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The Effect of Climate Litigation on Stock Prices

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Abstract

This thesis studies the effect of climate litigation on the stock price of the targeted firm and to what extent these effects can spillover to industry peers. Furthermore, it investigates the relationship between ESG-ratings and climate litigation effects. A combined event study and peer analysis methodology is used to calculate cumulative abnormal returns after climate litigation events. Results show that climate litigation causes significant negative abnormal returns for the targeted firm and for industry peers in the ten days prior to the event date. Following that, an ordinary least squares regression analysis is used to estimate the relationship between ESG-scores, and abnormal returns caused by climate litigation. Results show that ESG performance mitigates the negative effect of climate litigation and provides a protection-like effect. This indicates that companies can improve their ESG performance to be less vulnerable to the spillover effects of climate litigation.

Keywords: Climate litigation, stock returns, event study, ESG, spillover effect

JEL Classification: G14, K41

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1. Introduction

Climate change has become an increasingly important topic over the last decade. There has been a surge in environmental awareness which comes paired with the urgency to act against climate change. In response to these growing climate concerns, a lot of regulation has been implemented. Regulatory changes such as the Paris Agreement (2015) are designed to steer the world towards a more sustainable future. To achieve these climate goals, compliance with this regulation is crucial. The large amount of climate change-related lawsuit filings suggests that this may not always be the case. Climate litigation has more than doubled since 2015 according to Loyens & Loeff (2022). This trend can have severe consequences for companies, who can experience reputational damage, legal costs, settlement fees, and many more. All these factors, in combination with investor speculation, can have a significant negative effect on a firm's value. This thesis will investigate how much of a risk climate litigation is for companies by looking into the effect climate litigation has on the stock price of the targeted firm. Furthermore, it will investigate to what extent these effects can spillover to peer companies. At last, this study will research the relationship between ESG-ratings and the effect climate litigation has on firm value.

Previous studies have already investigated the impact of climate litigation on firm value. This relationship is investigated by looking into abnormal returns that have been computed with an event study methodology. Sato et al. (2023) investigated the effect of a climate related lawsuit or an unfavorable court ruling on the firm value of the targeted company. Looking at 108 climate related lawsuits in Europe and the US, the study finds that on average, firm value declines by -0.41% after a lawsuit or unfavorable court ruling. Kolarich (2023) dives deeper into this subject and investigates if the negative effects of climate litigation can spill over to other companies within the oil and gas industry. By looking at the Milieudefensie versus Royal Dutch Shell lawsuit, the study finds that oil and gas companies located in the United States and Europe experience significant negative stock returns after the filing against Shell. Dulak & Gnabo (2024) elaborate on this, instead of only looking at the Shell case, they examine 96 lawsuits and court decisions. This research finds limited effects, concluding that climate litigation does not lead to a significant decrease in the stock price of companies or their industry peers.

All in all, previous literature draws different conclusions about the effect of climate litigation on firm value. In some instances, climate litigation seems to effect firm value and this effect can spillover to industry peers, but this is not always the case. Given the fact that this effect is unclear, this study aims to clarify the impact of climate litigation on firm value by analyzing a different sample of climate litigation events. The sample of this thesis is unique because it focusses on companies in the oil and gas industry. Furthermore, this research will examine to what extent the effects can spread and spillover to

other companies in the industry. Finally, this thesis will explore the role of ESG-ratings in climate litigation. It will investigate whether high ESG-ratings can mitigate the effects and protect corporations from climate litigation. The central research questions of this thesis are formulated as follows:

1. What is the effect of climate litigation on the stock price of the targeted firm in the oil and gas industry?
2. Can climate litigation effects spillover to stock prices of peer companies in the oil and gas industry?
3. What is the role of ESG-scores with regards to climate litigation effects?

This thesis will answer these research questions by using a combined event study and OLS regression method. Data on climate change related lawsuits will be gathered from the Climate Change Litigation Database at the Sabin Center for Climate Change Law. The first part of this research will examine two concerns. Firstly, the effect of climate related lawsuit filings and court rulings on the targeted firm's stock price. Secondly, the impact of climate litigation on industry peers' stock prices will be investigated. To study these effects multiple event studies are implemented, after which cumulative abnormal returns will be evaluated. The other part of this research will investigate how ESG-ratings relate to the effects of climate litigation. An ordinary least squares regression method will estimate the relationship between the ESG-scores and the cumulative abnormal returns. This analysis will provide insights into whether ESG-scores can mitigate the impact of climate litigation and offer protection against its effects.

This research hypothesizes that climate litigation will have a significant negative effect on targeted firm's stock price. Furthermore, it is expected that climate litigation will exhibit spillover effects and can have a negative impact on the stock price of industry peers as well. These results should become visible in the negative cumulative (average) abnormal returns of the event studies. Lastly, I expect that ESG-scores have a mitigating effect and can protect against the negative effects of climate litigation. This implies that firms with better performance in environmental, social, and governmental aspects, are affected less by the negative effects of climate related lawsuits.

Using an event study methodology, this thesis finds that climate litigation has a significant negative impact on the stock price of the targeted firm. On average, companies experience a significant negative CAR of -1.206% up to -1.762% in the ten days prior to the lawsuit. It seems that this effect can spillover to industry peers and create significant negative stock returns for these companies as well. Finally, a regression analysis reveals a significant positive relationship between ESG-scores and the effects of climate litigation. This means that higher ESG performance tends to decrease the negative effect of climate litigation, indicating that ESG performance can provide a protection-like effect against climate litigation events.

The remainder of this thesis is structured as follows. Section 2 discusses relevant literature and provides an overview of the existing research. Section 3 describes the data used to conduct this research. Section 4 provides an explanation of the empirical methodology and section 5 presents the main results and answers to the hypotheses. Section 6 discusses the main findings and relates them to existing literature. Section 7 summarizes and concludes this research, hereafter, Section 8 will give an overview of the limitations and provide recommendations for further research. At last, the appendix contains additional supportive materials.

2. Literature review

2.1 Climate litigation

As this research investigates the effects of climate litigation, it is critical to accurately define this concept. Yale Expert Kysar (2023) provides a very broad definition, he defines climate litigation as any litigation event that involves climate as part of the subject matter. He claims that most lawsuits have an impact on the climate in some way, this impact is larger in some cases, but in the end almost all lawsuits have some form of carbon implication and thus have effect on the climate. Because the definition of Professor Kysar is very broad, almost all litigation events can be categorized as climate related in some way. Hilson (2010) confirms this thought, he states that almost all manner of litigation could conceivably be characterized as climate related in some form. Setzer & Vanhala (2019) concur as well, adding that there are as many understandings of what counts as climate change litigation as there are authors writing about the phenomenon. In order to properly define climate litigation, the definition needs to be narrowed. Peel & Osofsky (2015) deal with this problem by defining climate change litigation in terms of a series of circles. At the center of these circles are litigation events with climate change as the central issue. Moving outward, litigation events with climate change as a peripheral issue are included. The further one moves outward through these circles, the more climate change moves to the background of the lawsuits.

McKenzie et al (2023) dive deeper in this matter with their work “Climate change litigation: one definition to rule them al…?”. This paper defines climate litigation by dividing it into two definitions, one for litigation and one for climate. In their research litigation is defined as disputes and cases brought before official judicial bodies. Non- and quasi-judicial matters are considered as litigation. Moreover, McKenzie et al. define the term “climate” within the context of litigation. They refer to this as cases that address climate law, policy and sciences. Climate has to be the main issue in the lawsuit and cannot be a secondary matter. This thesis will apply the definition provided by McKenzie et al., focusing solely on litigation matters where climate change is the primary issue and where the case is presented before official judicial entities.

2.2 Effect of climate litigation on the targeted firm

Previous studies have already investigated the effect of non-climate litigation on stock prices. Gande & Lewis (2009) look at class action lawsuits and find that these lawsuits create significant negative stock price reactions. Deng et al. (2024) take a different angle and look at patent infringement cases in China. They find that this type of litigation increases the risk of a stock price crash. Bhagat et al. (1994) have a broader view and find that the defendants’ stock price decreases by 1% shortly after any lawsuit filing. Law firm Gowling WLG (2022) confirms this finding, finding that companies typically experience a drop in share price upon the announcement of litigation. On average, claimants see a 3.5% drop, while

defendants see a more pronounced drop of 6.1%. Where most of this research focuses on the United States, Arena and Ferris (2018) take their study internationally. Their research confirms the significant negative stock price reaction in the United States, but does not find a significant result in other regions. In conclusion, previous research has investigated different types of litigation, and all studies conclude that litigation events create significant negative stock price reactions.

