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Putting Oil and Gas in CARs: The Impact of Climate Policy Events on Stock Performance

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Abstract

This thesis investigates how climate policy events impact the financial performance of the oil and gas industry in Western markets: the US, Canada, Europe, Australia and Japan. Using a multi-event study methodology approach using a CAR, BHAR and pooled OLS regressions analysis, the short- and medium-term impacts of several international, national and political events on the stock return performance of the oil and gas industry is examined. The findings report that international global climate policy commitments such as the Paris Agreement, COP26 and COP28 lead to sustained negative abnormal returns, especially in the US oil and gas industry. National policies show more diverse results, only the EU Fit for 55 Package induced a strong and consistent negative market reponses. The Inflation Reduction Act showed more moderate effects, indicating that these events were already anticipated by investors. Political events also showed notable results; the Trump elections showed reasonable positive results in the shorter windows, although this effect was reversed in the longer windows. Conversely, Bidens' elections, showed a strong negative reaction in the oil and gas industry globally. Furthermore, the analysis demonstrates that in line with institutional theory, firms with stronger and more credible institutional framework are more impacted by climate policy shocks than those without. Notably, higher ESG ratings correlated slightly with more negative abnormal returns, challenging mainstream expectations. Finally, the results that suggested oil and gas stocks could even act as partial hedges in times broader market uncertainty. These findings contribute to the literature on climate finance by highlighting the varying market reactions to climate policy across different institutional environments and displaying the interplay between regulatory credibility, firm characteristics, and investor sentiment.

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1 Introduction

Last decade, the relationship between the climate policies and the financial performance of firms in carbon intensive industries has caught the attention of academia, investors and regulators as the number of (global) climate policies and initiatives has been increasing rapidly. On 12 December 2015, the Paris Agreement was adopted at the COP21 under the United Nations Framework Convention on Climate Change (UNFCCC), which set the global benchmark of limiting global warming under 2 degrees Celsius. Nearly 200 countries agreed to combat climate change by achieving net-zero greenhouse emissions by 2050. Since then, numerous climate agreements and initiatives have been introduced to reach the targets of the Paris Agreement. This global shift in climate policy and contribution to these agreements had large consequences for carbon intensive industries, in particular for the oil and gas sector, as this signaled the beginning of the systematic transitions away from fossil fuels. Moreover, institutional investors are incorporating socially responsible investment strategies in their portfolio management as globally the importance of mitigating climate change is gradually more and more being acknowledged. Larry Fink stated in his 2020 letter to CEOs that climate risk must be incorporated in investment strategies, as it has become a key determinant risk in companies' long-term prospects.[1] A recent report from EY stated that currently 88 percent of the institutional investors are taking Environmental, Social and Governance (ESG) factors into account when constructing or rebalancing their portfolios.[2] This shift in investors preferences has led to a divestment from carbon intensive assets, in particular those related to the oil and gas industry, as these exhibit high transition risks, making it less attractive to include them into their portfolios.

The financial risks associated with the transition to a low carbon economy, the so-called transition risks in combination with the shift in investor preferences have become a growing concern in the oil and gas industry (Carney, 2015). These transition risks are fueled by several recent developments. Firms operating in the exploration and extraction of oil and gas cope with increasing costs and regulations, consequently making new investments in fossil fuel projects not economically viable. Moreover, the decrease in the production costs of renewable energy technologies due to rapid innovation, enhances the competition with green energy sources. The

[1] https://www.blackrock.com/corporate/investor-relations/2020-larry-fink-ceo-letter#:~:text=In%20a%202020%20letter%20to,sustainability%2Drelated%20risk%2C%20such%20as.
[2] https://www.ey.com/en_nl/insights/climate-change-sustainability-services/institutional-investor-survey.

adoption and with that the increasing demand for electric vehicles will lead to a decrease in the long-term demand for petrol and diesel. Additionally, the introduction of stricter regulation regarding vehicle efficiency, will further reduce long-term demand for fossil fuels. Also, the implementation of carbon pricing mechanisms and environmental taxation skyrocket the operational costs. These transition risks are reflected in decreasing profitability, higher cost of capital, stranded assets, lower credit ratings and decreasing stock prices.

The financial implications regarding the incorporation of climate policies are generally undiscussed. Recent years, the financial sector has been reallocating huge amounts of capital to subsidize the decarbonization and transformation to sustainable economies. As large liquidity providers, they can define the outcomes of climate policies. Future expectations of firms and industries are mirrored by the reactions of financial markets, making them a well-established proxy to forecast the effectiveness of certain climate policies. The investments needed for the transition to a zero-carbon economy will thus be highly dependent on financial markets and institutions (Battiston et. al, 2021; TCFD, 2017). However, the uncertain speed of the transition and consequences have become a policy concern over the last years. If financial markets adapt as quick as the developments of climate policies, this could have large implications for the stability of the financial system. The pricing and quantifying of transition risks have turned out to be a major concern in developing climate policies (Drudi et Al., 2021; Semieniuk et al., 2022). Therefore, the goal of this thesis is to investigate how certain crucial climate policies affect the financial performance of the oil and gas industry in the US, Canadian, European, Australian and Japanese market. By examining crucial climate policies, we aim to get better insight in the severity of stock market reactions to climate policies. This results into the following main research question: *To what extent do climate policies affect the financial performance of oil and gas firms in Western markets?*

Although an increasing amount of literature has examined the effects of climate risk and ESG factors on financial markets, there is still limited understanding of how specific climate policy announcements affect the financial performance of carbon-intensive firms, particularly in the oil and gas sector. While previous literature primarily focused on the general correlation between firm-level ESG exposure and stock return, relatively a few studies have investigated the short and medium-term stock market reactions of carbon intensive industries to climate policy events. Moreover, existing literature focuses primarily on one policy dimension and one geographic region (mainly the US), limiting the ability to assess the exposure to transition risks in different institutional environments. This is critical limitation, as policy makers and investors must be able to quantify the financial consequences associated with the shift to a low carbon economy. Furthermore, the literature shows inconsistent evidence regarding whether climate risks are efficiently priced into equity markets, as many studies report varying investor responses and possible mispricing. Also, the majority does not address short-term investor sentiment reflected by implied volatility, trading volume or policy uncertainty factors. Investors sentiment is a relatively uninvestigated part of the transition risk.

This thesis addresses this research question by performing a multiple event study analysis including 5 different Western regions. Moreover, different event types are analyzed, such as the Paris Agreement, COP26, the Inflation Reduction Act (IRA) and the 2024 US election (2024), all having large implications on climate governance. Using an event-study we are able to determine how capital markets internalize transition risks into stock prices for oil and gas companies. In this way further insight is given into how oil and gas firms respond to various climate policy related events (elections, international policies and national policies) in different institutional contexts. It builds on existing literature by integrating several methodological approaches such as CARs (including the market model and Fama-French 5-factor model), BHARs and pooled OLS regressions to examine short- and medium-term climate policy impacts. Moreover, the role of ESG performance investigated as a potential buffer against negative policy shocks is further examined as it is underexplored common literature. Lastly, the impact of implied volatility of local stock indices on the cumulative abnormal returns is assessed.

The thesis shows that international climate agreements as the Paris Agreement, COP26 and COP28 lead to persisting negative abnormal returns for oil and gas companies, in particular in the US and Canada. This shows that internationally coordinated climate policy commitments can induce severe market reactions in the oil and gas equity markets, thereby enhancing transition risks. Conversely, national policies showed more mixed results. The EU Fit for 55 Package was the only policy that led to a consistent negative market response, indicating that national policies can result in increased transition risks across the globe. The EU Green Deal and the Inflation Reduction act denoted more anticipated reactions. Also, the political events had a notable impact on the oil and gas industry. Both Trump elections (2016 and 2024) reported moderate positive cumulative abnormal returns in the shorter windows, although this effect was reversed in the longer-run. In contrast, the election of Biden showed strong negative market reactions.

The BHAR analysis revealed that from the high impact events only the EU Fit for 55 Package and the COP28 shows persistent negative market reactions in the short to medium timeframe, reflecting that climate policy events can lead to sustained devaluations. This underscores that due interconnectedness of the financial markets climate policies can have persistent negative effects on the firm performance oil and gas firms.

The pooled OLS analysis showed that oil and gas firms headquartered in European or Canadian markets were more vulnerable to climate policy shocks than US firms, suggesting that investors price in transition risks more rigorously for firms located in a credible and ambitious climate policy framework. Additionally, the analysis showed that firms with a larger market capitalization are more resilient to climate policy shocks. Surprisingly, ESG ratings showed a positive correlation with the cumulative abnormal returns, contrarian to mainstream literature (Friede et. al, 2015; Bauert et al., 2024; Hsu et al., 2023). Furthermore, the implied volatility denoted consistent negative results in relation to the cumulative abnormal returns over multiple event windows, therefore suggesting that oil and gas firms might perform better during times of general economic uncertainty.

Overall, the findings indicate that internationally coordinated climate polices, national climate polices and climate policy shifts induced by elections can lead to severe negative effects on the financial performance of the oil and gas firms. It provides insight in the heterogeneous reactions by investors across different institutional environments induced by climate policy events and how certain climate policy can lead to spillover effects. This thesis contributes to the increasing literature which examines how climate risk is priced into financial markets and how investors react to certain climate related policies (Bolton & Kacperczyk, 2021; Pastor et al., 2021; Bua et al., 2024). Moreover, it contributes the existing literature who have studied the correlation between climate policy events and financial performance in carbon-intensive sectors like the oil and gas industry (Monasterolo & De Angelis, 2020; Diaz-Rainey et al., 2021; Henge et al., 2023; Ramelli et. al 2021). By analyzing multiple international agreements, national climate policies and political elections across the US, Canada, Europe, Australia and Japan, this thesis provides a comprehensive cross-country and multi-event perspective on how transition risks are incorporated in oil and gas equity markets. Moreover, this study also examines the relationship between different institutional environments and investor reactions due to climate policies, contributing to the current comparative institutional theory literature (Blanco et al., 2020). Furthermore, by incorporating ESG factors into the estimations of abnormal returns, this study builds and extends on earlier ESG literature related to firm performance (Friede et al., 2015; Bauer et al., 2024; Halbritter and Dorfleitner; Auer and Schuhmacher (2016); Shaneav and Ghimire, 2022; Lins et al. 2017; Yin et al.,2023). Lastly, this study contributes to the current implied volatility literature by examining the use of implied volatility as a proxy to determine market uncertainty during climate policy events (Ilhan et al., 2021; Diaz-rainey et al., 2021; An et al., 2014).

This structure of this thesis is as follows. Section 2 describes the prevailing literature and introduces the hypotheses formulated to address the research question. Section 3 involves the methodology used to test the hypotheses. In section 4 the emperical results will be presented and discussed. In section 5 an appropriate conclusion will be drawn. Moreover, in this section the limitations, discussion and future research will be discussed.

2 *Theoretical Framework*

This work builds on conventional finance theory and modern environmental issues. Firstly, related literature will be discussed after which hypotheses for this study are formulated and discussed.

2.1 Literature Review

2.1.1 Transition risk and stranded assets

The Task Force on Climate-Related Financial Disclosures (TCFD) and the Mark Carney Climate Risk Taxonomy developed a climate framework which describes the three fundamental climate related financial risks, namely the physical risk, the liability risk and the transition risk. Firstly, the physical risk which resembles the both acute and chronic risks arising from direct physical exposure to climate change, such as hurricanes, floods, rising sea level and wildfires. Secondly, the liability risk, the risk related with legal action to climate change, for example lawsuits against firms for environmental harm, greenwashing and shareholder litigation. Thirdly, the transition risk, which implies the risk associated with the shift to a low carbon economy, such as changes in policy, regulations, market behavior and technology. The latter, the transition risk, is for a high carbon intensive industry like the oil and gas industry from big importance, as their main business model is extracting, distributing and selling brown assets. According to Carney (2015), transition risk has evolved into a financial issue for capital markets, especially in fossil fuel intensive industries. He states that a slow transition to a low carbon economy would endanger financial stability through higher climate risk exposure. On the contrary, Papandreou (2019) suggests that a too rapid transition to a low carbon economy would lead to substantial devaluations in carbon intensive sectors and thereby spilling over to the entire financial system. The magnitude of the transition risks is influenced by the stringency of climate policies and the speed of transformation to a low carbon economy (Grubb et al., 2020; Batten et al., 2016).

An important aspect related to transition risks in the oil and gas industry induced by stringent global climate policies is the concept of stranded assets. These are assets that lose economic value before their end of their expected life as a consequence of regulatory policies, technological changes or market changes (Van Der Ploeg & Rezai, 2020). Stranded assets can be divided into two categories. The first one implies the financial losses caused by unexploited oil, gas and coal reserves.

Meinhausen et al. (2009) state that in order to reach the climate targets of the Paris Agreement, a large part of the global oil, gas and coal reserve cannot be exploited. The second type of stranded assets concerns the production assets that are devaluated or will need costly reconversion. Think of power plants, pipelines or high-emission industrial facilities that will become unprofitable or non-compliant. This implies that oil and gas industry will be confronted with assets write-downs, assets impairments and discontinuation of investments in costly extraction products. Moreover, this devaluation of brown assets will affect investors' expectations and will be eventually translated into the stock prices of oil and gas firms.

Daumes et al. (2023) states that stranded assets do not only endanger individual firms, but they could also impose major risks to the financial systems' stability. Due to the highly interconnectedness of the financial system, stranded asset related losses can indirectly spread to other firms (Semieniuk et al., 2022). This happens through several transmission channels. Large financial institutions often have substantial positions in fossil fuel related assets, increasing their balance sheet exposure to stranded assets. Rapid devaluation of these assets could cause solvency problems for these institutions, possibly leading to credit crunches, asset fire sales or liquidity crises. In addition to that, stranding assets may induce contagion. Instantaneous repricing in carbon intensive industries driven by for example climate policy announcements or technological breakthroughs in combination with high correlation among portfolios can lead to market-wide volatility. This effect might be enhanced by panic selling or herding behavior, creating spillover to other sectors. Moreover, stranded assets can lead to a so-called macro-financial feedback loop, in which shocks from the real economy spill over to the broader financial system. Stranding assets could trigger capital flights, making investors abruptly rebalance their portfolio, moving away from carbon intensive industries. Consequently, an underinvestment in carbon intensive industries will follow, resulting in decreasing exchange rates and increasing sovereign bond yields, making it harder to attract international credit. This in combination with a decline in oil and gas revenues will further weaken the governments budgets and eventually spillover to other countries industries, leading to a system-wide financial economic crises (Semieniuk et al., 2020). Lastly, in the financial system is a lack of oversight concerning climate risk exposures, creating climate-related blind spots. Most of the financial institutions do not provide extensive and consistent data about the carbon exposure of their portfolios. Although there are frameworks such as the TFCD, the implementation of particular disclosures is often voluntary and therefore leads to inconsistent data collection. This makes the identification of patterns regarding climate risk exposure challenging and could lead to an underestimation of systemic climate risk by regulators and investors. Comprehensive reporting of climate exposures is essential to determine vulnerabilities in the financial system. A lack of transparency increases the chance of transition shocks being mispriced or unrecognized, leading to contagion and financial distress (Drudi et Al., 2021; Semieniuk et al., 2022).

2.1.2 ESG investing and investors preferences

Another key development with regard to the increasing transitions risks is the shift in investors preferences from the traditional shareholder value model to the stakeholder-oriented model. The shareholder model implies that firms and investors aim to maximize short-term profits, while the stakeholder model thrives to take the interest of all kinds of stakeholders into account such as employees, creditors, suppliers, communities, customers, and the environment (Jansson, 2005). Where previously climate risks were seen as externalities, investors all over the globe are becoming more aware of the negative effects of climate risk exposure, preferring long-term value creation over short-term profits. Consequently, investors are extensively incorporating Environmental, Social and Governance (ESG) factors, socially responsible investing and impact investing into their investment strategy as there is an increasing demand for firms to align with sustainability and climate resilience goals (Krueger et al., 2020; Humphrey & Li, 2021). Growing literature shows that incorporating ESG in investing portfolios could yield positive returns. For instance, Friede et al. (2015) conducted a study analyzing over 2200 ESG related studies and found that around 90 percent of the studies report a non-negative relationship between ESG and stock performance. Moreover, around 63 percent of the studies even indicated a positive relationship. Furthermore, Yin et al. (2023) found a positive correlation between stock return performance and ESG rating, in particular for non-state-owned firms. Lins et al. (2017) examined the relationship between ESG performance and stock return following the 2008 financial crisis and found that companies with enhanced social responsibility outperformed other firms and exhibited more resilience to crisis-related risks. On the contrary, Halbritter and Dorfleitner (2015) did not report any significant relationship between ESG ratings and stock returns. Moreover, Shaneav and Ghimire (2022) showed by using multiple asset pricing models that higher ESG ratings are correlated with lower stock returns. Additionally, Auer and Schuhmacher (2016) showed that ESG-related investments are more widely supported and adopted by European investors compared to those in the U.S. and Asia-Pacific regions; nonetheless, they also reported that such investments do not consistently result in superior stock performance. These findings indicate that incorporating ESG considerations into investment strategies might act as potential hedge against transition risks, though the financial performance is dependent on firm characteristics, region and market conditions. This heterogeneity might question to what extent the increasing investor preference for ESG investing actually mitigates the adverse of climate policy shocks in the oil and gas sector, a key item in this thesis.

