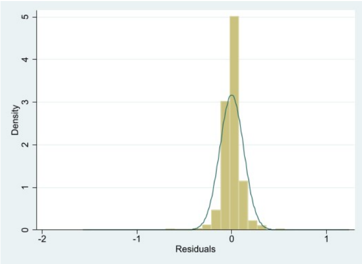

Figure 12: CAPM residual distribution with outlier

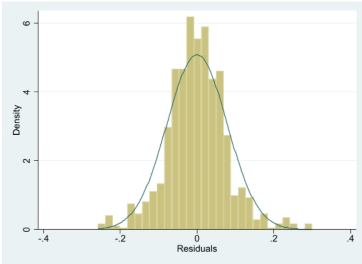

Figure 13: CAPM residual distribution without outliers

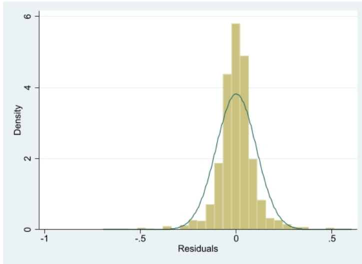

Figure 14: CAPM residual distribution without anomalies

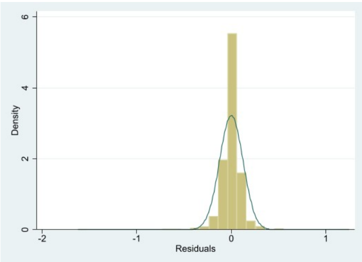

Figure 15: FAMA3 residual distribution with outlier

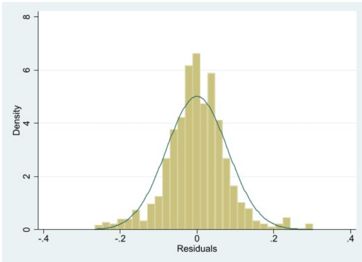

Figure 16: FAMA3 residual distribution without outliers

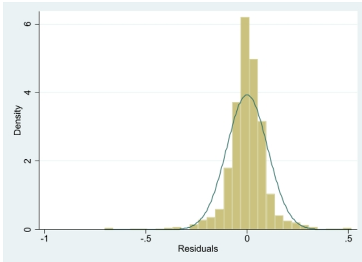

Figure 17: FAMA3 residual distribution without anomalies

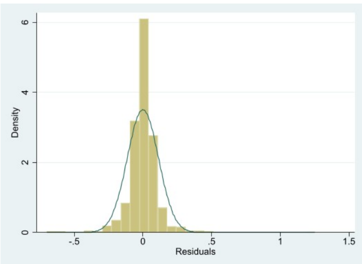

Figure 18: FAMA5 residual distribution with outlier

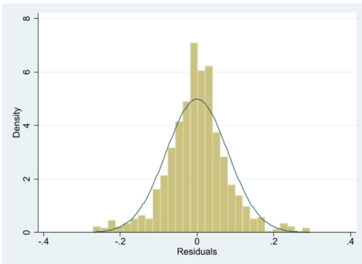

Figure 19: FAMA5 residual distribution without outliers

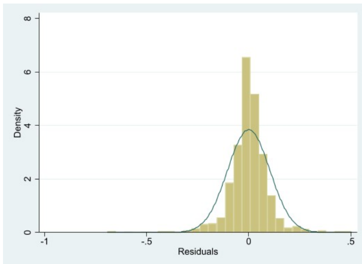

Figure 20: FAMA5 residual distribution without anomalies