The previous section has shown that non-climate litigation has a negative impact on the stock price of a company, but does this apply to climate litigation as well? The answer to this question seems to be more difficult as the literature on climate litigation is limited. Karpoff et al. (2005) investigate this matter by looking at a firm's market value after an environmental violation. He finds that the market value significantly decreases after the environmental violation has taken place. Wei et al. (2011) look directly into climate litigation and discover that lawsuit filings regarding pollution lead to a significant decrease of the companies' stock price. Sato et al. (2023) provide the most conclusive evidence for the effect of climate litigation on stock prices. Their causal analysis estimates that a climate related lawsuit filing or a negative court ruling, reduces firm value by -0.41% on average, showcasing even larger stock price decreases for Carbon-Majors. This study demonstrates that climate litigation is a risk that companies should be aware of. Even though, previous literature on the effects of climate litigation is limited, it seems to draw conclusions similar to those of studies on non-climate litigation. It concludes that climate litigation has a significant negative impact on the stock price of the targeted firm.

All in all, research supports the conclusion that non-climate litigation has a negative effect on the stock price of the targeted firm. Even though the literature for climate litigation is scarcer, studies show the same results. Based on these conclusions, the first hypothesis of this research states:

Hypothesis 1: Climate litigation has a negative impact on the targeted firm's stock price

2.3 Spillover effects of climate litigation

Section 2.2 has displayed that litigation has a negative impact on the stock price of the targeted firm. This section will elaborate by examining whether these effects can spillover to peer companies. Donelson et al. (2022) explored litigation spillover effects by looking into a rare case of litigation, securities litigation. Even though this type of litigation is uncommon, they find that peers exhibit significant negative abnormal returns before and after case filings. Huang et al. (2017) extend this research by looking at class action lawsuits against foreign firms. Their study concludes that these lawsuits create significant spillover effects for peer companies in other countries. Barko et al. (2023) confirm these findings by stating that competitors face negative spillover effects when rivals experience class action lawsuits. Wang & Zhang (2023) look at a different type of lawsuit, namely shareholder litigation, and also find significant spillover effects to peer companies. All literature considered, it seems

that litigation induces negative effects, not only for the targeted firm, but also for industry peers. This means that litigation can create spillover effects to other companies.

It is clear that spillover effects are visible in non-climate litigation events, but does this phenomenon also occur in climate litigation events? Once again, this question is difficult to answer because there is limited research on spillover effects in climate litigation. Antoniuk (2021) investigates this matter, not directly, by looking at climate related lawsuits, but by looking at climate related policy changes. He finds that the Paris Agreement implementation had a significant negative impact on stock prices in the oil and gas industry. Ramelli et al. (2021) also investigate the matter by researching the effect of climate activism on the stock market. Their study finds that the first global climate strike has negatively affected the market value of carbon-intensive companies. Kolarich (2023) does look directly at the effects of climate litigation and finds that a negative court ruling can subject peer companies in the United States and Europe to negative spillover effects. Dulak & Gnabo (2024) expand this research, instead of looking at one climate litigation event, they look at a sample of 96 litigation events. The results of this larger sample are contradictory to those of Kolarich. Dulak & Gnabo do not encounter significant spillover effects caused by climate litigation.

To conclude, previous research has shown that non-climate litigation can showcase spillover effects to peer companies. Whether climate litigation exhibits the same effect is unclear. Literature shows that policy changes and climate risk activism can generate spillover effects, but climate litigation studies provide contradicting conclusions. Kolarich (2023) does find significant spillover effects, but Dulak & Gnabo (2024), who use a larger sample of climate litigation events, do not find any significant effects. The fact that non-climate litigation has shown clear spillover effects, in combination with the results of Kolarich, causes the second hypothesis of this research to be:

Hypothesis 2: Climate litigation has negative spillover effects on stock prices of industry peers.

2.4 ESG and climate litigation

The last part of this thesis investigates the relationship between ESG-scores and climate litigation effects. Existing literature that examines this exact relationship is very limited. However, there is research that investigates whether ESG performance can provide a layer of protection against negative events. For example, Luo et al. (2023) investigate if ESG performance can reduce the risk of stock price crashes. In their research they find that good ESG performance mitigates the risk of stock price crashes. Nirino et al. (2021) also explore the moderating role of ESG performance, but they find different results. Contrary to the research of Luo et al., their research indicates there is no significant moderating effect of ESG-scores. Godfrey et al. (2008) perform similar research, but instead of looking at ESG performance, they look at participation in corporate social responsibility practices (CSR), which is

closely related to ESG performance. Their findings suggest that participation in CSR practices can provide an insurance-like effect against negative events. Shiu & Yang (2015) confirm these findings. They find that engagement in CSR practices on a long-term basis provides an insurance-like effect against negative events.

Overall, drawing a clear conclusion based on the existing research on this subject is difficult. There is little research that examines the relationship between ESG-scores and climate litigation effects. However, previous research has shown that ESG performance and CSR participation can have a protection-like effect, mitigating the effects of negative events. This shows that ESG performance can protect against negative events, which suggests that it might be able to protect a firm from the effects of climate litigation as well. Due to the insurance-like effect that ESG performance seems to exhibit, the last hypothesis reads as follows:

Hypothesis 3: ESG performance can have a protection-like effect, mitigating the effects of climate litigation.

3. Data

3.1 Litigation events

The main source for climate litigation events is the Sabin Center for Climate Change Law, provided by the Columbia Law School. This source consists of two databases, the U.S. Climate Change Litigation database and the Global Climate Change Litigation database. Together these databases contain information on over 2,000 climate related lawsuits from all around the world. For these cases, the database provides a brief description of the lawsuit, an overview of all relevant filing and ruling dates and links to additional case documents.

After carefully examining the lawsuits in the Sabin Centre databases, all relevant "pro-climate" litigation events are selected. In this study, a pro-climate lawsuit refers to a case that tries to protect the environment and fights against pollution. This research does not consider climate related cases where corporations oppose regulations or cases regarding climate related sanctions as pro-climate. A list of pro-climate lawsuits is created, which contains climate litigation events against a specific firm on a particular date. There are two types of climate litigation events, lawsuit filings and court decisions. All events that regard non-corporate entities and private companies are dropped. Furthermore, events where daily stock prices on the event date and/or during the estimation window are missing, are dropped as well. At last, all observations involving companies outside the oil and gas industry are excluded. After applying these filters, a list of 209 pro-climate litigation events in the oil and gas industry remains, with events dating from July 29th, 2005, until today. The total list of climate litigation events is visible in Table 9 in the appendix.

3.2 Oil and Gas industry

This research focusses on the most polluting industry in the world, according to research done by the Eco Experts (2024). With an annual emission of 37.5 billion metric tons of greenhouse gases, the oil and gas industry is clearly the most polluting. In order to limit the litigation events to lawsuits and court rulings within the oil and gas industry, a filter is applied based on industry codes. For firms in the United States, Canada and Mexico, the North American Industry Classification System (NAICS) is used. NAICS-codes that start with 211 represent firms that are active in the Oil and Gas Extraction industry, only these firms, in addition with firms operating in Support Activities for Oil and Gas Operations (NAICS: 213112), are included in this research. For European countries NACE-codes are used, where codes that begin with B6 represent firms in the Extraction of Crude Petroleum and Natural Gas industry. Firms with NACE codes B9.1 & B9.1.0 are firms active in Support Activities for Petroleum and Natural Gas Extraction, these firms are included as well. Litigation events involving companies outside of the NAICS and NACE classifications are individually inspected and included if they operate in the oil and gas industry.

3.3 Financial data targets

Multiple event studies will be performed to analyze the effect of climate litigation on the stock price of the targeted firm. All relevant stock related data is collected from the Center for Research in Security Prices (CRSP) provided by the Wharton Research Data Services (WRDS). Daily stock returns excluding dividends and stock splits will be used. In addition, daily market returns are obtained from the Kenneth R. French data library. This research uses the Fama and French 5 factors European, North American and Developed excluding US, databases.