2.1.3 Climate risk pricing in financial markets

Given the growing attention for ESG investing as a potential strategy to manage transition risks, the question arises whether climate-related risks are already priced into financial markets, especially in carbon-intensive sector such as the oil and gas industry. The evidence in the literature regarding the existence of a carbon risk premia remains inconclusive. Matsumura et al. (2014) state that greater carbon emissions are negatively correlated with firm valuation. Moreover, Bolton and Kacperczyk (2021) found that companies with higher total carbon emissions have higher returns, indicating that investors demand compensation for being exposed to carbon risk. Nevertheless, their research did show a discrepancy. Although investors responded to absolute emissions, their divestment strategies were mainly focused on certain industries and emission intensity. Pastor et al. (2021) state that in equilibrium green assets achieve lower expected returns than brown assets, as investors use green assets to hedge climate risk. However, when investors are faced with concerns about a climate shock, green assets outperform brown assets, resembling a change in investor preferences. Furthermore, Bua et al. (2024) found that European investors are pricing in both transition and physical risk into financial markets. Hsu et al. (2023) showed in their study that high carbon intensive firms are more vulnerable to strict environmental policy risk and therefore investors demand higher returns. Additionally, firms that have a large carbon exposure could face higher cost of debt and equity (Chava, 2013; Yan et al., 2025). Ilhan et al. (2021) stated that firms with a high carbon intensity experience significantly greater downside tail risk, which can be seen in prices of equity options markets. This shows that carbon risk is not only priced through average returns, but also through skewness and implied volatility. On the contrary, Hong et al. (2019) report that global equity markets do not adequately price the increasing risk of drought severity faced by agricultural companies. Moreover, Gorgen et. al (2022) did not find any carbon premium, although carbon risk did explain systemic risk variation well. Furthermore, Choi et al. (2020) found that carbon intensive firms underperform during abnormal warm period, when investor awareness of climate risks is expected to be elevated. However, this underperformance is not explained by fundamentals and does not show reversal over time, indicating that climate risk is not efficiently priced.

Although the Efficient Market Hypothesis (EMH) states that markets are informationally efficient and assets in financial markets fully reflect all available information (Fama, 1970), there is growing evidence that climate risk may be mispriced in financial markets. Engle et al. (2020) stipulated the fact that inadequate universal metrics to report and measure firms' exposure to climate risk hinder climate related investment decisions. In this way, investors cannot make a unified assessment of a company's exposure to climate risk, which can result in the risky assets holdings (Bolton and Kacpercyzk, 2021). Moreover, investors may not be responsive to climate change shocks due to unawareness and market inattention, suggesting that climate risk pricing could be affected by the attention of investors (Engle et al., 2020). Murfin and Spiegel (2020) and Hong et al. (2019) found inefficiencies in climate risk pricing, assigning this to market inattention and skepticism to climate risk shocks. On the contrary, this could also be attributed to the heterogeneity of beliefs about the size of value impact (Lontzek et al., 2023). Barnett et al. (2020) highlight that uncertainty – in particular ambiguity and incorrect model assumptions – is a crucial determinant of both climate policy outcomes and the valuation of financial assets. Furthermore, Kumar et al. (2019) also found that climate risk is not efficiently priced into financial markets. These inefficiencies and conflicting findings raise the question to what extent climate policy shocks are actually internalized into stock valuations. This underscores the need to examine how specific climate policy events are reflected in financial markets, especially in a carbon-intensive industry as the oil and gas industry.

2.1.4 Financial market response to climate policies

Currently, there are relatively few studies that examined the effect of climate policies on stock returns of firms in the oil and gas industry. Monasterolo and De Angelis (2020) investigated whether financial markets price in transition risks, in particular with regard to the announcement of the Paris agreement. Their findings suggest that the announcement of the Paris Agreement led to a decrease in systematic risk of low carbon indices, while the effect on the high carbon indices was moderate. Their findings suggested that investors started to perceive assets with high carbon exposure as riskier holdings and started to rebalance their portfolio to more low carbon assets. This supports the view that stringent climate policy announcements can serve as a mechanism through which transition risks are gradually priced into financial markets. Furthermore, Mukanjari and Sterner (2018) examined the reactions of financial markets with respect to different energy sectors (from renewables to fossil fuels) to the announcements of the Paris Agreement and the US 2016 elections (Trump 1). These results showed that the adoption of the Paris Agreement had a negative impact on the stocks returns of the oil and gas industry, but on the contrary rewarding the renewable energy sector. However, these reactions were reversed after the Trump 1 election, indicating that investors are closely observing and pricing in signals of changing climate policy. The study of Diaz-Rainy et al. (2021), which is closely related to this thesis, performed an event study regarding the effect of climate policy on the financial performance of listed US oil and gas firms. They found that the announcement of the Paris Agreement resulted in negative cumulative abnormal returns for oil and gas firms, but in particular for the exploration and production sector (scope 1). Besides, they observed a steep increase in option-implied volatility, resembling investor uncertainty. Surprisingly, they found that the election of Trump 1 resulted into negative abnormal returns in oil and gas industry overall. They assigned this to the fact that deregulation led to benefits for only unlisted oil and gas companies, while the international operating and listed firms were still exposed to the global transition risks and green initiatives. Moreover, they attributed this to sub-national green initiatives such as the "we are still in' and United States Climate Alliance initiatives. Ramelli et al. 2021 examined the response of the stock market during the 2016 and 2020 U.S. Presidential elections. They found enhanced stock market performance for carbon-intensive firms in response to Trumps' election, while firms with greater climate responsibility exhibited higher abnormal returns during both the Trump and Biden election victories. Ardia et al. (2022) constructed a Climate Change Concerns index based on news about climate change from major newspapers. Their findings showed that on days with unexpected increase in climate change concerns, green stocks increased in value and brown stocks decreased in value. Additionally, Henge et al. (2023) examined the impact of unexpected increase in carbon price – induced by regulatory announcements under the EU Emissions Trading System (ETS) – on firm performance by using data of 2000 publicly listed European firms. They found that firms with high carbon exposure reported negative stock returns, with a pronounced measured effect for firms outside the scope of the ETS. Furthermore, Bauer et al. (2024) showed that firms with high ESG scores, in particular high environmental scores, during the introduction of the Inflation Reduction Act (IRA) in 2022 displayed fewer negative abnormal returns compared to firms with lower ESG scores. This suggests that higher ESG scores can serve a potential mitigator against policy shocks.

Overall, the existing literature demonstrates that climate policy can induce significant market reactions in financial markets. However, the direction, size and duration of these effects differ. This thesis further examines how such policy announcements affect the stock returns of oil and gas companies across different regions.

2.1.5 Institutional context and geographic heterogeneity

Furthermore, the comparative institutional theory states that investment behavior in financial markets can be determined by the institutional environment. The institutional environment implies the set of rules, norms and enforcement mechanisms to which economic systems are bound in a particular country or region (Daddi et al., 2018). This theory suggests that different climate policy events could result into different investor reactions depending on the stringency and credibility of climate institutions. Blanco et al. (2020) argue that carbon and energy targets are used to monitor their progress toward policy goals. The European Union (EU) has a multilateral binding and regulatory framework incorporating several stringent climate and disclosure regulations such as the EU Green Deal, EU Emission Trading System (EU ETS) and mandatory sustainability reporting (CSRD). On the contrary, the US is more conservative in this aspect, as their climate policy is largely dependent on switches in their federal government. Additionally, climate regulation can also be determined at the state level, leading to even more uncertainty. Moreover, Canada has introduced ambitious climate policies recent years, such as the Net-Zero Emissions Accountability Act and Clean Fuel Regulations. However, political fragmentation and provincial differences limit the enforcement of these ambitious climate policies. Furthermore, Australia is historically seen a large exporter of fossil fuels and is known for their limited climate ambition. Nonetheless, Australia has increased climate commitment by initiatives as the Australia Safeguard Mechanism Reform, but their climate policy framework is still evolving. Lastly, Japan is known as a large importer of fossil fuels. Japan increased its climate policy ambitions recently, though it is known for its delay in implementing these policies. The above suggests that differences in institutional environment trigger different reactions by financial market to similar climate policies.

2.2 Hypotheses development

Based on the literature and empirical evidence above, the following hypotheses are formulated.

H_1: The introduction of stricter climate polices and regulations are correlated with negative cumulative abnormal returns for firms in the oil and gas industry in Western Markets.

Firms operating in the oil and gas industry are highly exposed to carbon risk. According to the theory of transition risks, firms with a high carbon exposure are confronted with increasing financial risks when stringent climate policy is introduced (TFCD, 2017). This is due to several factors. Transition risks can result in direct limitations in extracting and exploration of new oil and gas resources. On the long-term this can potentially result into stranded assets and therefore huge losses. Furthermore, this will lead to an increase in operational and regulatory costs. Think of the increased costs associated with carbon-intensive production processes, such as penalties for flaring and methane leakages or the increasing cost of capital due to lower credit ratings and higher interest rates. Moreover, the introduction of Emission Trading Schemes, carbon pricing and increasing compliance (CSRD) will lead to additional regulatory costs. These increasing costs will weaken the competitive advantage of oil and gas firm compared to renewable companies. Furthermore, the EMH theory states that markets are efficient and incorporate all available information. This means that these increasing costs associated with transition risk and the decreasing competitive advantage should be reflected in negative abnormal returns in case a new stringent climate policy or climate policy related event has occurred. This is supported by the findings of Mukanjari and Sterner (2018) and Diaz-Rainy et al. (2021), showing that a credible announcement of climate policy can result in negative abnormal returns for firms in the oil and gas industry.

H_{1A}: The financial performance of oil and gas firms in the European market are more heavily impacted by stringent climate policy events or shocks than US oil and gas firms.

When we take the comparative institutional theory take into account, meaning that investment behavior in financial markets can be determined by the type of institutional environment, we expect that the adoption of the same climate policies can result in different expectations and responses from investors. As discussed earlier, Europe has a more supplicated, coordinated and credible climate policy regulation compared to the US. The US is more prone to policy volatility due to governmental changes and state-driven climate regulation. Therefore, we would expect that transition risks are more priced by European financial markets. In other words, the implementation of stringent climate policy will impact the oil and gas industry in Europe more heavily, as investors in European markets are anticipating transition risk. This is also supported by the findings of Monasterolo and De Angelis (2020), Berg et al. (2023) and Bua et al. (2021), who find that climate risk is priced more aggressively in European markets than in the U.S.

H_2: Oil and gas companies with higher ESG ratings experience fewer negative cumulative abnormal returns in climate policy events than companies with low ESG scores.

ESG factors are globally increasingly incorporated by institutional and retail investors into their investment strategies (Krueger et. al, 2020). In line with stakeholder theory, companies that meet their obligations to various stakeholders, can build sustainable and ethical firms. By doing this, they attain long term value creation for all stakeholders involved. Incorporating ESG in their business strategies could therefore lead to a mitigation of the adverse effects related to the introduction of new climate policies. Therefore, a positive correlation is expected between the ESG score and the negative cumulative abnormal returns during climate policy events. This is supported by the study of Bauert et al. (2024), who found that US firms with high ESG scores during the introduction of the Inflation Reduction Act in 2022 exhibited fewer abnormal returns than firms with lower ESG scores.

H_3: Climate policy events will lead to an increase in implied volatility of stock indices, indicating higher investor uncertainty.

According to the option pricing theory of Black and Scholes, the implied volatility can be used to determine the market expectation regarding future stock fluctuations (Black and Scholes, 1973). When new climate policies are adopted, the fundamentals for carbon intensive industries will be reconsidered, as there is increasing uncertainty about the future cash flows, liabilities and profitability due to transition risks. In addition to that, the information regarding the implementation of these climate policies is often vague and inconsistent, leading to further uncertainty. Option traders adapt their behavior accordingly when uncertainty increases, leading to an increase in demand for options in order to hedge downside risk. Consequently, a steep increase in implied volatility will follow, indicating that investors anticipate higher uncertainty and potential downside risk. Therefore, we would expect an increase in implied volatility when more stringent climate policy is implemented. This is supported by the study of Ilhan et al. (2021) who found that after major climate policy events firms with high carbon exposure found a higher tail-risk and implied volatility. Also, Diaz-rainey et al. (2021) found a strong increase in implied volatility after the adoption of the Paris Agreement and election of Trump 1.

3 Methodology

In order to measure the short-term impact of different climate policies or climate policy related events on the financial performance of firms in the oil and gas industry, an event-study approach will be used. Event studies are widely used in economics to test for stock price reactions around certain events of importance (Brown & Warner, 1985; MacKinlay, 1997). By using an event-study approach, we will try to gain more insight in the short-term impact of climate policies on financial performance in the oil and gas industry. Moreover, multiple multivariate regressions will be run in order to separate the event effect from other factors contributing to the results of the abnormal returns.

3.1 Sample and Data collection

The sample used in this thesis consists out of 688 US, European, Canadian, Japanese and Australian publicly listed oil and gas and coal mining companies. These firms can be divided into three sub-sectors, upstream, midstream and downstream companies. Upstream involves the extraction and exploration of oil and gas. Midstream implies mainly the transportation and storage of natural gas. Downstream involves the processing and distribution of oil and natural gas as well as selling products to customers. The sample contains data from the period 2013 until and including 2024.

In order to delineate the sample to purely publicly listed oil, gas and coal mining companies, the ORBIS database was used to retrieve the company data and industry codes. Daily stock returns, index returns, historical volatility and trading volume are obtained from Refinitiv database, as well as the control variables Tobins Q, Current Ratio, Market Capitalization, ESG ratings and Firm Age, Brent oil price and the Henry Hub Natural Gas Spot Price. The data regarding the Fama French 5 Factor model including the Carhart Momentum Factor is downloaded from the Kenneth R. French database.[3] The policy uncertainty factor is retrieved from the Economic Policy Uncertainty Database.[4] The implied volatility of the local stock indices (VIX) is retrieved from Yahoo Finance. All data is retrieved over the period 2014 until and including 2024. Furthermore, all currency denoted variables are expressed in US dollars.

[3] https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html
[4] https://www.policyuncertainty.com/

It was noticeable that the raw dataset contained a considerable number of outliers, particularly in the financial metrics of the companies. To address this issue, the winsorization method was applied, meaning a certain percentage of the extreme values at both ends of the distribution is replaced with the respective average values. Specifically, for stock returns, the top and bottom 0.3 percentiles were replaced by their mean. For all other variables, the top and bottom 1 percentile were similarly replaced by their respective average values.

3.2 Timeline and events

This study investigates the impact of 11 climate policy-related events between 2015 and 2024 on the financial performance of oil and gas companies, by analyzing abnormal returns across various event windows. Each event analyzed in this study is carefully selected based on the following five criteria to assess their possible impact and relevance on the oil and gas industry. First, each event must represent an activity which directly or indirectly relates to changes in climate policy, reflecting either regulatory shifts or policy signals with potential financial implications. Second, each event must potentially have a reasonable possible impact on the oil and gas industry, such as changes in investor sentiment, increasing costs or expected stricter future regulation. Third, the events must geographically spread and include regional regulatory diversity. In this way a comparison across jurisdictions with different climate policy stringency can be made (Blanco et al. (2020). Fourth, the information must be transparently and timely published to financial markets. Fifth, the event type must vary in order to capture a broad range of climate-related transition risks and investor responses (Batten et al., 2016; Grubb et al., 2020). Therefore, three different categories of events are analyzed in this thesis: elections, international policies and national policies.

The international agreements involve the Paris Agreement or COP21 (2015), COP26 Glasgow (2021) and COP28 Dubai, all considered milestones in the development global policy coordination. The national policy events include the withdrawal from the Paris Agreement by the US (2017), the EU Green Deal (2019), the rejoining of the Paris Agreement by the US (2021), the EU fit for 55 Package (2021) and the Inflation Reduction Act (2022). Finally, the elections include the 2016 (Trump I), 2020 (Biden I) and 2024 (Trump II) US elections. These events encompass a broad scope of binding and non-binding agreements, potentially inducing severe transition risks for the oil and gas sector (Monasterolo & De Angelis, 2020; Ramelli et al., 2021; Bauer et al., 2024; Henge et al., 2023; Diaz-Rainy et al., 2021). A detailed overview of all events including their dates, categories, rationale and corresponding expectations can be found in the Table 5 of the Appendix.

3.3 Variables

3.2.1 Main variables

CAR Analysis

In order the examine the investor reactions on the stock prices due to climate policy events, the event-study approach of Kolari and Pyonomen (2010) is applied. Climate policy events usually are adopted at specific dates among a broad sample of firms, meaning they affect market or sectors simultaneously.