3.4 Peer companies

After investigating the effect of climate litigation on the targeted firm, the spillover effects will be researched. In order to research this matter, peer companies need to be collected. This study creates three peer groups based on geographical location; North America (the United States and Canada), Western Europe and the rest of the world. Peer companies from the oil and gas industry are selected based on NAICS- and NACE-codes, as is explained in Section 3.2. Each group contains the hundred largest companies per region, based on revenue in 2023. Observations involving private companies and those in which stock returns are unavailable during the event and/or estimation window, are dropped. This leaves 78 North American peers, 37 European peers and 46 peers from the rest of the world. The list of peer companies is shown in Table 10 in the appendix. Stock returns of peer companies are gathered from Orbis. Once again, returns excluding dividends and stock splits are used. Because the CRSP database only contains stock information on American and large European companies, the data is supplemented with information from Investing.com.

3.5 ESG-scores

Following the event studies which explore the direct and spillover effects of climate litigation, this research will examine the relationship between ESG-ratings and the effects of climate litigation. In particular, by looking into the relationship between a firm's ESG-score and the negative spillover effect of that firm. This is executed by looking at the spillover effects caused by the negative court ruling against Shell on 26th of May 2021. The same peer groups that were used to investigate spillover effects, as described in Section 3.4, are used, except for the group of companies from the rest of the world. For each peer company, information on firm-specific characteristics such as ESG-score, firm size, capital structure, profitability and liquidity are collected. The 2021 ESG-scores are gathered from Refinitiv Eikon/Datastream. Data on firm size and liquidity, measured by the firm's total assets and cash position respectively, is collected from Orbis. Profitability and capital structure are represented by the firm's return on assets and the leverage or debt-to-equity ratio, which are also collected from Orbis. The date of interest in this matter is the May 26th, 2021. Thus, the average of the 2021 and 2022 end-of-year values is used for all accounting data, because this is the best representation of values at the date of

interest. After dropping observations for which ESG-scores and/or accounting data are not available, a total of 78 peer companies remain. The US sample consists of 48 companies and the EU sample of 30 companies. Table 1 provides an overview of the descriptive statistics of the US and EU subsamples, as well as the total population.

Table 1. Descriptive statistics of peer companies

Variable	N	Average	Median	1st Quartile	3rd Quartile	Std. deviation
Panel A: All peer companies						
ESG-score	78	49.5	51.5	29.6	69.0	23.1
Total Assets (Million $)	78	32264	3820	1064	13708	79317
Leverage (%)	78	1.097	0.760	0.185	1.631	8.488
ROA (%)	78	0.026	0.043	-0.015	0.086	0.153
Cash (Million $)	78	2283	183	48	771	6211
Panel B: EU peer companies						
ESG-score	30	53.6	56.2	33.8	73.6	25.4
Total Assets (Million $)	30	52437	4387	662	53392	101270
Leverage (%)	30	1.6	0.6	0.1	1.0	7.0
ROA (%)	30	0.049	0.047	0.000	0.070	0.107
Cash (Million $)	30	4918	658	150	4231	9283
Panel B: US peer companies						
ESG-score	48	47.0	50.2	27.6	63.0	21.1
Total Assets (Million $)	48	19656	3445	1179	10863	58311
Leverage (%)	48	0.754	0.961	0.213	2.888	9.268
ROA (%)	48	0.011	0.038	-0.040	0.097	0.175
Cash (Million $)	48	637	124	32	313	1330

This table shows the descriptive statistics of the groups of industry peer companies. The table shows the sample statistics for the firm's ESG-score, total assets, leverage, return on assets (ROA) and cash. Total assets and cash are measured in millions of US dollars, leverage and return on assets measured in percentages. Panel A shows descriptive statistics of the total population, Panel B of the Western Europe peer group and Panel C of the American peer group.

4. Methodology

4.1 Event study targets

The first part of this thesis will examine the effect of climate litigation on the stock price of the targeted firm. To examine this relationship, multiple event studies will be performed. At first, the market model will be implemented. This model relates the expected normal return of the firm to the return of the market. According to MacKinlay (1996), employing multi-factor models often does not necessarily improve results, because the explanatory power of these factors is often quite small. Researchers at Robeco (2024) agree with MacKinlay that more is not always better and that adding factors to the model does not necessarily lead to better results. Thus, in this research we will perform event studies using the market model. The following event windows will be investigated: [-10,0], [-5,0], [-1,1], [-1,3], [-1,5], [0,5] and [0,10]. By investigating event windows that include the period before and after the event date, early and late adoption of information by the market will be incorporated into the results. After computing event studies with the market model, the market adjusted model, the Fama and French 3 factor model and the Fama and French 5 factor model will be implemented as well. This will be done to try to confirm and validate the results of the market model. For these models the same event windows are implemented.

4.1.1 Market Model

The first analytical framework, the market model, is a statistical model which relates the expected normal return to the market return. To estimate α_i and β_i an estimation window of 250 trading days is used, starting 10 days prior to the event date. The market model is defined by the following equation:

$$R_{i,t} = \alpha_i + \beta_i * R_{m,t} + \varepsilon_{i,t}$$

Where $R_{i,t}$ is the return of stock i at time t, α_i is the average excess return of the stock i, β_i represents the sensitivity of stock i's return to the market return, $R_{m,t}$ is the market return at time t and $\varepsilon_{i,t}$ is the error term.

4.1.2 Market Adjusted Model

After the market model, three other models will be implemented to validify the results of the market model. The first of these models is the market adjusted model, which is a simpler model than the market model. It states that the expected normal return is equal to the return of the market. This model assumes α_i to be zero and β_i to be 1. For this model it is not necessary to specify an estimation window, it is defined by the following equation:

$$R_{i,t} = R_{m_i}$$

Where R_{m_i} equals the market return of that day.

4.1.3 Fama and French 3 Factor Model

The third model that will be implemented is the Fama and French 3 Factor Model. This model expands on the market model by incorporating two extra factors, small minus big (SMB) and high minus low (HML). This model incorporates the outperformance of small-cap companies relative to large-cap companies and the outperformance of high book-to-market value companies versus low book-to-market companies. For this model an estimation window of 250 trading days is also used, starting 10 days prior to the event date. The model is defined as follows:

$$R_i - R_f = \alpha + \beta_1 * \left(R_m - R_f\right) + \beta_2 * SMB + \beta_3 * HML + \varepsilon$$

Where $R_{i,t}$ is the return of stock i, R_f is the risk-free rate, α is the average excess return of the stock, R_m - R_f denotes the market risk premium, SMB is the size premium, HML is the value premium and ε is the error term.

4.1.4 Fama and French 5 Factor Model

At last, the 3-factor model can be extended to the Fama and French 5 Factor model by adding two more factors. This model takes into account differences in operating profitability and differences in returns for conservative and aggressive investments. For this model an estimation window of 250 trading days is used as well. The 5-factor model is defined by this equation:

$$R_i - R_f = \alpha + \beta_1 * \left(R_m - R_f\right) + \beta_2 * SMB + \beta_3 * HML + \beta_4 * RMW + \beta_5 * CMA + \varepsilon$$

Where $R_{i,t}$ is the return of stock i, R_f is the risk-free rate, α is the average excess return of the stock, R_m - R_f denotes the market risk premium, SMB is the size premium, HML is the value premium, RMW is the profitability measure, CMA is the measure for conservative versus aggressive investments, and ε is the error term.

4.1.5 Cumulative Abnormal Returns

After projecting the expected returns, abnormal returns can be computed. Abnormal returns (AR) are calculated by subtracting the actual returns with the projected normal returns. The following formulas display how abnormal returns are calculated for each model:

Market Model:

$$AR_{it} = R_{it} - (\widehat{\alpha_i} + \widehat{\beta_i} * R_{mt})$$

Market Adjusted Model:

$$AR_{it} = R_{it} - R_{m_i}$$

Fama and French 3 Factor Model:

$$AR_{it} = R_{it} - (\widehat{\beta_1} * (R_m - R_f) + \widehat{\beta_2} * SMB + \widehat{\beta_3} * HML)$$

Fama and French 5 Factor Model:

$$AR_{it} = R_{it} - (\widehat{\beta_1} * (R_m - R_f) + \widehat{\beta_2} * SMB + \widehat{\beta_3} * HML + \widehat{\beta_4} * RMW + \widehat{\beta_5} * CMA)$$

Where $\widehat{\alpha_i}$ and $\widehat{\beta_i}$ are the regression coefficients of stock i.

In this case, abnormal returns display results of one trading day. In order to evaluate an event window consisting of multiple trading days, abnormal returns must be aggregated, which gives cumulative abnormal returns (CAR). CARs are calculated by aggregating all abnormal returns for a given event window, as displayed by the following formula:

$$CAR_{i,[t_1;t_2]} = \sum_{t=\tau_1}^{\tau_2} AR_{it}$$

The results are winsorized at the 1% and 99% level. Statistical significance is calculated using the parametric standard t-test and the nonparametric Wilcoxon signed-rank test. In addition, to account for clustering in the form of overlapping event and estimation windows, the Adjusted Patell test is performed. This test is robust against the distribution of CARs within an event window and accounts for cross-sectional correlation and event-induced volatility.

4.2 Spillover effect to industry peers

After examining the impact of climate litigation on the stock price of the targeted firm, this thesis will explore whether such litigation can also influence the stock prices of peer companies. To investigate these spillover effects, this research will look at the *Milieudefensie versus Shell* lawsuit. There are

multiple reasons why this specific lawsuit was chosen. Firstly, Shell is a prominent and influential company in the industry. Shell is one of the "Big Oil" companies, meaning that it is one of the seven largest public oil and gas companies in the world, also referred to as a "Supermajor". In addition, this lawsuit has received a lot of media attention internationally. At last, this case is unique because it is the first time that a court has ruled against a large oil and gas company like Shell. The court has demanded that the oil giant reduces its CO2-emissions by 45% in 2030. All these factors combined make this a highly influential lawsuit that is likely to have a significant impact on the industry. Table 2 displays three relevant events and dates from the *Milieudefensie versus Shell* lawsuit.

Table 2. Event dates *Miliedefensie versus Shell* lawsuit

Date	Description
05-04-2019	Milieudefensie submits the subpoena to court.
17-04-2019	The first time that Shell appears in front of the court.
25-06-2021	The court rules against Shell. The company must reduce CO2-emission by 45%.

This table provides an overview of all relevant events in the *Milieudefensie versus Shell* lawsuit. It provides the relevant date and a brief description of the event.

This study will investigate the effects on the industry peers of Shell by performing event studies on three dates, the 5th of April 2019, the 17th of April 2019 and the 21st of May 2021. Three different industry peer groups are created based on geographical location; North America, Western Europe and the rest of the world. For each of these peer groups, cumulative abnormal returns are calculated using the market model. The following event windows are investigated: [-10,0], [-5,0], [-1,1], [-1,3], [-1,5], [0,5] and [0,10]. Instead of assessing CARs per individual company, this research aims to assess the effect of the Shell lawsuit on the entire peer group. Thus, the average cumulative abnormal return (CAAR) will be computed. The CAAR is the average abnormal return for a group of industry peers for a given event window. For a sample of N firms, the average cumulative abnormal return is equal to:

$$CAAR_{i,[t_1;t_2]} = \frac{1}{N}\sum_{i=1}^{N} CAR_{i,[t_1;t_2]}$$

The results are winsorized at the 1% and 99% level. Statistical significance is calculated using the parametric standard t-test and the nonparametric Wilcoxon signed-rank test.

4.3 ESG-analysis

After investigating the spillover effects of the *Shell versus Milieudefensie* case, this thesis will look into the role of ESG-ratings in relation to climate litigation. To research the impact of ESG-scores an ordinary least squares (OLS) regression is estimated. The dependent variable in this regression are the

cumulative abnormal returns regarding the spillover effects of the negative court ruling against Shell on May 26th, 2021. Specifically, the CARs, winsorized at the 1% and 99% level, of the [-10,0] event window. These particular CARs were chosen because this event window shows significant results in the event study regarding targeted firms and the event study regarding spillover effects. The independent variable is the company's ESG-rating. Furthermore, multiple firm-specific characteristics are added as control variables, such as firm size, capital structure, profitability and cash. This regression examines the peer groups of North America and Western Europe. To account for heteroskedasticity, robust standard errors are used. The OLS regression is defined by the following formula:

$$CAR_{i,[-10,0]} = \beta_0 + \beta_1 ESG\ Score_i + \beta_2 \ln(Total\ Assets)_i + \beta_3 leverage_i + \beta_4 Return\ on\ Assets_i + \beta_5 \ln(Cash)_i + \varepsilon_i$$

Where $CAR_{i,[-10,0]}$ is firm *i*'s [-10,0] event window CAR and *ESG-score* is firm *i*'s 2021 ESG-rating from Refinitiv Eikon. *Total Assets* controls for firm size, *Leverage* (debt-to-equity ratio) for capital structure, *Return on Assets* for profitability and *Cash* for the firm's cash position. A detailed description of these variables is provided in Section 3.5.

5. Results

5.1 Event study targets

First of all, this thesis looks into the effect of climate litigation on the stock price of the targeted firm. This is achieved by performing event studies with the market model. Event studies are performed in Stata using the estudy2 command. Table 3 shows the average and median CARs for all event windows, the CARs are winsorized at the 1% and 99% level. The results show that there are no significant abnormal returns for the short-term event windows [-1,1], [-1,3], [-5,0] or [0,5]. The only significant CARs are those of the event window [-10,0]. This means that there are significant negative abnormal returns during the 10-day period prior to the day of the lawsuit, which implies that the market reacts early. An average negative CAR of -1.483% means that on average, stock prices decreased by -1.483% in the ten days prior to the lawsuit. The other event windows do not show significant CARs, in fact, most of them are positive. This means that the stock price of the targeted firm reacts little to the litigation event, thus climate litigation does not have a negative impact on stock returns in these event windows. This result opposes expectations based on previous literature. Hypothesis 1, which states that climate litigation has a negative impact on the stock price of the targeted firm, is rejected for the [-5,0], [-1,1], [-1,3], [0,5] and [0,10] event windows. The hypothesis is accepted for the [-10,0] event window.

Table 3. CARs Market Model

	Average	Median
CAR [-10,0]	-1.483%**	-1.207%***
CAR [-5,0]	-0.169%	0.061%
CAR [-1,1]	0.043%	-0.048%
CAR [-1,3]	0.689%	0.412%*
CAR [0,5]	0.366%	0.372%
CAR [0,10]	0.811%	0.176%

This table shows the average and median cumulative abnormal returns of 209 target events, for multiple event windows. Cumulative abnormal returns are estimated with an event study using the market model. The results are winsorized at the 1% and 99% level. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. Statistical significance is calculated with the standard t-test, Wilcoxon signed-rank test and Adjusted Patell test.

Existing research has shown negative CARs in the event windows during and shortly after the lawsuit date. Because the results of this thesis are different, other models are also implemented. The market adjusted model, the Fama and French 3 factor model (FF3 model) and the Fama and French 5 factor model (FF5 model) are performed to validate the results of the market model. The winsorized results of these models are shown in Table 4. For the FF3, FF5 and the market adjusted model we see similar results to those of the market model. Only the [-10,0] event window, shows significant negative

cumulative abnormal returns. All other event windows, except the [-5,0] event window of the market adjusted model, show no significant abnormal returns. Once again, it is visible that the short-term event windows [-1,1], [-1,3] or [0,5], exhibit little negative and occasionally even positive CARs. This result confirms that information on climate litigation reaches the market early, resulting in negative abnormal returns during the 10 days before the day of the lawsuit.

Table 4. CARs Market Adjusted, FF3 and FF5 Model

	Average	Median
Panel A: Market Adjusted Model		
CAR [-10,0]	-1.762%***	-1.689%***
CAR [-5,0]	-0.390%*	-0.216%
CAR [-1,1]	-0.046%	-0.165%
CAR [-1,3]	0.461%	0.147%
CAR [0,5]	0.116%	-0.012%
CAR [0,10]	0.195%	0.009%
Panel B: Fama and French 3 factor Model		
CAR [-10,0]	-1.206% *	-0.387%*
CAR [-5,0]	-0.310%	0.155%
CAR [-1,1]	0.083%	0.124%
CAR [-1,3]	0.545%	0.554%
CAR [0,5]	0.177%	0.284%
CAR [0,10]	-0.411%	-0.435%
Panel C: Fama and French 5 factor Model		
CAR [-10,0]	-1.564% **	-0.730%**
CAR [-5,0]	-0.494%	-0.120%
CAR [-1,1]	-0.086%	0.058%
CAR [-1,3]	0.166%	0.277%
CAR [0,5]	-0.109%	-0.155%
CAR [0,10]	-0.690%	-0.305%

This table shows the average and median cumulative abnormal returns of 209 target events, for multiple event windows. Panel A shows the results of the market adjusted model, Panel B of the Fama and French 3 factor model and Panel C of the Fama and French 5 factor model. The results are winsorized at the 1% and 99% level. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. Statistical significance is calculated with the standard t-test, Wilcoxon signed-rank test and Adjusted Patell test.