As estimation window the period from t= -225 trading days to t= -26 trading days will be taken. This estimation window is long enough to estimate reliable long term abnormal returns and is also in accordance with literature of other climate policy event studies (Diaz-Rainey et al., 2021). Furthermore, an interval of 5 trading days is included between the estimation window and the event window to prevent possible information leakage or market speculation to impact the abnormal returns. The benchmark window used in the CAR analysis is t= -5 to t= +5, as it accounts the actual timing of news leakage before the event as well the event as the possibility of market underreaction after the event. Moreover, five alternative event windows are chosen as robustness check, namely an event window from t= 0 to t=2, t= -1 to t= +1, t= -10 to t= +2, t= -10 to t= +10 and t= -20 to t= +20. Furthermore, if the event takes place on a non-trading day, the first trading after the event is used as event date. In the instance of missing stock data or ETF datapoints in the estimation window or event window, these companies are excluded from the results.

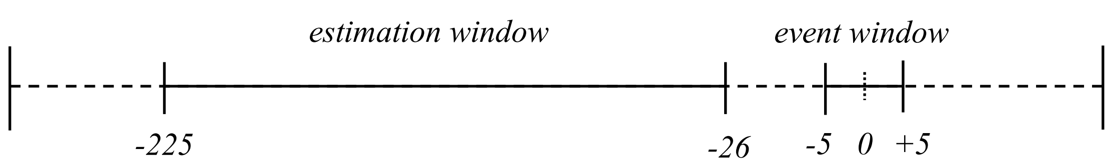


***Figure 1**. Event study timeline of benchmark window [-5,5]. The analysis also involves alternative windows [-1, 1], [0, 2], [-10, 2], [-10, 2], [-10,10] and [-20,20]*

To be able to measure the cumulative abnormal returns (CAR) of each event, the AR is calculated using both (i) the market model and (ii) the Fama-French Five-factor model including the Carhart

Momentum Factor (Fama & French, 2014). The market model will be used for the initial estimation of abnormal returns, as it is widely used in event studies to estimate the presence of abnormal returns in the occurrence of certain events (McKinlay, 1997). The intuition behind the market model is to estimate the expected return of a firm based on its historical relationship with the overall market. This market return is composed out of two elements: the market return (the beta coefficient) and a firm specific variable that cannot be explained by the market movement (the alpha). The following formula (i) here below resembles the market model.

$$R_{i,t} = \alpha + \beta_i (R_{m,t}) \qquad (i)$$

The abnormal return of the stock is calculated by taking the actual return of the firm and subtracting it by the market return calculated by the market model. The following formula (ii) resembles the formula of the abnormal returns calculated by the market model

$$AR_{i,t} = R_{i,t} - (\alpha + \beta_i R_{m,t}) \qquad (ii)$$

When using this formula to calculate abnormal returns, we proxy the return of the market using the return of the S&P 500 index at time t for American oil and gas firms, the return of the Euro Stoxx 50 at time t for European oil and gas firms, the return of the S&P/ASX 200 at time t for Australian oil and gas firms, the return of the S&P/TSX Composite Index for Canadian oil and gas firms and the Nikkei 225 for the Japanese oil and gas firms.

Once the market model is run, the Fama French 5 factor regression model in combination with the Carhart momentum factor will be used for an even more reliable and extensive estimate of the abnormal returns of 'high impact events.[5] The Fama French five factor model is an extension of the traditional CAPM model and Fama French three factor model and is commonly used in economics to explain stock returns. Besides the market risk premium (CAPM), a size factor (SMB) and a value factor (HML), it incorporates two additional factors in order to explain systemic risk

[5] A high impact event is an event that induces an estimated consistent significant CAAR of 3 percent or higher across multiple regions.

in stock returns, namely a profitability factor (RMW) and an investment factor (CMA). Additionally, we include a momentum factor (MOM) into the regression model to control for the presence of momentum. Lastly, the Brent Oil Price and gas price is added as control variable.

The regression formula of the Fama French 5 factor model is formulated as the following:

$$AR_{i,t} = R_{i,t} - \{ R_{f,t} + \alpha + \beta_{1,i} (R_{m,t} - R_{f,t}) + \beta_{2,i} SMB_t + \beta_{3,i} HML_t + \beta_{4,i} RMW_t + \beta_{5,i} CMA_t + \beta_{6,i} MOM_t \} \quad (i)$$

Important to note for the calculation of the abnormal returns is that some events which are included in this study overlap, in the sense that the event windows of two or more events overlap. This makes the approach of the market model or the Fama French 5 Factor Model for the calculation of the abnormal returns unreliable. Therefore, the choice is made in case of two or more events within the time range of 10 trading days to take these events together and analyze it as one event (Mackinlay, 1997). In this instance, the Market model and the Fama-French 5-Factor model is still used to calculate the abnormal returns.

Once the abnormal returns are calculated per firm over the event window, the abnormal returns will be cumulated for each firm over the event window, thereby calculating the cumulative abnormal return (CAR) over the event window. When adding all these CARs together and dividing them by the number of firms, the cumulative average abnormal return is calculated (CAAR). You can find the formulas of the CAR (ii) and CAAR (iii) here below.

$$CAR_{i,t} = \sum_{t=-T}^{t=T} AR_i \quad (ii)$$

$$CAAR_{i,t} = \frac{1}{N} \sum_{i=1}^{N} CAR_{i,t} \quad (iii)$$

Table 1 *Variable Summary CAR Calculations*

Name	*Variable*	*Description*
$AR_{i,t}$	Dependent	The Abnormal Return of firm i at time t
AAR_x	Dependent	Average Abnormal Return in window x
$CAAR_x$	Dependent	Cumulative Average Abnormal Return in window x
$R_{i,t}$	Independent	The Stock Return of firm *i* at time *t*
$R_{f,t}$	Independent	The Risk-Free Rate resembled by the one-month US Treasury Bill rate at time *t*
$(R_{m,t} - R_{f,t})$	Independent	The Market Risk Premium controls for the excess return generated by investing in the market over the risk-free rate firm *I* at time *t* (Sharpe, 1964)
SMB_t	Independent	The Small-Minus-Big factor controls for the empirical observation that in the long-run smaller firms tend to outperform larger firms at time t (Fama & French, 1993)
HML_t	Independent	The High-Minus-Low factor controls for the empirical observation that firms with high book-to-market tend to outperform those with a low book-to-market value at time t (Fama & French, 1993)
RMW_t	Independent	The Robust-Minus-Weak profitability factor controls for empirical observation that firms with high operating profitability ('robust') to outperform those with low profitability ('weak') at time t (Fama & French, 2014)
CMA_t	Independent	The Conservative-minus-Aggressive factor controls for the empirical observation that firms who invest conservatively outperform those who invest aggressively at time t (Fama & French, 2014)
MOM_t	Independent	The Momentum factor controls for the empirical observation that firms which performed well in the last 6 to 12 months keep performing well in the next 3 to 12 months and vica versa at time t (Jagadeesh & Titman, 1993)

BHAR Analysis

In addition to the traditional event study methods, a Buy-And-Hold abnormal return (BHAR) analysis will be performed to examine the medium- and or long-term effects of the climate policy related events on the financial performance of oil and gas companies. By incorporating the BHAR into the analysis we are able to determine whether the valuation effects measured with the CARs are persistent over time (Barber & Lyon, 1997). It will therefore be used as a robustness check for 'high-impact events' with long-term implications, such as the Paris Agreement, COP 26 and 28, the EU Green Deal and Inflation Reduction Act. The BHAR is calculated by taking the compounded buy-and-hold return of an oil and gas firm and subtracting this from the buy-and-hold return of a benchmark index in a similar period. The benchmark return will, similar to the CARs, be proxied by local index returns. The BHAR's are calculated over three windows: t=0 to t=30, t=0 to t=60, t=0 to t=90 and t=0 to t=120. By using these event windows to balance the detection of structural market reactions with the need to minimize noise from unrelated market developments. You can find the formula of the BHAR analysis here below.

$$BHAR_{i,t} = \prod_{t=1}^{T}(1 + R_{it}) - \prod_{t=1}^{T}(1 + R_{bt}) \quad (iv)$$

$BHAR_{i,t}$ = Buy-And-Hold Abnormal Return for firm i at time t
$R_{i,t}$ = daily stock return of firm i a time t
$R_{b,t}$ = daily return of the Benchmark Index on time t
T = total length in trading days of the holding period stock of firm i

3.2.2 Control variables

After calculating the CARS by the Market Model and Fama French 5 factor model, several multivariate Pooled OLS regressions will be run on the calculated CARs of each event window. By doing this, it is possible to further examine what firm level factors or macro-economic factors might drive to these positive or negative cumulative abnormal returns.

Investors sentiment

The first control variable involves the Policy Uncertainty Indicator (PUI), representing a score based on the measured general policy uncertainty. Policy events can induce uncertainty as often the implications of events or policies are not directly clear to the public. Baker et al. 2016 found that higher policy uncertainty has a negative effect on cumulative abnormal returns. Moreover, Jin et al. (2019) found that increasing policy uncertainty is positively correlated with stock price crashes. This effect is particularly relevant for firms operating in carbon-intensive industries such as the oil and gas industry, as climate policy uncertainty leads to increasing valuation risk (Ilhan et al., 2021). Furthermore, macroeconomic conditions caused by precautionary demand or geopolitical tensions are correlated with an increase in policy uncertainty (Kang and Ratti, 2013). By including the climate policy factor as control variable, it ensured that the impact of climate policy events is separated from broader general economic uncertainty.

Secondly, the historical volatility is used as control variable, resembling the actual observed fluctuations of firm's stock price in the period leading up to the event. It controls for the fact that certain firms exhibit historically seen more volatility, which suggests that these firms are more vulnerable to climate policy shocks (Zhang et al., 2006). Moreover, the incorporation of historical volatility secures that the estimated CARs are not driven by trends in volatility, but can be attributed to the climate policy events itself. Additionally, the implied volatility is added as control variable, as it used to forecast market uncertainty and market expectations. It mirrors investor expectations about future risk in the broader financial system and is influenced by macroeconomic shocks and policy announcements. The implied volatility in this study is derived from index options of the S&P 500, the Eurostoxx 50, the S&P/ASX 200, S&P/TSX and the Nikkei 225. By integrating implied volatility from major index options, this study captures system-wide sentiment and perceived risk that might influence how investors respond to climate policy events (Ilhan et al., 2021; An et al., 2014). This is highly relevant to control for, because the uncertainty induced by climate policy events could have a spillover effect to other sectors. Furthermore, Trading Volume are widely used proxies to measure market sentiment and investor attention. Trading volume is perceived as indicator for informational salience of a stock; it reflects how much attention is given to certain stocks by investors and how fast new available information is priced into the stock price. Stocks with higher trading volume are positively related to the degree of price change (Karpoff, 1987).

Market size and profitability

The return on equity, Tobin's Q, current ratio and log market capitalization will be used as control variables, as they proxy the profitability, liquidity and size of a company. Firms with weaker financial fundamentals are more prone to the adverse changes climate of policy, as they often do not have the financial buffers or strategic capability to adapt to these policy changes (Liu et al. 2024; Ilhan et al., 2021). Moreover, firms with high market value or high Tobins Q are often growth-oriented, meaning they are generally valued based on their future growth expectations. This makes these firms in particular vulnerable to uncertainty and regulatory risks associated with climate policy event shocks (Ziegler et al., 2009). On the contrary Delis et al. (2019) state that firms with a higher market capitalization are less impacted by climate transition risk in financial markets, making them resilient to increasing borrowing costs. They attributed this to their stronger creditworthiness and potential government support.

Moreover, higher transition risk might result in the revaluation of credit risk, particularly for firms with high carbon exposure. Furthermore, older companies often have strong routines and long-term capital structures, reducing the flexibility changes in governance. However, older companies do have excess to historical data and relationships, and they preserve operational stability which can also contribute to a more easily adaption to climate policy shocks. Younger companies might respond earlier to sustainability trends, but face more problems with regard to financing their operations (Berrone et al., 2013).

Additionally, Incorporating ESG performance as an explanatory variable provides insight into whether firms with stronger sustainability profiles show different sensitivities to climate policy shocks. Given the growing emphasis by institutional investors on ESG criteria when allocating capital (Friede et al., 2015; Krueger et al., 2020), ESG performance may serve as a buffer that mitigates the adverse effects of transition risks on firm valuations.

Furthermore, the daily Brent Oil Price and the daily Henry Hub Natural Gas Spot Price (DHHNGSP) will be used as control variable, as both oil and gas prices directly impact the profitability of oil and gas companies. The Brent Oil Price is the global benchmark used to determine the oil price, making it an excellent variable to incorporate in the regression model. The Henry Hub Natural Gas Spot Price resembles the benchmark price for gas in the US, which is globally used as key indicator for gas market conditions. Besides their direct financial impact, fluctuations in oil and gas prices might drive investor sentiment and volatility expectations. Therefore, by including them as control variables, we are able to separate pure climate policy effects from global market conditions.

Lastly, regional dummies as well as event type dummies are used as control variables, to gain insight whether certain regions or certain event types are correlated with the cumulative abnormal returns. The dummy variable indicates a value of 0 in case of the absence of certain region or certain event type and the value of 1 indicates the presence of a region or an event type. As reference category for event type the US is chosen. The reference category for event type will be Election.

For a complete description of all control variables, see Table 3. Moreover, the descriptive statistics of all variables are presented in table 4.

Table 2 *Control variable summary*

Name	Variable	Description
ROA	Dependent/ Independent	Return on Assets of firm i at time is t (yearly)
ROE	Dependent/ Independent	Return on Equity of firm i at time is t (yearly)
TQ	Dependent/ Independent	Tobin's Q of firm i at time is t (yearly)
PUI	Independent	Policy Uncertainty Indicator at time is t (daily)
Volatility	Independent	Historical Volatility of firm i at time t (daily)
Volume	Independent	Tranding volume of firm i at time is t
LOG MV	Independent	Log market capitalization of firm i at time is t (yearly)
CR	Independent	Current Ratio of firm i at time is t (yearly)
Brent Oil Price	Independent	Brent crude oil price (in USD per barrel) at time t (daily)
DHHNGSP	Independent	Henry Hub Natural Gas Spot Price in USD per MMBtu at time t(daily)
CA_dum	Independent	Dummy variable indicating the presence of Canadian oil and gas firms. Value equal to 1 is present, value equal to 0 is not present.
JAP_dum	Independent	Dummy variable indicating the presence of Japanese oil and gas firms. Value equal to 1 is present, value equal to 0 is not present.
AUS_dum	Independent	Dummy variable indicating the presence of Australian oil and gas firms. Value equal to 1 is present, value equal to 0 is not present.
EU_dum	Independent	Dummy variable indicating the presence of European oil and gas firms. Value equal to 1 is present, value equal to 0 is not present.
IP_dum	Independent	Dummy variable indicating the presence of event type "International Policy". Value equal to 1 is present, value equal to 0 is not present.
NP_dum	Independent	Dummy variable indicating the presence of event type "National Policy". Value equal to 1 is present, value equal to 0 is not present.

Table 3 *Descriptive statistics of all variables*

	Beta (β)	N	Mean	St. dev.	Min.	Median	Max.
Panel A: Financial Metrics							
Stock Return	0.02	663	0.00	3.11	-100.00	0.11	100.00
Index Returns		668	0.00	0.71	-16.40	0.10	3.50
ROE		524	-14.30	28.59	-103.70	-5.10	116.70
CR		548	3.70	5.78	0.20	1.40	23.20
TQ		552	2.40	3.21	0.60	1.20	14.00
Panel B: Firm-level statistics							
Volatility		663	1.15	1.06	0.00	0.83	15.92
Volume		657	2444.00	30904.21	0.00	137.00	9569028
LOG Market Value		654	2.99	3.41	-4.61	2.88	12.27
Firm age		593	18.75	18.13	1.00	14.00	134.00
ESG		198	40.80	21.51	0.90	38.60	93.30
Panel C: Macroeconomic statistic							
PUI		669	193.77	96.78	37.09	170.48	883.28
VIX		669	17.62	6.69	7.39	15.80	85.62
Brent oil price		669	72.47	23.22	9.12	71.21	133.18
Henry hub Natural gas price		669	3.26	1.45	1.21	2.88	23.86
Panel D: Fama French Factors							
MRP		669	0.04	1.03	-1.20	0.05	9.52
HML		669	-0.01	0.72	4.40	-0.01	6.63
SMB		669	-0.01	0.51	5.27	-0.02	5.15
RMW		669	0.01	0.35	1.81	0.01	3.43
CMA		669	0.00	0.44	-2.80	-0.01	2.31
MOM		669	0.02	0.83	-12.07	0.05	0.02
Risk-free rate		669	0.01	0.01	0.00	0.00	0.02

3.3 Econometric Specifications

In this section 3.4.1 the methodology is explained to test hypothesis I. In section 3.4.2 the methodology of hypothesis I, II and III is discussed.

3.3.1 Hypothesis I

CAR analysis

In order to test the first hypothesis, firstly a CAR analysis will be performed. To strengthen the results found at the CAR analysis, an additional panel regression is conducted. Moreover, a BHAR analysis is performed.

In order to test Hypothesis I (stringent climate policy events have a significant negative impact on the CARs of firms in the oil and gas industry), at first an event analysis will be performed by calculating the AARs and CAARs for all companies for each event over multiple event windows (from t= 0 to t=2, t= -1 to t= +1, t= -5 to t= +5, t= -10 to t= +2, t= -10 to t= +10 and t= -20 to t= +20). The CARs will be calculated by using at first the market model or the market adjusted model, depending on the date of certain events which could possibly confound with each other. The high impact events will then be taken out and further examined by using the Fama-French 5-Factor Model including the Carhart Momentum factor as robustness check. For further explanation regarding the calculation of the CARs, see section 3.3.