When looking at the average and median CARs in Table 4, the only significant results are in the [-10,0] event window. But when events are assessed individually, a lot more significant events are visible. Individual CARs can differ a lot from each other. The results vary from significant positive CARs to significant negative CARs, as well as CARs close to zero depending on the event date and firm. The results of the market model are plotted in figure 1, a box and whiskers graph. This graph shows that the average CAR is close to zero for all event windows except the [-10,0] event window. Furthermore, it

displays a high variance in CARs, where the lowest observation is -25% and the highest is over +22%. This indicates a stock price reaction to climate litigation is dependent on the lawsuit and firm specific characteristics. A detailed table with descriptive statistics of the abnormal returns of the market model is visible in the appendix in Table 11.

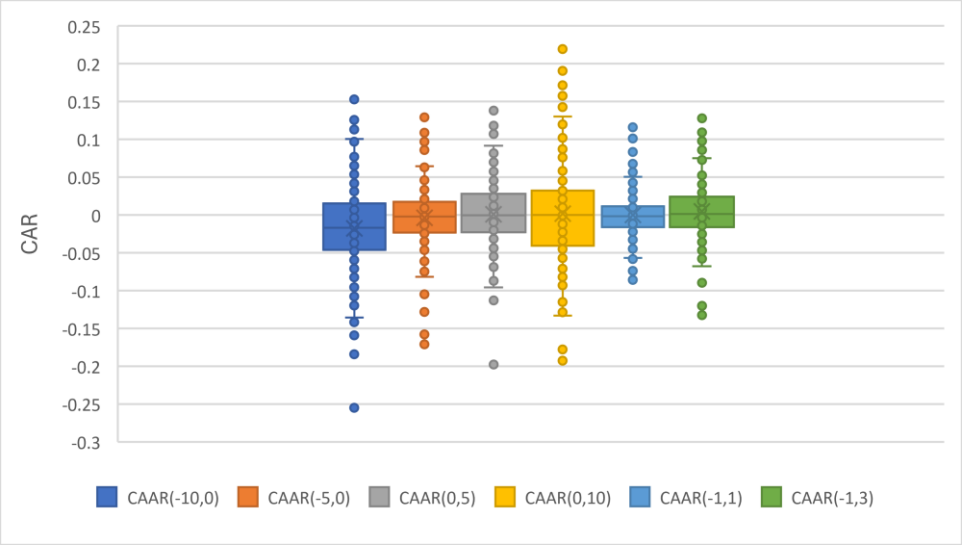

Figure 1. This figure is a box and whiskers graph of all cumulative abnormal returns computed with the market model. It displays the CARs of 209 target events, for all event windows.

To conclude, the market model indicates that climate litigation only leads to significant negative average and median CARs in the [-10,0] event window. This result is verified by the market adjusted, FF3 and FF5 models. None of the models produce significant results for any of the other event windows. This indicates that the market reacts early to the climate litigation event. When assessed individually, CARs vary a lot. Depending on the firm and the lawsuit, CARs can be significantly positive, negative or close to zero. This means that the stock price reaction to climate litigation is unique and dependent on the lawsuit and firm characteristics. All in all, hypothesis 1: climate litigation has a negative effect on the stock price of the targeted firm, can only be accepted for the [-10,0] event window. As a result, climate litigation has a negative effect on the target firm's stock price during the ten days prior to the lawsuit.

5.2 Spillover effects to industry peers

To further investigate the impact climate litigation can have on stock prices, this thesis also examines if the negative effects can also spillover to industry peers. This will be determined by examining the *Milieudefensie versus Shell* lawsuit. There are three important dates in this lawsuit, the date of submitting the subpoena by Milieudefensie (5-4-2019), the day Shell appeared in court for the first time (17-4-2019), and the date of the court ruling against Shell, (26-5-2021). Table 5 shows the CARs for Shell for these events, these numbers display the stock price reaction of Shell to the lawsuit. It is visible that Shell does not experience significant negative CARs for the events on the 5th and the 17th of April

2019. The CARs of the 5th of April 2019 are close to zero and even slightly positive for the [-1,1], [-1,3] and [0,10] event windows. The CARs for the 17th of April are more negative, but still not significant. The CARs regarding the 26th of May are significant and negative for the [-10,0], [-5,0], [-1,1] and [-1,3] event windows. These results show that the events of the 5th and the 17th of April did not affect Shell's stock price, whereas the negative court ruling on the 26th of May did. The results indicate that the outcome of the lawsuit has led to a decrease in the stock price of Shell for the [-10,0], [-5,0], [-1,1] and [-1,3] event windows.

Table 5. CARs Shell

Date	CAR [-10,0]	CAR [-5,0]	CAR [0,5]	CAR [0,10]	CAR [-1,1]	CAR [-1,3]
5-4-2019	-0.33%	-0.08%	-0.23%	0.43%	2.09%	1.76%
17-4-2019	-0.55%	-1.55%	-0.09%	-0.23%	-0.64%	0.51%
26-5-2021	-2.15%*	-3.19%**	1.65%	1.25%	-3.87%***	-3.33%**

This table shows cumulative abnormal returns of Shell for all relevant dates regarding the *Milieudefensie versus Shell* lawsuit. Cumulative abnormal returns are estimated with an event study using the market model. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. Statistical significance is calculated with the standard t-test and Wilcoxon signed-rank test.

Table 6 shows the results of the event studies per industry peer group, North America, Europe and the rest of the world. The CARs are winsorized at the 1% and 99% level. The table displays the average cumulative abnormal returns (CAAR) of the peer groups for the three relevant dates in the *Milieudefensie versus Shell* lawsuit. The results show similarities compared to those of Shell. The results regarding the event on the 5th of April are insignificant, which means that submitting the subpoena against Shell did not have a significant impact on the stock prices of peer companies in the US, Europe or the rest of the world. On an overall basis, the CAARs of the 17th of April are more negative, but still insignificant. This demonstrates that the Shell's court appearance did not influence the stock prices of industry peers. The event study from May 26th, the day the court ruled against Shell, does show significant negative results. CAARs are significant and negative for American and European companies in the [-10,0] and [-5,0] event windows. For firms from other parts of the world there is no significant effect. This means that the negative effect of the court ruling against Shell can spillover to peer companies in North America and Europe, but not to companies in other parts of the world. On average, the stock price of European peers decreases in the [-10,0] and [-5,0] event windows by -3.12% and -2.89% respectively. For American companies these numbers are -2.65% and -5.06% respectively. For the American sample CAARs are significantly positive for the event windows [0,5], [0,10] and [-1,3]. This indicates that the negative effects revert and the stock recovers in the days shortly after the court ruling. All in all, hypothesis 1, which states that climate litigation has negative spillover effects on the stock prices of industry peers, can only be accepted under certain conditions. The hypothesis only holds for the negative court ruling on the May 26th, 2021, only for peer companies from North America and Western Europe, and only for the [-10,0] and [-5,0] event windows.

Table 6. Spillover effect to peer companies

Date	CAAR [-10,0]	CAAR [-5,0]	CAAR [0,5]	CAAR [0,10]	CAAR [-1,1]	CAAR [-1,3]
Panel A: 26th of May 2021						
EU	-3.12%*	-2.89%*	2.55%	2.33%	-0.27%	1.41%
US	-2.65%*	-5.06%**	4.86%**	2.61%*	-0.17%	2.94%*
Rest of the world	0.43%	0.28%	1.49%	1.71%	-1.10%	-0.45%
Panel B: 17th of April 2019						
EU	-1.36%	-1.04%	0.29%	-2.41%	-0.73%	1.84%
US	-0.86%	-0.04%	2.19%	3.52%	4.03%*	3.77%
Rest of the world	1.58%	0.84%	-0.39%	-1.81%	0.47%	0.85%
Panel C: 4th of April 2019						
EU	-2.05%	1.69%	0.33%	0.53%	0.83%	0.48%
US	0.82%	-0.14%	-2.52%	-2.19%	-0.19%	1.92%
Rest of the world	0.26%	1.15%	0.86%	1.81%	0.67%	0.55%

This table shows cumulative average abnormal returns (CAAR) after winsorizing at the 1% and 99% level, of the EU, US and rest of the world peer groups regarding the *Milieudefensie versus Shell* lawsuit. Cumulative average abnormal returns are estimated with an event study using the market model. Panel A shows the CAARs with regards to the 26th of May 2021, Panel B the 17th of April 2019 and Panel C the 4th of April 2019. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. Statistical significance is calculated with the standard t-test and Wilcoxon signed-rank test.

5.3 ESG-scores

The previous event studies have shown that climate litigation affects the targeted firm's stock price, and that these effects can spillover to industry peers and have a negative impact on their stock price as well. This section will investigate the relationship between ESG-ratings and the effect that climate litigation has on stock prices. This is done by estimating an ordinary least squares (OLS) regression with as dependent variable the [-10,0] event window CARs, with regards to the spillover effects of the court ruling against Shell on May 26th, 2021. The CARs for this date and event window were chosen because they showed significant results in Section 6.2. In this section only the North American and European peer groups showed significant results, the peer companies from the rest of the world did not, which is why the regression analysis is only performed for these peer groups. The results of the analysis are displayed in Table 7.

Table 7. Regression results

	EU + US	EU	US
ESG-score	0.0013***	0.0014***	0.0009
	(2.89)	(2.86)	(1.17)
ln(Total Assets)	0.0130	0.0026	0.0269*
	(1.13)	(0.23)	(1.77)
Leverage	-0.0001	0.0001*	-0.0004
	(-0.10)	(1.89)	(-0.45)
Return on Assets	0.0288	0.0336	-0.0491
	(0.69)	(1.11)	(-0.85)
ln(Cash)	-0.0086	-0.0092	-0.0109
	(-1.35)	(-1.03)	(-1.35)
Constant	-0.1509**	-0.0531	-0.2412***
	(-2.55)	(-1.45)	(-3.00)
N	76	30	46
R^2	0.37	0.33	0.45
F-value	6.38	3.84	3.30

This table shows the ordinary least squares regression results for the European, North American and combined sample. The $CAR_{[-10,0]}$ of the spillover effect event study, regarding the event on the 26th of May, is the dependent variable. *ESG-score* a firm's ESG-rating from Refinitiv Eikon. Firm-specific control variables are *Total Assets*, a firm's total assets in million US$, *Leverage*, a firm's debt-to-equity ratio, *Return on Assets*, a firm's return on assets and *Cash*, a firm's cash and cash equivalents. All control variables are an average of the 31st of December 2021 and 2022 values. Robust t-values are shown in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

The model's R-squared for the combined American and European sample is 0.37, which means that 37% of the variance can be explained by variables in the model. For the separate American and European samples this equals 33% and 45% respectively. Jointly looking at the American and European samples, Table 7 shows a significant positive coefficient for the ESG-score variable. This means that firms with higher ESG-scores experience lower negative abnormal returns after the ruling in the *Shell versus Milieudefensie* lawsuit. A coefficient of 0.0013 indicates that an increase in a firm's ESG-score by one leads to an increase in the CAR of that firm by 0.13%. These results indicate that a high ESG-rating can mitigate the negative spillover effects of climate litigation. When the sample is split into two groups, North American peer companies and European peer companies, it is clear that the coefficient for European companies is higher than the coefficient for North American companies. In addition, the coefficient of the EU sample is significant, while that of the North American companies is not. This means that the mitigating effect of a higher ESG-score is stronger for European firms than for American firms. The control variables total assets and return on assets have a positive effect, while leverage and cash have a negative effect. All in all, this means that hypothesis 3, which states that climate litigation has less impact on the stock price of a firm with a relatively high ESG-score, can be accepted. European and American firms with higher ESG-ratings are affected less by the negative spillover effects caused by the ruling against Shell.

6. Discussion

The first main result of this paper states that climate litigation has a significant negative impact on the stock price of the targeted firm in the ten days prior to the day of the lawsuit. This finding is in line with previous studies that find that non-climate litigation leads to a significant decrease in the stock price of the targeted firm, such as the studies of Gande & Lewis (2009) and Deng et al. (2024). The results are similar to previous research that studied the same context of climate litigation, such as the paper of Sato et al. (2023). The second finding concludes that climate litigation can lead to significant negative spillover effects on industry peers. This finding is similar to that of Donelson et al. (2022) and Huang et al. (2017) who found that non-climate litigation events can be the cause of significant negative returns for peer companies. Kolarich (2023), who has researched a similar setting of climate litigation events, finds the same negative spillover effects. On the contrary, Dulak & Gnabo (2024) who investigate a larger sample, do not find any significant spillover effects. At last, this study has investigated the relationship between climate litigation effects and ESG-ratings. It has been concluded that companies with higher ESG-scores are less affected by negative spillover effects caused by climate litigation. No previous studies have researched this matter, but studies that have examined a comparable relationship have found similar results. The study by Luo et al. (2023) also finds an insurance-like effect of ESG performance. Godfrey et al. (2008) and Shiu & Yang (2015), who look at CSR participation, also conclude that CSR participation decreases the magnitude of the effect of negative events.

7. Conclusion

This thesis has investigated the effects of climate litigation on stock prices. Climate litigation is becoming more prevalent and has doubled over the last 8 years according to Loyens & Loeff (2022). In addition, a rise in environmental awareness spurs climate related regulation. This means that firms are confronted with climate litigation more often, making it a substantial risk. Previous literature has already investigated this matter and confirmed that climate litigation is a substantial risk and creates significant negative returns for the targeted firm. Whether these effects can spillover to peer companies is still unclear, because previous research has found varying conclusions. This thesis aims to clarify this matter by investigating whether the effects of climate litigation can spillover to peer companies. In addition, the role of ESG-ratings in the effects of climate litigation will be examined. Therefore, the research questions of this paper state: What are the effects of climate litigation on the stock price of the targeted firm and of industry peers? And what is the relationship between ESG-scores and the effects of climate litigation?

To answer the first research question, this thesis has employed an event study methodology. The results show that climate litigation has a significant negative impact on the targeted firm's stock price in the ten days prior to the lawsuit date. The second main finding of this study concludes that climate litigation effects can spillover to industry peer companies, also only in the [-10,0] event window. Lastly, an ordinary least squares regression has been estimated to examine the relationship between ESG-scores and the spillover effects caused by climate litigation. The results show a significant positive relationship for North American and European companies. This means that firms with a higher ESG-score are less affected by negative spillover effects caused by climate litigation, indicating that ESG performance provides a protection-like effect.

This study confirms existing research and concludes that climate litigation has a significant negative effect on the stock price of the targeted firm. These negative effects can spillover to American and European industry peers. This shows that climate litigation is a substantial risk for companies and definitely a factor they should take into account. This thesis also shows that ESG-scores exhibit a mitigating effect, decreasing the negative effects of climate litigation. This means that by improving their ESG performance, companies can protect themselves from the negative effects caused by climate litigation.

8. Limitations

A potential limitation of this research is that the sample of climate litigation events is restricted. It uses 209 litigation events, but the downside of this sample is that there are multiple litigation events per company and similar event dates across firms. This makes the diversity of firms and event dates limited. Future research is encouraged to complement the sample with more climate litigation events to create a larger and more diverse sample. Moreover, another limitation of this research is that it only looks at three event dates to investigate the spillover effects of climate litigation. This thesis finds significant results for the event May 26th, but not for other dates. This indicates that climate litigation effects can spillover to industry peers, but this does not necessarily mean that this is always the case. Therefore, future research can contribute to this study by increasing the sample size and investigating if the spillover effect is still significant. At last, this study concludes that ESG-scores lessen the negative effect of climate litigation when looking at the effects caused by the event on May 26th. Future research can contribute by validating if this relationship holds when looking at a larger sample and by increasing the number of events.