When conducting an event-study, results can be biased because of cross-sectional correlation between the abnormal returns of the firms. Another problem that could occur is event-induced volatility. These biases can lead to an over-rejection of the null hypothesis. To validate the significance levels of the abnormal returns, two statistical tests are performed as robustness check. The first test used is the Patell test, a parametric method that adjusts for firm-specific return volatility in order to assess whether the average standardized abnormal returns significantly differ from zero (Patell, 1976). Nonetheless, the Patell test assumes that returns are normally distributed, therefore an additional non-parametric test, the Corrado Rank test, will be applied to address potential deviations from normality (Kolari & Pynnönen, 2010). Specifically, the Corrado rank test controls for the effect of non-normality and outliers (Corrado, 1989). Using this approach, it is ensured that the results will not be biased by extreme values or deviations from standard normal distributions.

BHAR

To assess the medium to long-term impact of the climate policies on the financial performance of the firms, a Buy-and-Hold Abnormal return analysis is performed after the announcement 'high impact events. The following events windows will be used in the BHAR analysis: t=0 to t=30, t=0 to t=60, t=0 to t=90 and t=0 to t=120 trading days (Barber & Lyon, 1997). For further explanation regarding the calculation of the BHARS see section 3.1.2.

Although the BHAR will gain to a more representative intuition regarding the impact of climate policy related events on abnormal returns of oil and gas companies, it does come with some limitations. The BHAR model is prone to the benchmark bias and the survivalship bias. The benchmark bias concerns the fact the that the benchmark return does not accurately reflect the expected return for the firm in the absence of the event. The bias is addressed by using the correct index return proxy in the BHAR calculation; this takes the value of the overall return of the exchange where the firm is listed, ensuring that index return used is representative. The survivorship bias implies the fact that certain firms are excluded from the sample, as they cease to exist during the event window. This can possibly lead to an overestimation of abnormal returns. However, the firms in this sample that ceased to exist are excluded from the sample, for several reasons. Firstly, the event windows are relatively short, meaning that delisting or bankruptcy is rarely experienced in such a short period. Secondly, there is no evidence that there is a direct link between the delisting of certain firms and the climate policy related events. Therefore, excluding these firms will not introduce systematic bias affecting the reliability of the BHAR returns.

3.3.2 Hypothesis IA, II and III

Univariate and Multivariate Pooled OLS Regression

To test Hypothesis 1A, II and III several univariate and multivariate Pooled OLS regressions will be run on the CARs of each event window. By doing this, it is possible to further analyze what firm level factors or macro-economic factors might drive these possible positive or negative cumulative abnormal returns experienced by oil and gas firms. The univariate regression is used to examine the individual impact of firm-level or macroeconomic variables on the CARs. By doing this, the impact of each variable on the CARs can be evaluated separately without the interference of other variables.

The following base regression is used for the univariate regression:

$$CAR_{i,t} = \alpha + \beta' X_{i,t} + \varepsilon_{i,t} \tag{v}$$

$CAR_{i,t}$ = Cumulative Abnormal Return firm i at time t

$X_{i,t}$= Vector for independent variables of firm i at time t

$\varepsilon_{i,t}$ = Error term

The multivariate regression allows to assess the partial effect of multiple variables on the CARs, whereas it still accounts for possible confounding factors. The control variables consist out of firm-level and macroeconomic elements. Furthermore, event type and region dummies are included in the multivariate regression to control for systematic differences in reactions across event categories and geographic regions. The region dummies are constant and do not vary over time. Additionally, the Brent oil price and the Henry Hub natural gas price are incorporated as a control variable in the multivariate base model, as they capture movements within the oil and natural gas markets which are highly relevant for integrated oil and gas companies. By incorporating both in the model, it is ensured market dynamics are isolated from climate policy effects. The variables used in the multivariate regression analysis are defined in section 3.3.

The following formula resembles the base regression for the multivariate regression:

$$CAR_{i,t} = \alpha + \gamma_1\, Event\ Type_t + \gamma_2\, Region_i + \beta_1 Controls_{i,t} + \beta_2 BrentPrice_{i,t} + \beta_3 GasPrice_{i,t} + \varepsilon_{it} \tag{vi}$$

$CAR_{i,t}$ = Cumulative Abnormal Return firm i at time t

Event Type = Dummy vector for event category at time t (International Policy (IP) and National Policy (NP))

$Region_i$ = Dummy vector for firm i’s region (EU, Japan, Canada and Australia)

Controls = Vector for firm-level and macroeconomic control variables

BrentPrice = Brent crude oil price (in USD per barrel) at time t

GasPrice = Henry Hub Natural Gas Price in USD per MMBtu at time t

$\varepsilon_{i,t}$ = Error term

Moreover, a correlation matrix and VIF test are conducted in order to detect potential multicollinearity between the control variables. This might be particularly relevant with regard to the Brent Oil Price and the Henry Hub gas price, as these two are often co-integrated with each other due to long-term contracts or market linkages. Moreover, a Breusch-Pagan test is performed to test for possible heteroskedasticity in the residuals. Considering that firm-level and macroeconomic control variables are included in the analysis, in combination with the diverse nature of climate policy events, the variance of abnormal returns might differ across observations. In case of heteroskedasticity, robust standard errors will be applied to guarantee valid interpretation of the results. Furthermore, a Durbin Watson test will be performed to test for possible autocorrelation.

4 Results

Paragraph 4.1.1 presents the CAR and BHAR analysis used to evaluate Hypothesis I. Results of the univariate and multivariate regression models used to test H1A can be found in paragraph 4.1.2. Estimations of the CAR regression analysis to test hypothesis II are presented in paragraph 4.1.3.

4.1 Hypothesis I

In order to evaluate how financial markets responded to certain climate policy events, this section analyzes cumulative average abnormal returns (CAAR) calculated using the market model for oil and gas firms across key global regions: the US, Europe, Canada, Australia and Japan. The event window [-5,5] is used as the benchmark for capturing both immediate and gradual market responses Diaz-Rainey et al., 2021.The alternative windows function as robustness checks and offer broader context over time. Moreover, the Fama-French 5-factor model is used to generate more reliable estimates around high-impact events. Finally, the statistical robustness is assessed using three methods: the traditional t-test, the Patell test and the Corrado rank test.

4.1.1 International policy

Paris Agreement

The Paris Agreement was the first global agreement that initiated stringent measures and targets to actively combat climate change by reducing Green House Gasses. The introduction of such agreement with global impact was a new phenomenon for financial markets, which is reflected in the pattern of the abnormal returns observed across global oil and gas equity markets.

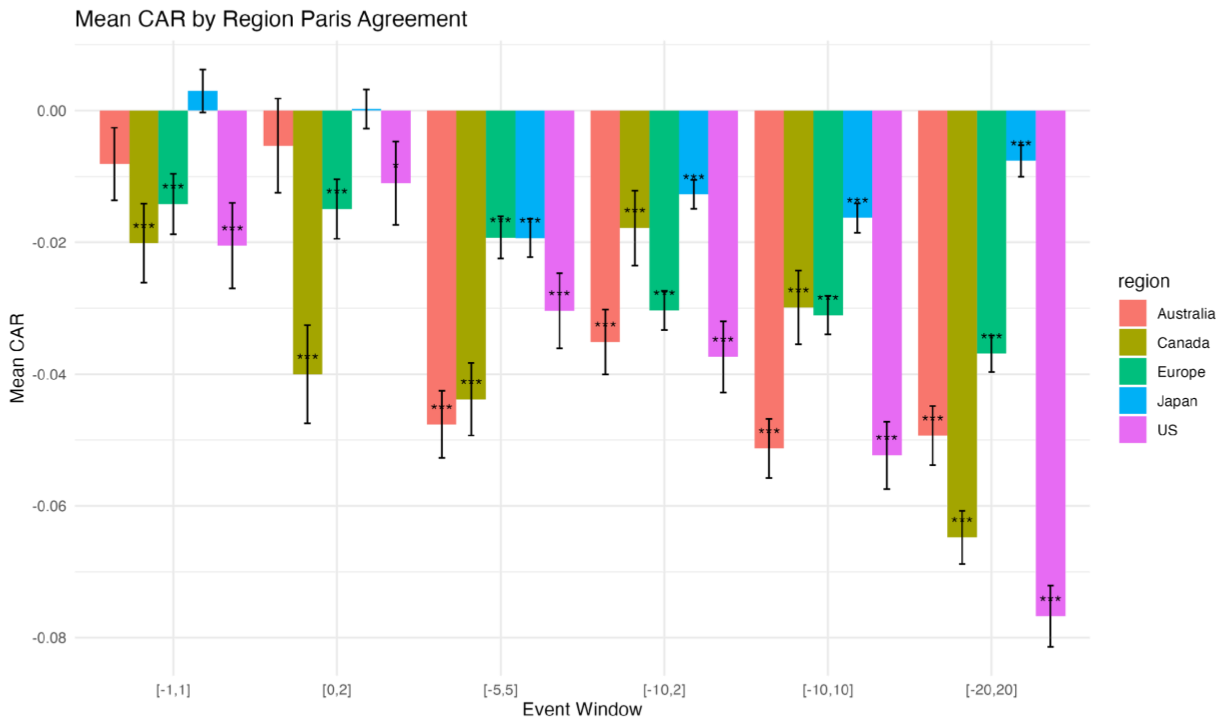


Figure 1 Paris Agreement (COP21) CAARs over event windows [-1,1], [0,2], [-5,5], [-10,2], [-10,10], and [-20,20]1

When analyzing Figure 1 and table 5 (see Appendix), it is observed that the global oil and gas sector experienced significant negative CAARs in all event windows during the Paris Agreement. The agreement had a global CAAR of -0.034 (t = -11.849, p < 0.001) in the [-5,5] benchmark event window, with an even larger CAAR of -0.0617 (t = -26.423, p < 0.01) in the event window [-20,20]. This suggests that the Paris Agreement had a strong negative impact on the returns in the oil and gas industry. Moreover, this indicates that the implications of the Paris Agreement were not directly clear and information was gradually incorporated by the public. The strongest impact of the Paris Agreement can be seen in North America. The US show significant negative CARs in nearly all event windows, with in the benchmark window equaling a value of -0.030 (t = -5.349, p < 0.01) and the [-20,20] window a value of -0.077 (t = -16.527, p < 0.001). Canada displays comparable results, with a CAAR of -0.065 (t= -16.042, p < 0.01) over the same period. This suggests that investors in North America priced in higher transition risks for the fossil fuel industry, due to both high fossil fuel dependence and expectations of stricter national regulation in the future. Australia shows similar significant negative CAARs in the larger events windows, although equities are not responsive in the smaller event windows. Europe exhibits less pronounced, but significantly negative CAARs as well, reporting values of -0.019 (t = -6.051, p < 0.01) in the

benchmark window and a value of -0.037 (t = -6.051, p < 0.001) in the [-20,20] window. Furthermore, Japan shows a significant CAR of -0.019 (t = -6.051, p < 0.001) in the [-5,5] event window, indicating a moderate reaction on the Paris Agreement. However, this effect vanishes in the longer horizons, showing that investors did not perceive the Paris Agreement as a threat to the Japanese oil and gas industry. This could be due to their reduced reliance on the fossil industry.
In order to test the robustness of these results, both the Patell test, which adjusts for event-induced variance, and the Corrado rank test, which is robust to non-normal return distributions, were applied. The results for the US and Canada are largely supported by these alternative tests, whereas findings for Europe, Australia and Japan are less robust under these specifications (see Appendix 8.2 Table 6).

Overall, these findings emphasize that the Paris Agreement is perceived by financial markets as an increasing transition risk for carbon-intensive industries, especially in regions with a high economic fossil fuel dependence. Moreover, findings are consistent with prior literature (Monasterolo & De Angelis, 2020; Diaz-Rainy et al., 2021) and the transition risk framework (TFCD, 2017).

COP26 Glasgow

The second international agreement concerns COP26 in Glasgow, which was a high impact convention that accelerated the transition to a low carbon economy.

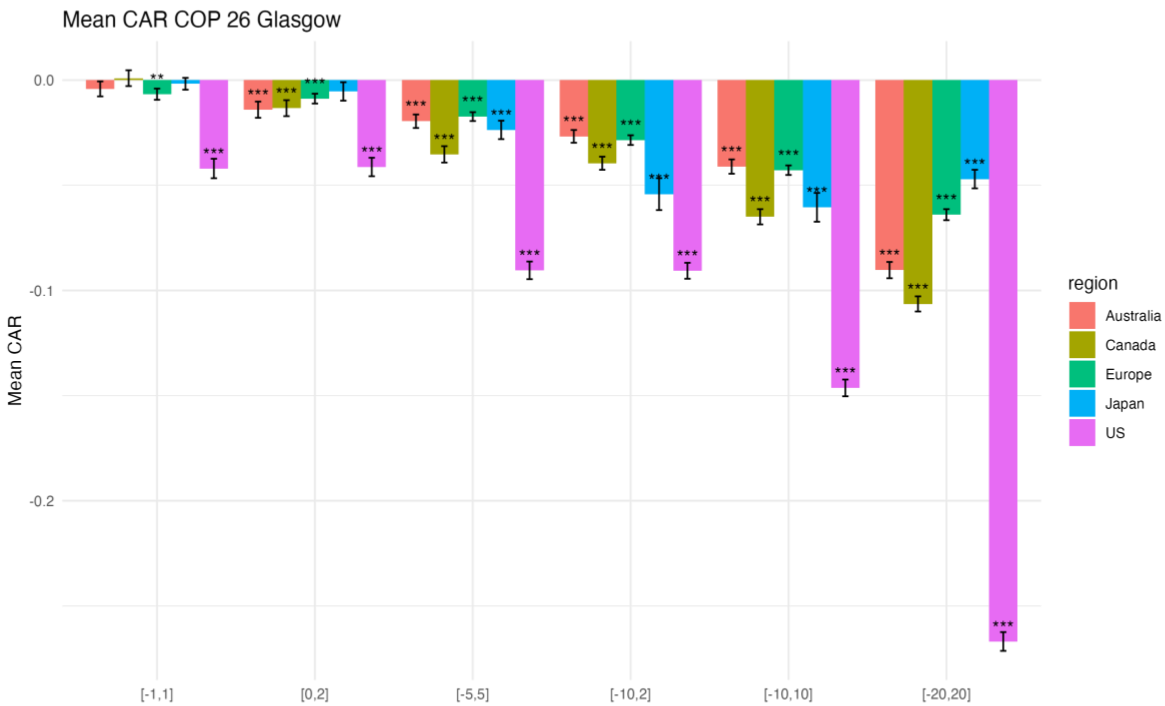


Figure 2 COP26 CAARs over event windows [-1,1], [0,2], [-5,5], [-10,2], [-10,10], and [-20,20]

When taking the results of the COP 26 event (see Figure 3 and Table 21 in the Appendix section 8.2) into account, you directly notice a large significant Global CAR in the bench mark event window [−5,5] equaling -0.048 (t = -22.902, p < 0.01), resembling a negative reaction by investors in response to the event. This negative impact is even greater in broader event windows, reaching up to -0.161 (t = -69.101, p < 0.01) in [−20,20] (see Table 21 Appendix). These results remain significant under the Patell and Corrado tests.

When disaggregating this effect into regional effects, it is observed that the US is impacted the most by COP 26. The US obtains a strong significant negative CAAR of -0.088 (t = 21.185 p < 0.01) after this event. This effect is robust and amplified in wider event windows [-10,10] (CAAR = -0.157, t =-36.665, p < 0.01) and [−20,20] (CAAR = 0.274, t = -60.348, p < 0.01) (see Table 21 Appendix). These results mirror the high exposure of US financial markets to oil and gas industry as well as the international climate commitments of the Biden administration. Likewise, Canada experienced a significantly negative CAAR of -0.034 (t = -9.117, p < 0.01) in the benchmark event window, suggesting a negative response by the market to the Canadian fossil fuel industry. The magnitude of these CAARs is also here enlarged in wider event windows, reaching -0.100 (t = 19.595, $p < 0.01$) in [-20,20] (see Table 21 Appendix). These results are in line with the reliance of the Canadian economy on the oil and gas industry. Investors foresee increasing financial divestment and regulatory risks associated with the accelerated transition to a low carbon economy imposed by COP 26. The results of the US and Canada are both confirmed by the Patell and Corrado test, as they remain significant.

Furthermore, a modest statistically significant negative CAAR of -0.010 (t = -4.453, $p < 0.01$) is observed for European firms in the benchmark event window. However, this modest reaction becomes more pronounced when the event window widens to [−20,20] (CAR = -0.050, t = -36.66 $p < 0.01$). The effect of the longer event windows is confirmed by the Patell-test and Corrado tests. This relatively moderate reaction might indicate that transition risks have already been more priced because of earlier implemented European climate agreements. Therefore, COP26 might have added relatively little new information.