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Appendix

Table 8. Climate litigation events

Date	Company	Date	Company
27-5-2011	APA CORPORATION	9-3-2020	Exxon Mobil Corporation
17-7-2017	APA CORPORATION	15-5-2020	Exxon Mobil Corporation
20-12-2017	APA CORPORATION	24-6-2020	Exxon Mobil Corporation
22-1-2018	APA CORPORATION	25-6-2020	Exxon Mobil Corporation
14-11-2018	APA CORPORATION	2-9-2020	Exxon Mobil Corporation
9-10-2020	APA CORPORATION	9-9-2020	Exxon Mobil Corporation
12-11-2019	Ascent Resources plc	14-9-2020	Exxon Mobil Corporation
26-2-2008	BP p.l.c.	9-10-2020	Exxon Mobil Corporation
17-7-2017	BP p.l.c.	12-10-2020	Exxon Mobil Corporation
19-9-2017	BP p.l.c.	22-2-2021	Exxon Mobil Corporation
20-12-2017	BP p.l.c.	22-4-2021	Exxon Mobil Corporation
9-1-2018	BP p.l.c.	26-4-2021	Exxon Mobil Corporation
22-1-2018	BP p.l.c.	22-6-2021	Exxon Mobil Corporation
9-5-2018	BP p.l.c.	14-9-2021	Exxon Mobil Corporation
2-7-2018	BP p.l.c.	27-5-2011	Hess Corporation
20-7-2018	BP p.l.c.	17-7-2017	Hess Corporation
14-11-2018	BP p.l.c.	20-12-2017	Hess Corporation
4-12-2019	BP p.l.c.	22-1-2018	Hess Corporation
12-2-2020	BP p.l.c.	2-7-2018	Hess Corporation
9-3-2020	BP p.l.c.	20-7-2018	Hess Corporation
16-6-2020	BP p.l.c.	14-11-2018	Hess Corporation
25-6-2020	BP p.l.c.	9-9-2020	Hess Corporation
2-9-2020	BP p.l.c.	9-10-2020	Hess Corporation
9-9-2020	BP p.l.c.	22-2-2021	Hess Corporation
9-10-2020	BP p.l.c.	26-4-2021	Hess Corporation
12-10-2020	BP p.l.c.	17-7-2017	Marathon Oil Corporation
22-2-2021	BP p.l.c.	20-12-2017	Marathon Oil Corporation
22-4-2021	BP p.l.c.	22-1-2018	Marathon Oil Corporation
26-4-2021	BP p.l.c.	2-7-2018	Marathon Oil Corporation
8-12-2022	BP p.l.c.	20-7-2018	Marathon Oil Corporation
26-2-2008	Chevron Corporation	14-11-2018	Marathon Oil Corporation
27-5-2011	Chevron Corporation	9-10-2020	Marathon Oil Corporation
17-7-2017	Chevron Corporation	22-2-2021	Marathon Oil Corporation
19-9-2017	Chevron Corporation	26-4-2021	Marathon Oil Corporation
20-12-2017	Chevron Corporation	27-5-2011	Murphy Oil Corporation
9-1-2018	Chevron Corporation	9-9-2020	Murphy Oil Corporation
22-1-2018	Chevron Corporation	9-10-2020	Murphy Oil Corporation
9-5-2018	Chevron Corporation	17-7-2017	Occidental Petroleum Corporation
2-7-2018	Chevron Corporation	20-12-2017	Occidental Petroleum Corporation
20-7-2018	Chevron Corporation	22-1-2018	Occidental Petroleum Corporation
14-11-2018	Chevron Corporation	14-11-2018	Occidental Petroleum Corporation
9-3-2020	Chevron Corporation	9-10-2020	Occidental Petroleum Corporation
25-6-2020	Chevron Corporation	17-7-2017	Ovintiv Inc.
2-9-2020	Chevron Corporation	20-12-2017	Ovintiv Inc.
9-9-2020	Chevron Corporation	22-1-2018	Ovintiv Inc.
9-10-2020	Chevron Corporation	14-11-2018	Ovintiv Inc.
12-10-2020	Chevron Corporation	9-10-2020	Ovintiv Inc.
22-2-2021	Chevron Corporation	27-5-2011	Pioneer Natural Resources Company
26-4-2021	Chevron Corporation	17-7-2017	Repsol SA
20-7-2018	CNX Resources Corporation	20-12-2017	Repsol SA
9-10-2020	CNX Resources Corporation	22-1-2018	Repsol SA
22-2-2021	CNX Resources Corporation	14-11-2018	Repsol SA
26-4-2021	CNX Resources Corporation	18-10-2023	Repsol SA
26-2-2008	ConocoPhilips Company	21-2-2024	Repsol SA
27-5-2011	ConocoPhilips Company	25-8-2021	Santos
17-7-2017	ConocoPhilips Company	29-7-2005	Shell plc

19-9-2017	ConocoPhilips Company	14-11-2005	Shell plc
20-12-2017	ConocoPhilips Company	26-2-2008	Shell plc
9-1-2018	ConocoPhilips Company	17-7-2017	Shell plc
22-1-2018	ConocoPhilips Company	28-8-2017	Shell plc
9-5-2018	ConocoPhilips Company	19-9-2017	Shell plc
2-7-2018	ConocoPhilips Company	20-12-2017	Shell plc
20-7-2018	ConocoPhilips Company	9-1-2018	Shell plc
14-11-2018	ConocoPhilips Company	22-1-2018	Shell plc
9-3-2020	ConocoPhilips Company	9-5-2018	Shell plc
2-9-2020	ConocoPhilips Company	2-7-2018	Shell plc
9-9-2020	ConocoPhilips Company	20-7-2018	Shell plc
9-10-2020	ConocoPhilips Company	14-11-2018	Shell plc
12-10-2020	ConocoPhilips Company	5-4-2019	Shell plc
22-2-2021	ConocoPhilips Company	17-4-2019	Shell plc
26-4-2021	ConocoPhilips Company	9-3-2020	Shell plc
17-7-2017	Devon Energy Corporation	8-6-2020	Shell plc
20-12-2017	Devon Energy Corporation	25-6-2020	Shell plc
22-1-2018	Devon Energy Corporation	2-9-2020	Shell plc
14-11-2018	Devon Energy Corporation	9-9-2020	Shell plc
9-10-2020	Devon Energy Corporation	28-9-2020	Shell plc
20-12-2019	Eni	9-10-2020	Shell plc
14-2-2022	Eni	12-10-2020	Shell plc
9-5-2023	Eni	22-2-2021	Shell plc
28-11-2011	Equinor ASA	12-4-2021	Shell plc
17-7-2017	Equinor ASA	22-4-2021	Shell plc
26-2-2008	Exxon Mobil Corporation	26-4-2021	Shell plc
27-5-2011	Exxon Mobil Corporation	26-5-2021	Shell plc
7-11-2016	Exxon Mobil Corporation	26-8-2021	Shell plc
23-11-2016	Exxon Mobil Corporation	14-9-2021	Shell plc
29-11-2016	Exxon Mobil Corporation	7-6-2023	Shell plc
17-7-2017	Exxon Mobil Corporation	17-4-2018	Suncor Energy Inc.
19-9-2017	Exxon Mobil Corporation	11-5-2012	TotalEnergies SE
20-12-2017	Exxon Mobil Corporation	5-7-2018	TotalEnergies SE
9-1-2018	Exxon Mobil Corporation	31-10-2018	TotalEnergies SE
22-1-2018	Exxon Mobil Corporation	29-10-2019	TotalEnergies SE
17-4-2018	Exxon Mobil Corporation	28-1-2020	TotalEnergies SE
9-5-2018	Exxon Mobil Corporation	11-2-2021	TotalEnergies SE
2-7-2018	Exxon Mobil Corporation	1-4-2021	TotalEnergies SE
20-7-2018	Exxon Mobil Corporation	18-11-2021	TotalEnergies SE
14-8-2018	Exxon Mobil Corporation	16-12-2021	TotalEnergies SE
24-10-2018	Exxon Mobil Corporation	2-3-2022	TotalEnergies SE
31-10-2018	Exxon Mobil Corporation	28-2-2023	TotalEnergies SE
14-11-2018	Exxon Mobil Corporation	5-3-2023	TotalEnergies SE
14-3-2019	Exxon Mobil Corporation	27-6-2023	TotalEnergies SE
2-5-2019	Exxon Mobil Corporation	6-7-2023	TotalEnergies SE
6-8-2019	Exxon Mobil Corporation	13-3-2024	TotalEnergies SE
5-9-2019	Exxon Mobil Corporation	21-12-2020	Woodside petroleum
24-10-2019	Exxon Mobil Corporation	21-6-2022	Woodside petroleum
2-12-2019	Exxon Mobil Corporation		

This table shows all climate litigation events used in this research. It displays the date of the lawsuit and the defendant company.