Australia showed a delayed reaction on the COP 26 agreement. It noted a moderate CAAR of -0.009 (t= -2.835, $p < 0.01$) in the benchmark window, but when looking at larger event windows, a strong CAAR of -0.079 (t= -19.935, $p < 0.01$) is observed in the [-20,20] window. This indicates that the information of the COP 26 was more gradually incorporated in Australia, possibly due to the critic on the less ambitious climate policy view of Australia during the COP 26.

Finally, Japan does not show a significant CAAR in the benchmark window, although it does show significance CAARs in the longer event windows [-10,10] (CAAR= -0.460, t = $p < 0.01$) and [-20,20]. This might suggest that Japanese markets were initially indifferent to COP26 but later reassessed its implications. Alternatively, Japan's diversified energy mix and conservative financial market reactions may have delayed price adjustments. However, the Patell and Corrado test do not confirm this result traditional significance level, which could indicate that the results may be sensitive to distributional assumptions.

To sum up, these findings show that transition risk is priced in the oil and gas equity market globally due to the COP26, with the most pronounced effect in North-America. Therefore, hypothesis H1 is supported.

COP28 Dubai

The third international agreement of interest is the COP 28 Dubai, in which was collectively agreed to completely phase out fossil fuels in the long-run. the results are shown in Figure 3 and Table 25

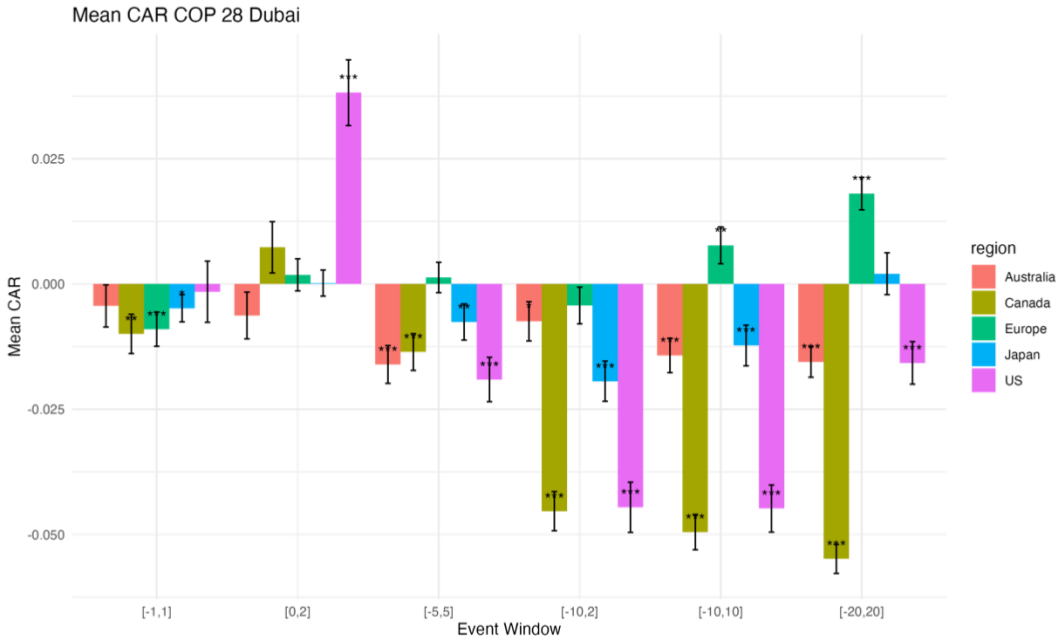


Figure 3 Mean CAR COP28 Dubai over the event windows [-1,1], [0,2], [-5,5], [-10,2], [-10,10], and [-20,20].

(see Appendix)

The global CAAR in the benchmark event window notes a value of -0.013 ($p < 0.01$ and t= -6.158), showing a small significant negative impact on the financial performance of the oil and gas industry. The broader event windows [-10,10] and [-20,20] show stronger significant CAARs, respectively -0.031 ($p < 0.01$ and t= -13.463) and -0.018 (t = -8.872, $p < 0.01$). However, these effects are not confirmed by the Patell test, while the Corrado test does confirm their significance, indicating robustness to non-normality.

The US oil and gas market again experiences the most notable market reaction to the COP28. In the benchmark window the CAAR equals -0.019 (t = -4.303, $p < 0.01$), a moderate reaction. However, the observed effect intensifies in event the wider event windows [-10,10] (CAAR= -0.045, t = -9.533, $p < 0.01$) and [-20,20] (CAAR= -0.016, t = -3.708, $p < 0.01$). The Patell test and Corrado test do not confirm these results as they show insignificant statistics. Moreover, the Canadian oil and gas market exhibit a significant negative market response as the benchmark window equals a CAAR value of -0.014 (t = -3.705, $p < 0.01$). This effect is enlarged in the broader event windows, noting a CAAR in event window [-10,10] of -0.050 (t = -3.708, $p < 0.01$) and in event window [-20,20] of -0.055 (t = -18.943, $p < 0.01$). This may suggest that investors perceived

the COP28 as a financial risk for Canadian oil and gas companies, mirroring expectations of increasing stringent climate regulation and growing divestment momentum. Australia exhibits a more moderate reaction by investors, a negative CAAR of -0.016 ($t = -3.708$, $p < 0.01$) in the benchmark window and similar effects in the extended windows. However, this effect is not confirmed by the Patell and the Corrado test. On the contrary, the European market shows very minimal and inconsistent effects in both the benchmark window and other windows, indicating that these risks might already be priced in to market and that COP28 added little new information for European oil and gas market. Moreover, this could indicate that the European market is less reliant on the fossil industry and is already positioned further in the transition to a low carbon economy. Japan does not exhibit any meaningful significant CAARs after the COP28,
which may reflect the limited share of oil and gas firms in Japanese equity markets and possibly lower direct exposure to fossil asset stranding.

In summary, COP28 led to small reasonable significant negative abnormal returns globally, with the largest effects in the US and Canada. This indicates that markets with more fossil fuel exposure react more tightening global climate commitments (TCFD, 2017; Bolton & Kacperczyk, 2021). By contrast, Europe reports a mild response which could show that climate risks are often already priced into markets with established regulatory frameworks (Monasterolo & De Angelis, 2020; Engle et al., 2020).

4.1.2 National Policies

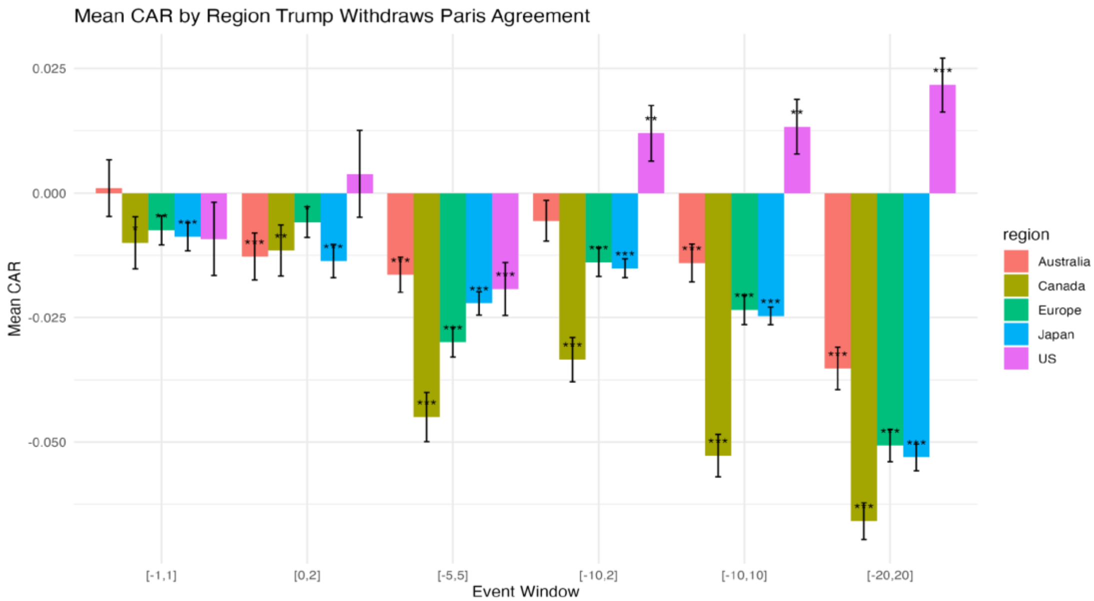


Figure 4 Trump withdraws Paris Agreemeent CAARs over event windows [-1,1], [0,2], [-5,5], [-10,2], [-10,10], and [-20,20]

Trumps withdraws Paris Agreement

The first national policy event involves the withdrawal of the Paris Agreement by the US, which president Trump promised to do during his campaign for US 2016 election.

To start with, the global effect measured in the benchmark windows denotes a CAAR of -0.027 (t = -10.314, p < 0.01), revealing a significant negative response to global oil and gas markets due to the withdrawal of the Paris Agreement by the US. This significant response is confirmed by the Patell and Corrado tests (see Table 11Appendix Table). These results are similar and robust in the broader event windows [-10,10] and [-20,20]. When separating the results by region, the US reports a significant positive CAAR of 0.019 (t = 3.627, p < 0.01), resembling a positive market reaction on the withdrawal of the US. Notably, Canada, Japan, Australia and Europe all experienced significant negative abnormal returns in the benchmark window as well as in broader windows [-10, 10] and [-20, +20]. Europe (CAAR= -0.030, t = -10.040, p < 0.01) and Canada (CAAR= -0.045, t = -9.104, p < 0.01) experience the strongest negative CAARs in the benchmark window, both confirmed by the Patell test and Corrado test, even in the wider windows. This suggests that investors foresee negative consequences in these markets due to the withdrawal of the US from the Paris Agreement. Both the European and Canadian market might interpret this as a delay of the transition to a low carbon economy, reflecting concerns over regulatory fragmentation and weakened long-run global coordination on climate targets. This could possibly lead to competitive disadvantages for Canadian and European oil and gas firms, as these firms are still bounded to their stringent climate policy framework.

In summary, these results suggest that the Withdrawal of the Paris agreement by a high carbon intensive state as the US created global uncertainty regarding the transition to a low carbon economy. These findings show that events that would impose deregulations for oil and gas firms can lead to long-term transition risks, emphasizing the importance of coordinated climate policies (TCFD, 2017).

EU Green Deal

The second national policy involves the EU Green Deal, an ambitious climate policy framework from the EU that aims to make their continent carbon neutral by 2050.[6]

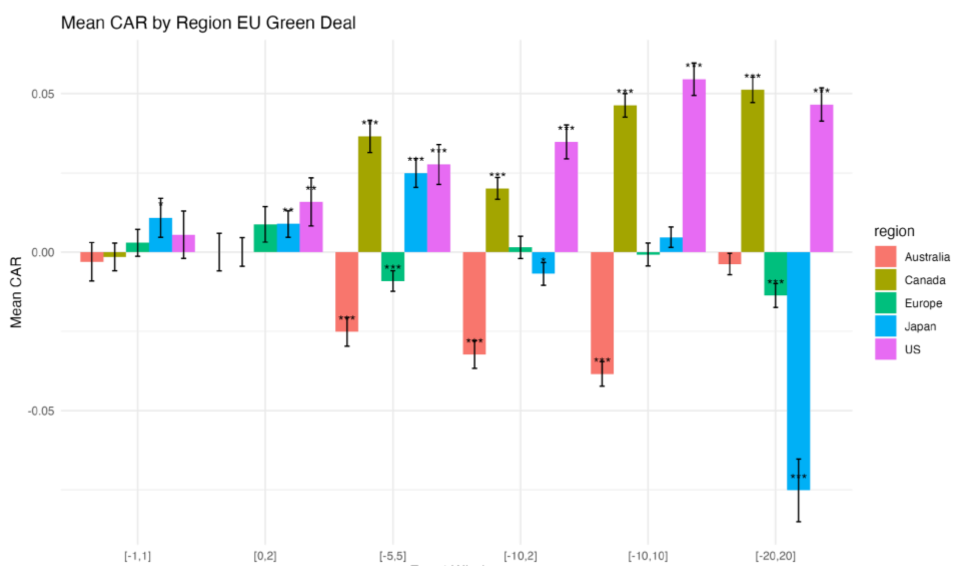


Figure 5 CAARs over event windows [-1,1], [0,2], [-5,5], [-10,2], [-10,10], and [-20,20]

The results in Table 13 (see Appendix section 8.2) report a significant global CAAR of 0.015 (t = 4.959, $p < 0.01$) for the benchmark window, which indicates globally a moderate positive response to the introduction of the Green Deal. This effect is confirmed by the Corrado test, but not by the Patell test. When interpreting the broader window, it is noticed that this significant positive effect

[6] https://www.europarl.europa.eu/topics/en/article/20200618STO81513/green-deal-key-to-a-climate-neutral-and-sustainable-eu#:~:text=to%20climate%20change-,The%20European%20Green%20Deal%20goals%20and%20benefits,and%20climate%20neutrality%20by%202050

increases to 0.028 (t = 11.135, p < 0.01) in window [-10,10] and to 0.027 (t = 10.718, p < 0.01) in window [-20,20]. This is reinforced by the Patell and Corrado test, both indicating significant statistical significance (Appendix Table 13).

The US, Canada and Australia all show significant positive CAARs in the benchmark window, suggesting that either the Green Deal is perceived among investors as growing confidence in coordinated climate policy frameworks and related investment opportunities in the energy transition or it might reflect the belief that they do not expect it to harm their own fossil fuel industries at all. On the contrary, Europe does experiences a mild negative CAAR of -0.009 (t = 10.718, p < 0.01) in the benchmark window and a -0.014 CAAR in the wider window [-20,20]. These results were not robust under the Patell and Corrado test however. This might indicate that the implications of the Green Deal were already priced into the market (Bua et al., 2024; Bolton & Kacperczyk, 2021) or investors perceived the Green Deal as an ambitious policy that had no short-term implication mechanisms.

Biden Rejoins Paris Agreement

The third national event is the official announcement of president Biden that the US will rejoin the Paris Agreement. The global CAAR in the benchmark window equals a value of 0.042 (t = 11.102,

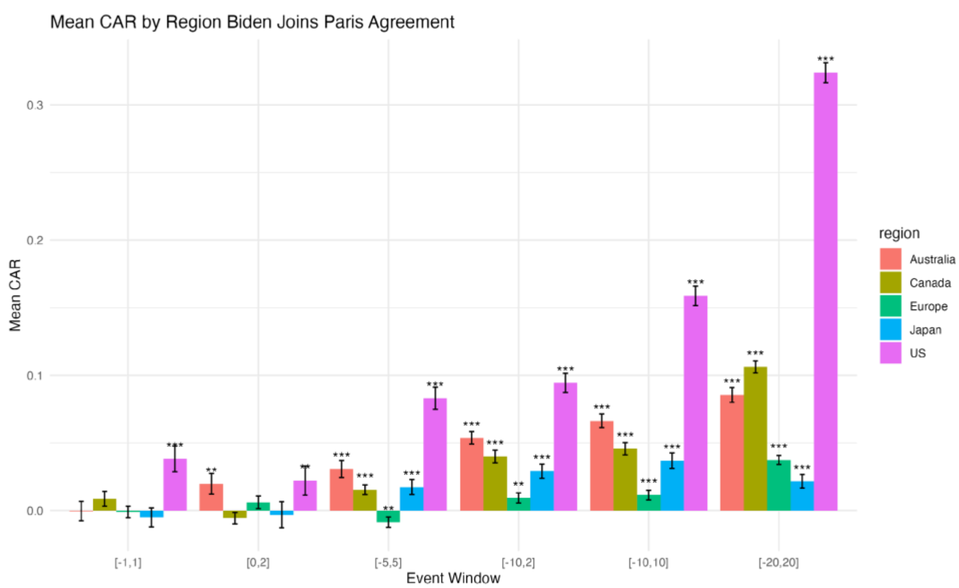


Figure 2 Biden joins Paris Agreement CAARs over event windows [-1,1], [0,2], [-5,5], [-10,2], [-10,10], and [-20,20

p < 0.001), suggesting that the rejoining of the Paris Agreement by the US (see table 17 Appendix). resulted in a positive market response in the global oil and gas equity markets. This result is supported by the Patell-test, but not by the Corrado test (Appendix Table 17). The longer event windows, indicate large significant CAARs, window [-10,10] equals 0.090 (t = 26.322 and p <0.001) and [-20,20] equals 0.181 (t = 51.277 and p <0.01). These broader event windows incorporate a macroeconomic event, namely a steep increase in the Brent Oil Price, which possibly explains these extremely high CAARs.[7] It is therefore more useful to analyze the shorter event windows, eliminating this interference. The event window [-1,1] notes a Global CAAR of 0.018 (t = 51.277 and p <0.001), supported by the Patell test, not the Corrado test. This could indicate a moderate positive response to the US rejoining the Paris Agreement. Nonetheless, when disaggregating this effect, it is revealed that almost no regions do show significant CAARs to neither the [-1,1] nor the [0,2] window except for the US. The US shows a CAAR of 0.038 (t = 3.966 and p <0.01) in window [-1,1] and a CAAR of 0.022 (t = 2.037 and p <0.05) in window [0,2], indicating that rejoining the Paris agreement did have a positive effect, but solely on the US oil and gas industry.