Table 9. EU & US peer companies

Panel A: Rest of the world peer group		*Panel B: EU peer group*	
Ticker	Company	Ticker	Company
ADAG	ADANI TOTAL GAS	ADME	ADM ENERGY PLC
ADNOCGAS	ADNOC GAS PLC	AET	AFRENTRA PLC
ARAM	ARAMCO	FKM	AKER ASA
BP	OMAN OIL MARKETING COMPANY SAOG	AKRBF	AKER BP ASA
BPCL	BHARAT PETROLEUM	BEMO	BARING EMERGING EUROPE PLC
BPT	BEACH ENERGY LTD	BP	BP PLC
CBH	COOLABAH METAL LIMITED	CNE	CAPRICORN ENERGY
CNOOC	CNOOC	CWE	CROWN ENERGY AB
COE	COOPER ENERGY LTD	DTNOF	DNO ASA
EC	ECOPETROL S A	DVD	DEEP VALUE DRILLER AS
ENS	ENEOS	ENOG	ENERGEAN PLC
ESSA	PT ESSA INDUSTRIES INDONESIA TBK	ENI	ENI SPA
FRP	FORMOSA PETROCHEMICAL	ENW	ENWELL ENERGY PLC
GAIL	GAIL	EQNR	EQUINOR A S A
GAZP	GAZPROM	ES	ESSO SOCIETE ANONYME FRANCAISE SA
HIND	HINDUSTAN PETROLEUM CORPORATION	MAU	ETABLISSEMENTS MAUREL ET PROM
HZN	HORIZON OIL LTD	FTI	FESTI HF
IOC	INDIAN OIL CORPORATION	GLE	GALP ENERGIA
IPG	IPD GROUPD LTD	GE	GENEL ENERGY PLC
IPX	INPEX	MAHA	MAHA ENERGY
KAR	KAROON GAS AUSTRALIA	MOH	MOTOR OIL HELLAS CORINTH REFINERIES
KLC	KUNLUN ENERGY COMPANY	NE	NESTE Oyj
LKOH	LUKOIL	NOG	NOSTRUM OIL & GAS PLC
NVTK	NOVATEK	NWF	NWF GROUP PLC
OILI	INDIA OIL	PEN	PANORO ENERGY ASA
ONGC	OIL AND NATURAL GAS CORPORATION	PHAR	PHAROS ENERGY PLC
PBR	PETROBAS	PFC	PHOENIX GLOBAL RESOURCES LTD
PCOR	PETRON CORP	RIG	REPSOL SA
PPL	PAKISTAN PETROLEUM LTD	RDS	ROYAL DUTCH SHELL PLC
PRIO3	PRIO SA	RBS	RUBIS SCA
PTC	PETROCHINA	SAVE	SARAS SPA
PTT	PTT PCL	SQZ	SERICA ENERGY PLC
ROSN	ROSNEFT	TGS	TETHYS OIL AB
SIBN	GAZPROM NEFT	TTE	TOTALENERGIES S E
SLB	STELAR METALS LTD	TWO	TULLOW OIL
SNGP	SYNERGA FUND SA	VAR	VAR ENERGI ASA
SNGS	SURGUTNEFTEGAZ PAO	WFRD	WEATHERFORD INTERNATIONAL PLC
SNP	SINOPEC		
STO	SANTOS		
TATN	TATNEFT		
TPIA	CHANDRA ASRI PETROCHEMICAL		
VEA	VIVA ENERGY GROUP LTD		
VISTAA	VISTA OIL & GAS SA		
WDS	WOODSIDE PETROLEUM		
WOR	WORLEY LTD		
YPF	YPF (YACIMIENTOS PETROLIFEROS FISCALES)		

This table displays all peer companies used to investigate spillover effects of climate litigation. Peer companies have been selected based on NAICS and NACE industry codes. The 100 companies with the largest revenue in 2021 have been selected for this research. Panel A shows the peer group with companies from the rest of the world, Panel B the peer group with companies from Western Europe.

Table 10. US peer companies

Ticker	Company	Ticker	Company
APA	APACHE CORP	MGY	MAGNOLIA OIL & GAS CORP
AR	ANTERO RESOURCES CORP	MNR	MACH NATURAL RESOURCES LP
ARCH	ARCH RESOURCES INC	MTDR	MATADOR RESOURCES CO
BCEI	BONANZA CREEK ENERGY INC	NBR	NABORS INDUSTRIES LTD
BRY	BERRY PETROLEUM CORP	NINE	NINE ENERGY SERVICES INC
BSM	BLACK STONE MINERALS LP	NOA	NORTH AMERICAN ENERGY PTNRS INC
BTE	BAYTEX ENERGY CORP	NOG	NORTHERN OIL & GAS INC
CDEV	CENTENNIAL RESOURCE DEVELOP INC	OAS	OASIS PETROLEUM INC
CHK	CHESAPEAKE ENERGY CORP	OII	OCEANEERING INTERNATIONAL INC
CNQ	CANADIAN NATURAL RESOURCES LTD	OVV	OVINTIV INC
COG	CABOT OIL & GAS CORP	OXY	OCCIDENTAL PETROLEUM CORP
CRC	CALIFORNIA RESOURCES CORP	PAH	PLATFORM SPECIALTY PRODUCTS CORP
CRK	COMSTOCK RESOURCES INC	PEY	PEYTO EXPLORATION & DEVELOPMENT CORP
CTRA	CONTURA ENERGY INC	PTEN	PATTERSON U T I ENERGY INC
CVE	CENOVUS ENERGY INC	PUMP	PROPETRO HOLDING CORP
CVX	CHEVRON CORP	RES	R P C INC
DO	DIAMOND OFFSHORE DRILLING INC	RRC	RANGE RESOURCES CORP
DVN	DEVON ENERGY CORP NEW	SBOW	SILVERBOW RESOURCES INC
EOG	EOG RESOURCES INC	SES	SYNTHESIS ENERGY SYSTEMS INC
ESI	ESIGN ENERGY SERVICES	SGY	STONE ENERGY CORP
FANG	DIAMONDBACK ENERGY INC	SM	S M ENERGY CO
FLMN	FALCON MINERALS CORP	SOIL	SATURN OIL & GAS INC
GPOR	GULFPORT ENERGY CORP	SU	SUNCOR ENERGY
GPRK	GEOPARK LTD	SWN	SOUTHWESTERN ENERGY CO
GTE	GRAN TIERRA ENERGY INC	TALO	TALOS ENERGY INC
HAL	HALLIBURTON CO	TDW	TIDEWATER INC NEW
HESM	HESS MIDSTREAM L P	TPGE	T P G PACE ENERGY HOLDINGS CORP
HLX	HELIX ENERGY SOLUTIONS GROUP INC	TTI	TETRA TECHNOLOGIES INC
HP	HELMERICH & PAYNE INC	VET	VERMILION ENERGY INC
HPK	HIGHPEAK ENERGY INC	VII	VICON INDUSTRIES INC
KLXE	K L X ENERGY SERVICES HDGS INC	WES	WESTERN GAS PARTNERS LP
KOS	KOSMOS ENERGY LTD	WTI	W & T OFFSHORE INC
LBRT	LIBERTY OILFIELD SERVICES INC	WTTR	SELECT ENERGY SERVICES INC
LPI	LAREDO PETROLEUM INC	XOM	EXXON MOBIL CORP

This table displays all peer companies from North America that were used to investigate spillover effects of climate litigation. Peer companies have been selected based on NAICS and NACE industry codes. The 100 companies with the largest revenue in 2021 have been selected for this research.

Table 11. Descriptive statistics of abnormal returns

	N	Average	Median	1st Quartile	3rd Quartile	Std. deviation
CAR [-10,0]	209	-0.0148	-0.0124	-0.0444	0.0199	0.0692
CAR [-5,0]	209	-0.0017	0.0004	-0.0211	0.0208	0.0494
CAR [0,5]	209	0.0037	0.0037	-0.0182	0.0310	0.0530
CAR [0,10]	209	0.0082	0.0017	-0.0300	0.0386	0.0775
CAR [-1,1]	209	0.0004	-0.0005	-0.0153	0.0133	0.0409
CAR [-1,3]	209	0.0069	0.0041	-0.0137	0.0257	0.0526

This table displays the descriptive statistics of the abnormal returns calculated using the market model. It shows descriptive statistics for all event windows. All numbers are displayed in percentages.