EU Fit for 55 Package

The EU fit for 55 Package is a comprehensive climate policy framework including stringent measures to reduce the EU's Greenhouse gasses by 55 percent in 2030, impacting both the European oil and gas market as well as others. Looking at the results in Table 19 (see Appendix), it is observed that the global CAARs are consistently negative across all event windows, with the benchmark window noting a CAAR of -0.071 (t= -26.670 and p< 0.01) up to window [-20,20] equaling a CAAR of -0.144 (t= -58.741, p <0.01). These effects are confirmed by the Patell and Corrado tests. The effect of the EU fit for 55 Package measured in the longer windows might be enhanced by a steep drop in oil price in the second half of July 2021 (see Appendix section 8.6), therefore making it more useful to evaluate shorter events windows.[8] When looking at the regional results, it is observed that the US experienced the most extreme significant reaction to the EU Fit for 55 Package in the benchmark window, with a value of -0.127 (t = -23.077, p < 0.01). This might reflect fears over indirect global cost pressures and spillover effects induced by the Fit for 55 Package, which are possibly amplified by commodity price adjustments. Canada exhibits a less

[7] A steep increase in the Brent Oil Price was experienced during the period December 2021 until and including February 2022. The Brent oil price increased from 47,03 US dollar per barrel to 65,86 US dollar per barrel. https://www.ft.com/content/3032d80d-89b0-4020-922e-f4fa15435b5d. See also section 8.6 appendix for an overview of the oil price

[8] A steep drop in the oil price was noted in the second half of July 2021 as OPEC agreed to increase the oil production due to global energy crisis. https://www.cnbc.com/2021/07/19/us-oil-drops-5percent-to-fall-below-70-amid-opec-production-boost-and-covid-fears.html. See also section 8.6 appendix for an overview of the oil price.

pronounced significant effect of -0.040 (t= -58.741, p <0.01). Remarkably, the European market appears to be moderately affected by the agreement, denoting a CAAR of -0.023 (t = -5.945, p < 0.01) in the benchmark window and a CAAR of -0.023 (t = -23.077, p < 0.01) in window [-10,2]. This market response indicates that investors expect increasing regulatory costs and stricter environmental compliance for the European oil and gas industry. The reaction is relatively moderate seen the implications of the agreement, which might reflect that most of the additional information was already been partly priced in by investors (Bua et al., 2024; Bolton & Kacperczyk, 2021). Australia shows a more moderate significant effect in the benchmark window (t = -23.077, p < 0.01), possibly due to their regulatory and geographical distance. Overall, these patterns are consistent with the findings of Henge et al. (2023), underscoring structural repricing of carbon transition risks across oil and gas markets due to the Fit for 55 Package. Therefore, hypothesis I is supported.

Inflation Reduction Act (IRA)

The last national event involves the Inflation Reduction Act, the first ambitious US climate policy which aimed to encourage sustainable investments in the US, thereby signaling a strong long-term commitment to decarbonization. A global CAAR of 0.014 (t = -6.183, p < 0.01) is denoted in the benchmark window, indicating a mild global positive reaction to the introduction of the IRA in the US. Additionally, this effect is reinforced by the Patell and Corrado test. The broader event windows show similar results, although only reinforced by Corrado tests (see Appendix Table 23). When disaggregating this effect, a moderately negative CAR of -0.013 (t = -3.054, p < 0.01) is reported in the benchmark window for US firms, which is also confirmed by the Corrado test. This effect is persistent across alternative windows [-10,10] and [-20,20]. This result might reflect increased compliance costs and competitive risks and is consistent with the findings of Bauer et al. (2024), who reported a small negative impact on the carbon intensive firms in the US during the announcement of the IRA. Moreover, Canada showed similar results to the US. By contrast, the European market shows a moderately positive reaction in the benchmark window with a CAAR of 0.016 (t = -23.077, p < 0.01). This suggests that the IRA was perceived as a positive signal by investors in the European oil and gas market, possibly due to greater global alignment on the energy transition. Likewise, Australia recorded a moderate significant positive reaction in the benchmark window (CAAR = 0.011, t = 2.426, p < 0.05).

Overall, the IRA did not provoke extreme market reactions, which might indicate that the impact was partly anticipated and priced in. It could be also resembling expectations of a tightening climate policy environment in North America. The above evidence offers modest support for H1, as the IRA did not lead to substantial revaluations of transition risk in the oil and gas industry.

4.1.3 Elections

US election 2016

The first event encompasses the election of president Trump during the US elections in 2016. During his campaign, Trump expressed strong support for the oil and gas industry, pledging to ease the strict regulations for carbon intensive industries and increase domestic oil production. The

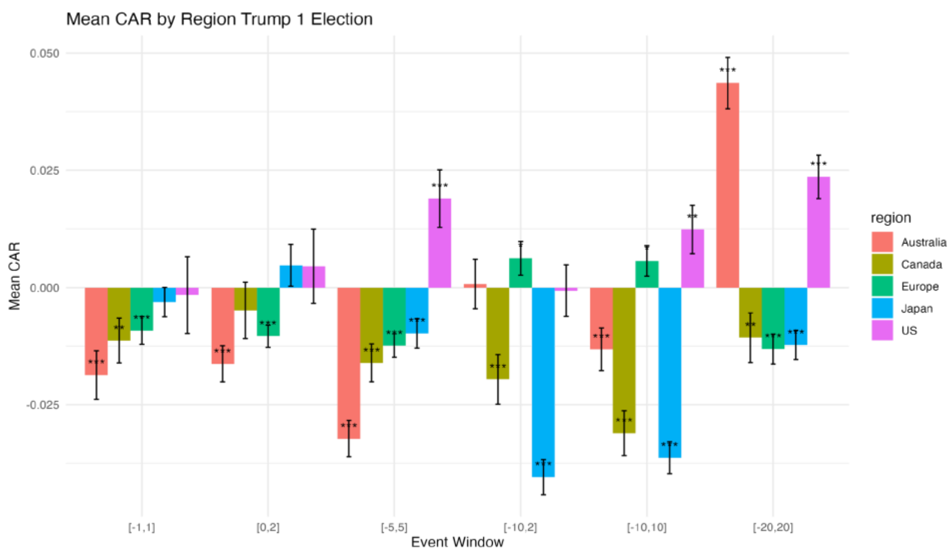


Figure 3 US 2016 election CAARs over event windows [-1,1], [0,2], [-5,5], [-10,2], [-10,10], and [-20,20]

results are shown in Figure 7 and Table 8 (see Appendix). In the global sample, no significant market response is reported in the benchmark window. In the short-term window [-1,1] a small significantly negative Global CAAR of -0.008 is observed, ($t = 2.119$, $p < 0.05$), indicating a slightly negative market response by investors. This significant effect is reversed in the [-20,20] window (CAAR = 0.012, $t = 4.731$, $p < 0.01$). Notably, both results lack support from the Patell test. These results might resemble initial market surprise or uncertainty, as the election of Trump was not expected by many investors. Over time, the implications of Trumps' election were reconsidered by investors, as the benefits for the oil and gas industry became clear, therefore adjusting stock prices.

The US market reveals a significantly positive CAAR of 0.019 (t = 3.094, p < 0.01) is reported in the benchmark window, suggesting a positive response by investors to the US oil and gas industry, and consistent with the deregulation and increasing oil production as initiated by Trump. This trend persists in the broader event windows [-10,10] and [-20,20]. Although the significant levels of the Patell and Corrado tests vary, the consistent pattern in CAARs across event windows resemble investor confidence in Trump's deregulatory energy agenda. The relatively small CAARs could indicate that only smaller firms benefitted in the US as the larger companies remain still exposed to international climate agreements (Diaz-Rainy et al., 2021). The Canadian, Australian, European and Japanese markets all report significant negative CAARs in the benchmark window, respectively -0.16 (t = -3.974, p< 0.01), -0.032 (t = -8.388, p< 0.01), -0.012 (t = -4.393, p < 0.01) and -0.010 (t = -10.759, p< 0.01). These results indicate that investors are generally pessimistic about the consequences of the election for industries outside the US, possibly due to geopolitical tensions and Trump's climate stance. Canada, Europe and Japan continue to show moderate negative CAARs in the [-20,20] window, although Australia noted a significant positive CAAR of 0.044 (t = 7.930, p < 0.01). This result is not reinforced by the Patell and Corrado tests however.
In sum, these results show that mainly the US oil and gas industry have consistently benefitted from the election of Trump, as moderate positive market reactions followed in the US market due to deregulation. Conversely, regions outside the US showed more negative reactions, possibly pricing in concerns about geopolitical tensions, competitive disadvantages and climate policy fragmentation. This supports H1, as it demonstrates how political shifts in combination with deregulation affect oil and gas companies across regions.

US election 2020

The second event under consideration is the election of president Biden during the 2020 US elections. Biden advocated in his campaign to phase out fossil subsidies during his campaign and

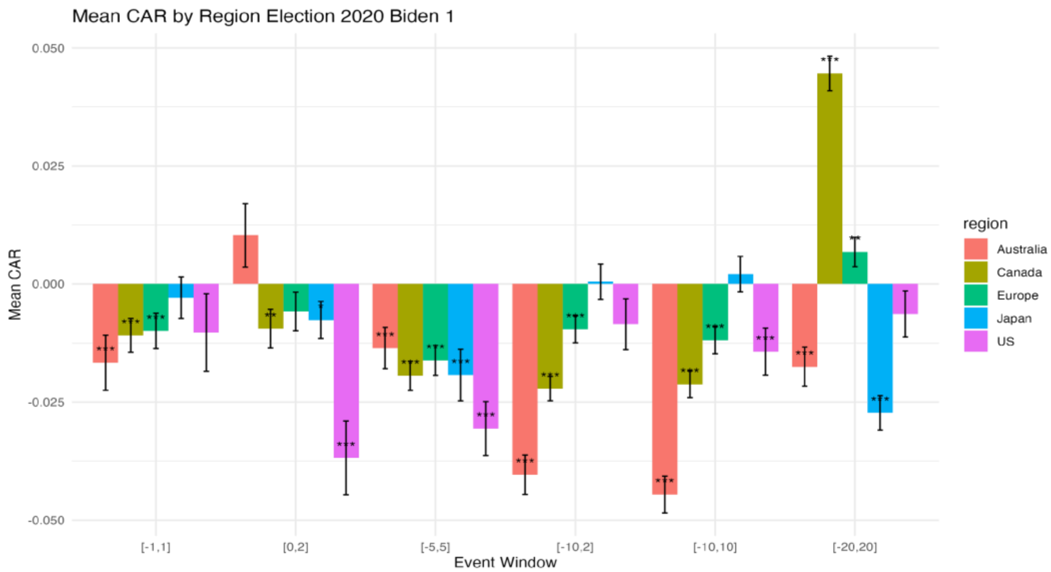


Figure 4 US 2020 election CAARs over event windows [-1,1], [0,2], [-5,5], [-10,2], [-10,10], and [-20,20]

instead increase the support for sustainable energies. His election was expected to trigger regulatory tightening for carbon-intensive industries. The results are shown in Figure 8 and Table 15 see Appendix.

In the global oil and gas market, all short to medium windows report significant negative responses during the 2020 US elections. The benchmark window shows a CAAR of -0.023 (t = 7.930, p < 0.01), which is reinforced by significant the Patell and Corrado tests. Likewise, the windows [0,2], [-1,1] and [-10,2] report significant and robust negative CAARs. These consistent short-term reactions indicate a robust immediate negative response to the victory of the Democrats, reflecting global growing concern under investors regarding the implementation of stricter environmental regulation and diminished policy support by the US.

The US market exhibited the largest negative response, with CAARs reaching up to -0.037 (t = -4.720, p < 0.01) in the [0,2] window and to -0.031 (t = -5.377, p < 0.01) in the benchmark window. This is also consistent with the significant CAARs reported in other short-term windows. However, in the longer event windows, these significant negative effects lower. These market reactions are robust, as they are reinforced by significant Corrado tests, indicating an immediate global negative response to the victory of the Democrats. The Canadian, European and Australian markets also report significant negative results, although less pronounced than the US, still indicating short-term declines in the stock performance. Nonetheless, in the broader window [-20,20], a reversal of this effect is observed for Canada and Europe, respectively a CAAR of 0.045 ($t = 12.154$, $p < 0.01$) and of 0.007 ($t = 12.154$, $p < 0.01$). This could imply that the upcoming Biden administration would induce competitive advantages for non-US firms, therefore yielding positive CAARs in the long-run. Japan reported inconsistent responses to the victory of the Democrats in all short windows, but in the longer window [-20,20], it does exhibit a significant negative CAAR of -0.027 ($t= -7.532$, $p < 0.01$).

Summed up, the negative abnormal returns in the short to medium term across regions globally underscore a concern under investors regarding the policy change of the US set in to motion by the election of President Biden. The US industry experiences the most pronounced effect itself. These findings are consistent with literature on transition risk, stating that differences in climate policy stringency can lead investors to adapting valuations across markets (Bolton & Kacperczyk, 2021; Monasterolo & De Angelis, 2020). This observed pattern supports H1, emphasizing how shifts in political leadership and increasing regulation impact valuations of carbon-intensive firms globally.

US election 2024

The third political event involves the election of president Trump during the 2024 US elections. As we discussed earlier, Trump is a strong supporter of the US oil and gas industry. He advocated during this election again for a more favorable regulatory environment for carbon intensive industries, thereby decreasing compliance costs and increasing oil and gas production ("~ Drill, baby, drill ~")[9]. The results are shown in Figure 9 and Table 26 (see Appendix)

[9] https://www.ft.com/content/6b7f0af8-6c59-44bb-b07a-43d4768b96fd.

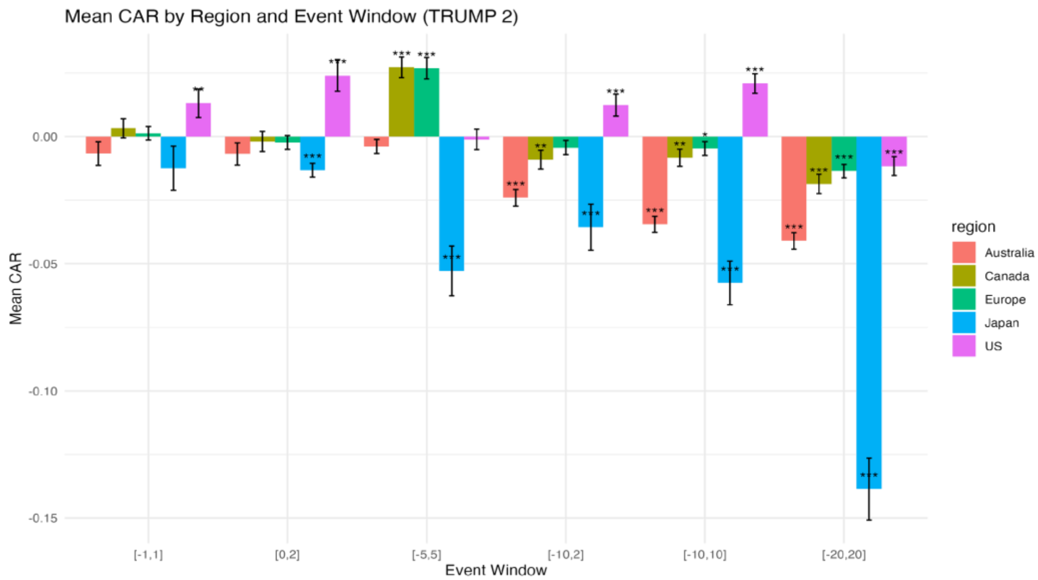


Figure 5 US 2024 election CAARs over event windows [-1,1], [0,2], [-5,5], [-10,2], [-10,10], and [-20,20]

The election of Trump induced a mild significant positive short-term reaction in the global oil and gas financial markets. The benchmark window and the [0,2] window report significant positive CAARs, respectively 0.009 (t= -7.532, p <0.01) and 0.005 (t= -7.532, p <0.05), although both not supported by the Patell and Corrado test. On the contrary, the [-20,20] windows reported a significant negative CAAR of -0.020 (t= -10.513, p <0.01), suggesting a negative response in the overall market. This is confirmed by the Corrado test, but not by the Patell test, suggesting robustness.

When analyzing the results by region, a moderate significant positive CAARs of 0.013 (t= 2.436, p <0.05) in the [-1,1] window and of 0.024 (t= 3.876, p <0.05) in the [0,2] window is denoted in the US market, however an insignificant result in the benchmark window. This relatively moderate positive reaction might indicate that only smaller domestic oil and gas firms profit from the regulations, as large firms operate worldwide, meaning that they still have to comply with stringent policies (Diaz-Rainy et al., 2021). Canada and Europe however, both show a significant positive CAAR of 0.027 (p < 0.01) in the benchmark window, indicating a positive perception by investors regarding the new policy course of the Republican administration. Nonetheless, this effect vanishes and becomes even significantly negative for both markets in the longer event windows. Australia also shows significant negative CAARs in the longer event windows, suggesting macroeconomic uncertainty. The reactions of Australia, Canada and Europe are largely supported by the Corrado test. Moreover, Japanese markets exhibit a strong significant negative reaction of -

0.053 ($t = -5.418$, $p < 0.01$) in the Benchmark window. Likewise, the windows [-10,10] and [-20,20] show persistent significant negative results. These market reactions are reinforced by the Patell test, not by the Corrado test. These reactions might indicate investor concerns about broader macroeconomic uncertainty, trade policies and geopolitical frictions under the Trump administration.

Considering the above, these results show initially Trumps' election is associated with short-term market optimism, although for almost all regions this effect is reversed in the broader event windows. This reflects increasing uncertainty among investors, possibly due to macroeconomic implications of the newly elected administration. These findings partly support H1 by showing that political shifts and climate policy shifts impact oil and gas valuations. Despite initial optimism, later reversals and broader patterns highlight how investors still price in long-term transition and policy risks, consistent with H1.

4.1.4 Key insights CAR analysis

Considering the above, it can be concluded that international agreements consistently lead to significant negative impacts on the oil and gas industries across the globe, particularly in regions with high fossil fuel dependence such as the US and Canada. This suggests that global coordinated climate policies are perceived by investors as increasing transition risks and is consistent with prior literature (Monasterolo & De Angelis, 2020). In contrast, national climate policy agreements showed heterogeneous effects. The EU Fit for 55 Package led to strong negative market reactions in the oil and gas equity markets, consistent with the findings of Henge et al. (2023). The IRA induced solely in the US a notable negative market reaction consistent with the findings of Bauer et al. (2024), indicating that this agreement was already largely priced in by markets. Likewise, the withdrawal of the Paris Agreement by the US reported modest reactions. The US 2020 election and the rejoining of the Paris Agreement both provoked extreme positive market reactions, although these can be likely attributed to large spikes in the oil price around the events. Estimations regarding the elections showed more uniform results. Both 2016 and 2024 Trump elections reported moderate positive reactions in the US markets due to the upcoming deregulations. However, the results in the broader windows often reversed which could reflect macroeconomic and geopolitical uncertainty. Notably, investors showed strong robust negative reactions to the Biden election, resembling the responsiveness to a shift to more stringent climate governance. Finally, the Fama French 5 factor model showed similar results during all events, although little less pronounced (see 8.4 in Appendix.

4.2 Buy-and-hold abnormal returns (BHARs)

The BHAR analysis is used to analyze whether high impact climate policy events, events that reported extreme positive or negative cumulative abnormal returns, lead to sustained revaluations of oil and gas firms, consistent with transition risk frameworks discussed by the TCFD (2017) and Van der Ploeg and Rezai (2020). The high impact events concern the Paris agreement, Trumps' withdrawal from Paris Agreement, Biden election, Bidens' withdrawal of Paris Agreement, the EU Fit for 55 Package, COP26 Glasgow and the COP28 Dubai. The event windows used to calculate the BHARs are [0, 30], [0, 60], [0, 90] and [0, 120] trading days. The results of the BHAR are shown in section 8.5 of the Appendix.

Following the Paris Agreement, the BHARs are predominantly negative, showing a significant negative loss of -0.041 ($p < 0.01$) in the [0,30] window. This underperformance compared to the benchmark index might indicate that investors began to price potential transition risks associated with the global emission targets set at the Paris Agreement, consistent with evidence from prior literature (Diaz-Rainy et al., 2021; Monasterolo & De Angelis, 2020). The longer event windows do not report any significant results however, which could imply that this market response is gradually absorbed over time. The BHARs after the withdrawal of the US from the Paris Agreement are inconsistent and insignificant, suggesting that either the market already anticipated this policy shift or that the withdrawal might not have altered that much to the global climate policy commitment. This could indicate that only smaller US oil and gas firms profited from the withdrawal of the Paris Agreement (Diaz-Rainy et al., 2021).

The results of the BHAR after the US 2020 (Biden I) election show extraordinarily large and significant BHARs in all windows, varying from 0.112 ($p <0.01$) in the [0,30] window up to 0.730 ($p <0.01$) in the [0,90] window. This seems counterintuitive, as it is expected that the stringent climate policies under Biden might have resulted in greater transition risk for oil and gas firms. Although a positive market response is theoretically possible, the results are likely driven by a macroeconomic trend or a steep increase in the oil price in the late 2020s.[10] Notably, the Biden rejoins Paris Agreement event also denotes highly significant positive BHARs (0.231 in the [0,30]

[10] These results coincide with a substantial recovery in oil markets: the Brent oil price rose by approximately 48% in the 90 days after the U.S. election (from $38.17 to $56.42) and by 17% in the 90 days after rejoining the Paris Agreement (from $55.66 to $65.34). These hikes in oil prices have likely contributed to the extreme positive significant BHARs observed, independent of policy signals. See appendix for the oil price

window and 0.187 in the [0,120] window, both showing $p < 0.01$), which could suggest investor optimism due to policy clarification. However, similar to the US election, the oil price was rapidly increasing in the start of 2021 which might have contributed to these positive BHARs. This indicates that these positive BHARs cannot be solely attributed to transition risk perceptions, but may also be driven by developments in commodity prices. Therefore, the results must be interpreted with caution.

In contrast, the BHAR following the EU fit for 55 Package takes a strong significant negative value in both the [0,30] window and the [0,90] window, respectively -0.116 ($p < 0.01$) and -0.095 ($p < 0.01$). This result might suggest that the binding implications of the EU Fit for 55 Package led to a global persistent negative investors response in the oil and gas sector, as it imposes material transition risks for carbon-intensive firms. This aligns with the findings of Bolton and Kacperczyk (2021), who demonstrate that firms with higher carbon emissions face higher required returns, as investors demand compensation for bearing carbon risk exposure. Likewise, the COP 26 summit which showed strong negative reactions in financial markets in short-run in the CAR analysis, also denotes a significant negative BHAR of -0.089 ($p < 0.01$) in the [0,30] window. However, this effect is reversed in the [0,90] window (-0.092, $p < 0.01$**)** and the [0,120] window. The lack of significance in the longer windows might indicate that these were short-run effects, aligning with the findings that climate risks are sometimes only partially internalized (Engle et al., 2020). Additionally, it may reflect that green assets outperform brown assets when climate concerns rise, but in the long-run reversing again. Finally, the COP28 summit did show persistent negative BHARs in the [0,60] and [0,120] window **(**-0.059, $p < 0.05$; -0.092, $p < 0.01$), showing persistent negative reactions in the industry due to the global consensus reached on the COP28 to completely phase out fossil fuels in the long-run.

Considering the above, it can be observed that not all climate policy events are priced equally. The events characterized by clear implications such as the EU fit for 55 Package and the COP28 exhibit a medium to long-term negative impact on the oil and gas industry. This is translated in stronger pricing of transition risks and therefore supports H1. By contrast Biden 1 and Biden rejoins Paris Agreement experience remarkably extreme significant positive BHARs, possibly suggesting influence of macroeconomic trends or increased investors' confidence. These diverse results underscore that the investors' reactions are not solely influenced by the content and credibility of climate policies, but also by timing and macroeconomic trends. Therefore, the interpretation of the BHARs within broader market contexts is essential.

4.3 CAR regressions

Table 4 CAR Regression results Window [-5,5]

	CAR	CAR	CAR	CAR	CAR
	(1)	(2)	(3	(4)	(5)
(Intercept)	-0.103***	-0.110***	-0.070***	-0.104***	-0.155***
	(0.014)	(0.027)	(0.018)	(0.025)	(0.033)
ROE	-0.002*				
	(0.001)				
TQ	0.001***	0.002***	-0.000	0.001***	-0.001
	(0.001)	(0.000)	(0.001)	(0.000)	(0.010)
Volatility		-0.004		-0.005	-0.004
		(0.008)		(0.008)	(0.008)
PUI		0.002***		0.0002**	0.0004**
		(0.000)		(0.000)	(0.000)
VIX		-0.002*		-0.002*	-0.001*
		(0.000)		(0.001)	(0.001)
Volume		0.000			
		(0.000)			
ESG			-0.001**		-0.001**
			(0.000)		(0.000)
CR	0.000				
	(0.000)				
Log MV	0.008***	0.007***	0.015***	0.005***	0.016***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Firm Age	0.000				
	(0.000)				
Brent Oil Price	0.001***	0.003	0.000	0.000	0.000
	(0.000)	(0.003)	(0.003)	(0.003)	(0.000)
Gas Price	0.001	0.004*	0.000	0.005*	0.002
	(0.002)	(0.003)	(0.002)	(0.001)	(0.003)
IP	-0.040***	-0.029***	-0.075***	-0.016**	-0.034***
	(0.006)	(0.003)	(0.003)	(0.009)	(0.011)
NP	0.010	0.022***	0.024***	0.017**	0.036***
	(0.007)	(0.008)	(0.003)	(0.007)	(0.009)
EU_dum	0.008	-0.005	-0.004	-0.006	-0.031***
	(0.008)	(0.010)	(0.009)	(0.010)	(0.010)
CA_dum	0.008	-0.016	0.004	-0.023*	-0.050***
	(0.008)	(0.011)	(0.009)	(0.009)	(0.012)
AU_dum	0.002	0.013	-0.006	0.017	0.019*
	(0.018)	(0.010)	(0.010)	(0.009)	(0.011)
JAP_dum	0.647***	0.032	-0.029	0.030	0.010
	(0.081)	(0.021)	(0.020)	(0.021)	(0.021)
N	3,618	3,762	1,395	4,444	1,395
R^2	0.042	0.048	0.126	0.035	0.155
Adjusted R	0.039	0.044	0.119	0.032	0.146
DW	1.921***	1.938***	1.663***	1.927***	1.737***
Breusch-Pagan	115.66(13)***	286.56(14)***	120.66(11)***	302.35(13)***	120.8(14)***

Significance indicators: *p < 0.1; **p < 0.05; ***p < 0.01

In this section, the results of the CAR regression analysis are discussed. Table 4 reports the results of five different pooled OLS regression models that estimate the impact of firm-level, market-based, and macroeconomic variables on CARs of window [-5,5] calculated in section 4.1.1.[11] The first regression examines whether firms with strong financial metrics are less likely to experience negative CARs during climate policy events. The second regression illustrates whether CARs can be explained by several sentiment and uncertainty indicators. The third regression examines the effect of ESG ratings on the CARs during climate policy events. In the fourth and fifth variables of previous regressions are aggregated into one complete regression, one without ESG ratings (model 4) and one with ESG ratings (model 5). All estimations control for market value, oil and gas prices, event type and region. VIF-tests and correlation tests are run to detect possible multicollinearity (see Table 46 in Appendix in Section 8.5.2). Breusch-Pagan test is used to test for heteroscedasticity and a Durbin Watson test is adopted to test for autocorrelation. If needed, in the regression models clustered robust standards errors are used to correct for heteroskedasticity and autocorrelation. Lastly, the reference category for the region dummies is the United States, and for the event type dummies, it is elections.

Notable in Table 5 is that the adjusted R-squared increases from 0.039 in model 1 to 0.146 in model 5 in the benchmark model, indicating that the explanatory power of the regression models is enhanced across the models. This shows that the use of firm specific variables as well as macroeconomic indicators improve the models' fit. The adjusted R-squared is relatively low, however this is common in event studies as a result of short windows and the noise in stock return data (Mackinlay, 1997). Additionally, the sample sizes across the models varies from 1,395 to 4,444 observations, meaning the sample is large enough to warrant statistical power and robustness of the results. Furthermore, no severe multicollinearity is detected, as all VIF-scores were lower than 5 (see Table 46 Appendix section 8.5.2), indicating that the predictors are not too highly correlated with each other. Moreover, the variables of concern do not indicate strong correlation with each other, as demonstrated in the correlation table (see Table 47 section 8.5.3 Appendix).

[11] The regression results of the alternative windows [-1,1], [0,2], [-10,2], [-10,10] and [-20,20] can be found in the chapter 2 in the Appendix.

Financial metrics

To start with, Tobin's Q shows a small significant positive correlation ($p < 0.01$) with the CARs in some of the models. This might indicate that growth-oriented oil and gas firms exhibit higher abnormal returns, because investors might perceive these firms as more capable of adapting to transition risks. This result is not robust across all regressions however, and must therefore be interpreted with caution. Moreover, Log_MV denotes consistently a positive significant correlation with the CARs, with the most remarkable effect measured in model 5 ($\beta = 0.017$, $p < 0.01$). This supports hypothesis H1, indicating that firms with a higher market capitalization are more resilient to negative climate policy shocks. Firms with a higher market capitalization often have greater financial reserves, broader diversification of energy portfolios, stronger creditworthiness and access to well established R&D, which enables them to absorb climate policy shocks (Delis et al., 2019). Firms with larger market capitalizations might be perceived by investors as too big to fail, as they are more politically influential and less exposed to idiosyncratic transition risks compared to smaller firms.

Investor sentiment

Interestingly, the PUI factor reports a significant coefficient positive in all regression models, indicating a positive correlation with the CARs. Although the coefficient is small, it shows that in times of higher general economic policy uncertainty, oil and gas firms could yield higher abnormal returns for oil and gas firms during climate policy events. This effect is also confirmed by the results of longer windows. This may seem counterintuitive, as in general higher policy uncertainty is related with lower abnormal returns due to increased valuation risk and reduced investor confidence (Jin et al., 2019). Investors might perceive oil and gas firms as defensive or hedging assets during periods of uncertainty, as these firms may benefit from volatility in specific uncertain macroeconomic times (Kang & Ratti, 2013). Therefore, Hypothesis III is not supported.

While historical volatility does not show consistent effects in the benchmark window, it does show strong significant negative effects in the shorter event windows [-1,1] and [0,2] (see Appendix Table 41 and 42 Appendix). This means that negative CARs in short-run are correlated with higher volatility, however this effect vanishes when in longer event windows.

The implied volatility of the stock indices, measured by the VIX, reports a significant negative coefficient in all models in the benchmark window. Moreover, this finding is robust across alternative event windows. These results suggest that in case markets forecast higher volatility – resembled by implied volatility – oil and gas firms could yield lower CARs. Moreover, this result confirms the effectiveness of the implied volatility as forward-looking proxy of market sentiment and perceived risk (Ilhan et al., 2021; An et al., 2014). This supports the second hypothesis, which states that negative abnormal returns in oil and gas industry are correlated with higher implied volatility.

ESG

Including ESG rating in model 3 and model 5, reveals a significant negative coefficient of -0.001 ($p < 0.01$), suggesting that higher ESG ratings do not yield higher CARs. The effect is negative, although relatively small. This correlation is robust across the alternative event windows. This is not in line with mainstream literature, which predominantly states that increased financial performance is associated with higher ESG ratings (Friede et al., 2015; Lins et al., 2017; Yin et al., 2023). This controversy could be explained by the general ESG skepticism of investors in traditional energy sectors such as the oil and gas industry. Another explanation could be that investors have more confidence in 'browner' oil and gas firms during uncertain times, as they are often financially more profitable due to less ESG-related investment. This allows these firms to more flexibly respond to climate policy shocks. Moreover, investors might perceive high ESG oil and gas companies not as a hedge, as the increased costs of compliance could affect short-term performance. In conclusion, this result does not support hypothesis H2.

Event type

The international climate policy (IP) event dummy reports in all models a strong significant negative coefficient ($\beta = -0.034$, $p < 0.01$), indicating that international climate policy events might have a negative impact on the returns in oil and gas industry. These results indicate that international climate policy agreements are considered as less avoidable – in particular for multinational oil and gas firms – as they signal a long-term globally coordinated regulatory shift. This is also in line with the findings of Bolton and Kacperczyk (2021), who found that cross-border climate policy agreements tend to increase cost of capital on carbon-intensive companies. This reduces the possibilities of regulatory arbitrage and intensifies transition risks. On the contrary, national climate policy events show positive significant coefficients in almost all models, suggesting a positive correlation between the CARs and national climate policy events. This could reflect investors already anticipated the introduction of the national polices, therefore transition risks already being priced into the markets. Moreover, national polices might be perceived as rather symbolic, as it often does not impose immediate penalties on the oil and gas firms. Furthermore, national policies often include compliance flexibility, subsidies and industry exemptions, limiting the real financial impact of the climate policy. The market may perceive national policies as a clarification, possibly decreasing policy uncertainty. These observations are robust across other windows. Compared to the reference category election, it is noted that international climate policy events are associated with significantly more negative abnormal returns, while national policies are correlated with more positive CARs. This could show that markets perceive international climate agreements as more disruptive and national policy as more anticipated.

Region

The European and Canadian Region dummies denote a negative coefficient in the benchmark window, -0.035 ($p < 0.01$) and -0.050 ($p < 0.01$) respectively in regression model 5. This suggests that oil and gas firms headquartered in Europe or Canada are generally more negatively impacted by climate policies than US firms, meaning that investors foresee enhanced regulatory enforcement and increased transition costs in these regions. On the contrary, Australia and Japan do not exhibit meaningful CARs compared to US firms in the benchmark window, however in alternative windows they do show positive significant CARs compared to the US (see Tables in section 8.5.1 Appendix). This could be explained by Australia’s slower and less consistent climate policy ambitions. These findings are also in line with the regulatory environment and market sentiment in these regions. Moreover, it supports the institutional theory, which states investor reactions depend on the stringency and credibility of climate institutions. The above illustrates that oil and gas firms that are headquartered in regions with strong and credible institutional climate framework are more heavily impacted by climate policy events than those situated in a weaker institutional climate policy framework. This results therefore supports hypothesis HIA.

5 Final remarks

5.1 Conclusion

This thesis aimed to examine the impact of various climate policy events on the financial performance of the oil and gas industry across the regions US, Canada, Europe, Australia and Japan. These findings report that international climate policy initiatives such as the Paris Agreement, COP26 and COP28 have persisting negative CAARs on the stock performance of oil and gas firms, particularly in the US and Canada. This pattern might indicate that internationally coordinated climate commitments are interpreted by financial markets as drivers of increasing transition and regulatory risks, consistent with the findings of Mukanjari and Sterner (2018) and Diaz-Rainey et al. (2021). In contrast national policies showed more diverse results. The EU fit for 55 Package was the only national policy that exhibited a clear negative global response in the oil and gas equity markets, consistent with the findings of Henge et al. (2023). The impact of EU Green Deal and the Inflation Reduction showed more moderate reactions, as these policies might have already been anticipated. The elections showed more uniform results. Both Trumps' elections (2016 and 2024) displayed reasonable positive market reactions in the global oil and gas industry, but these reactions were reversed in the longer run, reflecting potentially macroeconomic uncertainty and geopolitical tensions due to the election. On the contrary, the election of Biden did show consistent negative responses over multiple windows, indicating that investors anticipated higher regulatory costs and stricter climate policy frameworks under his administration.

When disaggregating the CARs by running a pooled regressions analysis, the results revealed a consistent stronger negative impact experienced by European and Canadian firms than US firms, in line with institutional comparative theory, supporting Hypothesis IA. This suggests that markets in regions with stricter or more credible climate regulatory frameworks price in transition risks more acutely. Also, a robust positive correlation between Market Capitalization and CARs was found, which might resemble that larger firms are more resilient to climate policy shocks. Moreover, a small (but significant) negative correlation was observed between ESG ratings and the CARs, indicating that oil and gas firms with lower ESG ratings might yield higher returns, challenging prior literature (Friede et. al, 2015; Bauert et al., 2024; Hsu et al., 2023) and Hypothesis II. Furthermore, the implied volatility showed small consistently significant positive results,

suggesting that oil and gas companies could be a good hedge in times of global economic uncertainty. This is contrarian to what was expected, therefore not supporting Hypothesis III.
The BHAR analysis revealed that structural policy commitments as the EU fit for 55 Package and the COP28 had persisting negative effects in the short to medium run, reflecting continuity of the repricing of transition risks. Moreover, it underscores how stringent climate policies can have spillover effects across financial markets, potentially amplifying systemic risk (Semieniuk et al., 2022). All in all, these results largely support H1, as international climate commitments, national climate policies and political elections can have severe negative impacts on the valuations of oil and gas firms globally.

5.2 Limitations

Although the results may provide valuable insights about the impact of climate policy events on the financial performance of the oil and gas companies, there are some limitations that should be recognized. The sample consists primarily of publicly listed oil and gas companies, as the data of private oil and gas firms was not available. The publicly listed companies are representative in the sense that they cover a large market share of the complete oil and gas industry, nonetheless a partial effect is still missing out. Moreover, the sample is limited to solely the oil and gas industry, limiting the generalizability of these results to other carbon-intensive industries. Also, the study primarily focuses on the short to medium term time frame, not capturing how long-term financial performance of oil and gas firms is impacted by climate policy events.

Another limitation concerns the fact that estimations of both the CARs and the BHARs can be impacted by several macroeconomic events, highlighted by the results of the US 2020 election and the US rejoins Paris Agreement. While this study incorporated multiple event windows, Patell and Corrado tests and a Fama-French 5-factor model (including controls such as the oil and gas price) as robustness checks, the overlap with other potential market-moving events cannot be completely eliminated. This makes it hard to isolate the true effect of the climate policy events.

Moreover, the significant negative correlation between ESG ratings and CARs was estimated with only 198 firms due to the moderate ESG data availability of oil and gas firms in the LSEG database, questioning the robustness of the results. This does not only lead to reduced sample size, but it could also introduce selection bias, as firms with ESG disclosures could systematically differ from those without.

Additionally, the lack of global uniform ESG reporting framework leads to diverse ESG ratings across agencies, questioning the reliability of the findings related to ESG performance (Berg et al., 2020). Therefore, other metrics such as the carbon intensity can be used to proxy climate risk exposure, although these are also not widely available. Furthermore, due to data constraints, the implied volatility of local stock indices in the particular regions is used and not the preferred data from oil and gas industry-specific options or the firms' own options. This limits the interpretation of the estimations of how uncertainty is perceived in specifically the oil and gas sector in the respective regions.

5.3 Discussion and Future research

The goal of this study was to investigate how different climate policy events affect the oil and gas industry in the western economies, as these are widely exposed to international, national and political climate policy shifts. By performing a multiple event study using a CAR, BHAR and pooled OLS analysis, this study was able to assess short- and medium-term impacts of these climate policy events across heterogeneous regions. This is particularly relevant, as the financial implications regarding the introduction of new climate policies are often underexplored and neglected. Therefore, this thesis contributes to a deeper understanding of the financial risks related to the increasing amount of climate policies.

This study showed that international agreements consistently induced negative abnormal returns for oil and gas firms, particularly in North America. This underscores how widely coordinated climate policies are associated with increasing transition risks by financial markets (Van der Ploeg & Rezai, 2020; TCFD, 2017; Semieniuk et al., 2022), especially in economies with a high fossil fuel dependence.

National policies however, reported more diverse results. The EU Green deal and Inflation Reduction Act showed more anticipated effects, while only the EU Fit for 55 Package showed a distinctive negative market reaction in the short- and medium run. The results of the 2020 US election and the rejoining of the Paris Agreement showed extreme positive CARs and BHARs, which can be likely attributed to a steep increase in the oil prices, due to positive expectations about COVID-vaccines and decreased oil production by OPEC. This emphasizes the difficulty of isolating the true impact of climate policy events, as macroeconomic events are hard to rule out. A possible solution is using dummies for fixed time effects in the OLS regression. In this way you can cope with time varying differences. However, when applying this, the effect of the events itself might be controlled out, as the event could coincide with the time variable.

The election results reveal that Trumps' election had a moderate positive response in the oil and gas equity markets in the shorter windows, although these positive expectations were reversed in the long-run possibly due to geopolitical tensions and macroeconomic uncertainty. It could also indicate that only smaller oil and gas firms benefit from the deregulation, as larger firms are still exposed to the international climate agreements (Diaz-Rainey et al., 2021). The election of Biden denoted strong negative market reactions, indicating that a political shift with strong climate ambitions can have a severe impact on the global oil and gas industry. While prior literature primarily showed that climate policy shocks can have a negative impact on oil and gas firms in the the US or in the EU (Mukanjari & Sterner, 2018; Diaz-Rainey et al., 2021; Henge et al., 2023; Bauer et al., 2023), this study shows that even national policies and elections can have severe global consequences for the oil and gas equity market.

Remarkably, firms with higher ESG ratings appeared to be more resilient to climate policy shocks, as they were negatively correlated with the CARs, conflicting with mainstream literature (Bauert et al., 2024). However, the measured effect was small and other proxies such as carbon intensity or pure environmental scores might give a more reliable estimate to assess a firms' exposure to climate policy risks (Bolton & Kacperczyk, 2021). Also, firms with a higher market capitalization were positively correlated with the CARs, indicating that investors valuate larger firms as more resilient and adaptable to climate policy shocks, aligning with the findings Delis et al. (2019).

From a practical point of view this study has important implications for both policymakers and investors. For regulators it emphasizes how the credibility and coordination of climate policy frameworks directly impact the financial stability within the oil and gas industry. This is particularly relevant with regard to the growing concerns about systemic strand assets risk related to oil and gas industry, as markets are highly interconnected and this could possibly spillover in financial markets (Semieniuk et al., 2022). For institutional investors, the results highlight the need to integrate detailed economic transition risk assessments in their portfolio construction, rather than purely rely on ESG scores. By gaining insight into how certain climate policy events affect regional markets, this could lead to more efficient hedging strategies and optimal capital allocation. These results are not only essential for portfolio managers and policymakers though, but also for foreseeing broader financial stability risks.

Future research should focus on long-term impacts of climate policy events, as these are largely unknown. By using the financial metrics such as the ROA, ROE or Tobins' Q as dependent variable in a panel regression model, it can be investigated whether certain climate policy agreements have an impact on the operational profitability of certain oil and gas firms in the long-run (Hart & Ahuja, 1996). Also, future research should incorporate an implied volatility analysis with specific oil and gas industry ETFs or stocks options, to get a more reliable estimate of the uncertainty related with transition risks. Considering the difficulty to isolate the true effect of climate policy events, future event-studies should focus on studying different industries at the same time to be able to compare an industry effect to a certain benchmark. Furthermore, seen the restrictions related to ESG ratings, research should integrate carbon intensity or scope 1–3 emissions as more direct measures of transition risk exposure (Bolton & Kacperczyk, 2021) in their study. Lastly, other event types such as lawsuits or developing regions could be include in future research for a further insight of the pricing of transition risks by investors.

6 References

An, B., Ang, A., Bali, T. G., & Cakici, N. (2014). The joint cross section of stocks and options. The Journal of Finance, 69(5), 2279–2337. https://www.jstor.org/stable/43612957.

Ardia, D., Bluteau, K., Boudt, K., & Inghelbrecht, K. (2022). Climate Change Concerns and the Performance of Green vs. Brown Stocks. Management Science, 69(12), 7607–7632. https://doi.org/10.1287/mnsc.2022.4636.

Arellano, M. (1987). PRACTITIONERS' CORNER: Computing Robust Standard Errors for Within groups Estimators*. Oxford Bulletin Of Economics And Statistics, 49(4), 431–434. https://doi.org/10.1111/j.1468-0084.1987.mp49004006.x.

Auer, B. R., & Schuhmacher, F. (2015). Do socially (ir)responsible investments pay? New evidence from international ESG data. The Quarterly Review of Economics and Finance, 59, 51–62. https://doi.org/10.1016/j.qref.2015.07.002.

Banz, R. W. (1981). The relationship between return and market value of common stocks. Journal of Financial Economics, 9(1), 3–18. https://doi.org/10.1016/0304-405x(81)90018-0.

Barnett, M., Brock, W., & Hansen, L. P. (2019). Pricing uncertainty induced by climate change. Review of Financial Studies, 33(3), 1024–1066. https://doi.org/10.1093/rfs/hhz144.

Battiston, S., Dafermos, Y., & Monasterolo, I. (2021). Climate risks and financial stability. *Journal of Financial Stability*, *54*, 100867. https://doi.org/10.1016/j.jfs.2021.100867.

Binder, J. (1998). The Event Study Methodology Since 1969. Review Of Quantitative Finance And Accounting, 11(2), 111–137. https://doi.org/10.1023/a:1008295500105.

Bua, G., Kapp, D., Ramella, F., & Rognone, L. (2024). Transition versus physical climate risk pricing in European financial markets: a text-based approach. European Journal of Finance, 30(17), 2076–2110. https://doi.org/10.1080/1351847x.2024.2355103.

Bolton, P., & Kacperczyk, M. (2023). Global pricing of Carbon-Transition risk. The Journal of Finance, 78(6), 3677–3754. https://doi.org/10.1111/jofi.13272.

Brown, S. J., & Warner, J. B. (1985). Using daily stock returns. Journal of Financial Economics, 14(1), 3–31. https://doi.org/10.1016/0304-405x(85)90042-x.

Caldecott, B. (2016). Introduction to special issue: stranded assets and the environment. Journal of Sustainable Finance & Investment, 7(1), 1–13. https://doi.org/10.1080/20430795.2016.1266748

Chava, S. (2014). Environmental externalities and cost of capital. Management Science, 60(9), 2223–2247. https://www.jstor.org/stable/2455058.

Choi, D., Gao, Z., & Jiang, W. (2018). Attention to global warming. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3180045.

Corrado, C. J. (1989). A nonparametric test for abnormal security-price performance in event studies. Journal of Financial Economics, 23(2), 385–395. https://doi.org/10.1016/0304-405x(89)90064-0.

Corrado, C. J. (2010). Event Studies: A Methodology review. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.1441581.

Daddi, T., Todaro, N. M., De Giacomo, M. R., & Frey, M. (2018). A Systematic review of the use of organization and management theories in climate change studies. Business Strategy and the Environment, 27(4), 456–474. https://doi.org/10.1002/bse.2015.

Daumas, L. (2023). Financial stability, stranded assets and the low-carbon transition – A critical review of the theoretical and applied literatures. Journal of Economic Surveys, 38(3), 601–716. https://doi.org/10.1111/joes.12551.

Diaz-Rainey, I., Gehricke, S. A., Roberts, H., & Zhang, R. (2021). Trump vs. Paris: The impact of climate policy on U.S. listed oil and gas firm returns and volatility. International Review of Financial Analysis, 76, 101746. https://doi.org/10.1016/j.irfa.2021.101746.

Drudi, F., Moench, E., Holthausen, C., Weber, P., Ferrucci, G., Setzer, R., Di Nino, V., Barbiero, F., Faccia, D., Breitenfellner, A., Faiella, I., Farkas, M., Bun, M., Fornari, F., Ciccarelli, M., Matthieu, D. P., Giovannini, A., Papadopoulou, N., Parker, M., . . . Ouvrard, J. (2021,September 1). Climate change and monetary policy in the euro area. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3928292

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. Journal of Financial Economics, 33(1), 3–56. https://doi.org/10.1016/0304-405x(93)90023-5

Fama, E. F., & French, K. R. (2014). A five-factor asset pricing model. Journal of Financial Economics, 116(1), 1–22.
https://doi.org/10.1016/j.jfineco.2014.10.010.

Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: aggregated evidence from more than 2000 empirical studies. Journal of Sustainable Finance & Investment, 5(4), 210–233
.https://doi.org/10.1080/20430795.2015.1118917.

Garcia-Castro, R., Ariño, M. A., & Canela, M. A. (2009). Does Social Performance Really Lead to Financial Performance? Accounting for Endogeneity. Journal Of Business Ethics, 92(1), 107–126.
https://doi.org/10.1007/s10551-009-0143-8.

Jansson, E. (2005). The stakeholder model: the influence of the ownership and governance structures. Journal of Business Ethics, 56(1), 1–13.
https://doi.org/10.1007/s10551-004-2168-3.

Jin, X., Chen, Z., & Yang, X. (2019). Economic policy uncertainty and stock price crash risk. Accounting And Finance, 58(5), 1291–1318.
https://doi.org/10.1111/acfi.12455.

Halbritter, G., & Dorfleitner, G. (2015). The wages of social responsibility — where are they? A critical review of ESG investing. Review of Financial Economics, 26(1), 25–35.
https://doi.org/10.1016/j.rfe.2015.03.004.

Hart, S. L., & Ahuja, G. (1996). Does it pay to be green? An empirical examination of the relationship between emission reduction and firm performance. Wiley Online Library.
https://doi.org/10.1002/(SICI)1099-0836(199603)5:1.

Hong, H. &. L. F. W. &. X. J. (2019). Climate risks and market efficiency. ideas.repec.org.
https://ideas.repec.org/a/eee/econom/v208y2019i1p265-281.html.

Humphrey, J. E., & Li, Y. (2021). Who goes green: Reducing mutual fund emissions and its consequences. Journal of Banking & Finance, 126, 106098.
https://doi.org/10.1016/j.jbankfin.2021.106098.

Kang, W., & Ratti, R. A. (2013). Structural oil price shocks and policy uncertainty. Economic Modelling, 35, 314–319.
https://doi.org/10.1016/j.econmod.2013.07.025.

Karpoff, J. M. (1987). The Relation Between Price Changes and Trading Volume: A Survey. Journal Of Financial And Quantitative Analysis, 22(1), 109. https://doi.org/10.2307/2330874.

Krause, F., Koomey, J., & Bach, W. (1992, January 1). Energy policy in the greenhouse. https://www.osti.gov/biblio/6244611.

Krueger, P., Sautner, Z., & Starks, L. T. (2019). The importance of climate risks for institutional investors. Review of Financial Studies, 33(3), 1067–1111. https://doi.org/10.1093/rfs/hhz137.

Lakonishok, J., Shleifer, A., & Vishny, R. W. (1994). Contrarian investment, extrapolation, and risk. The Journal of Finance, 49(5), 1541–1578. https://doi.org/10.1111/j.1540-6261.1994.tb04772.x.

Lontzek, T., Pohl, W., Schmedders, K., Thalhammer, M., & Wilms, O. (2023). Asset Pricing with Disagreement about Climate Risks. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.4473164.

Matsumura, E. M., Prakash, R., & Vera-Muñoz, S. C. (2013). Firm-Value effects of carbon emissions and carbon disclosures. The Accounting Review, 89(2), 695–724. https://doi.org/10.2308/accr-50629.

Meinshausen, M., Meinshausen, N., Hare, W., Raper, S. C. B., Frieler, K., Knutti, R., Frame, D. J., & Allen, M. R. (2009). Greenhouse-gas emission targets for limiting global warming to 2 °C. Nature, 458(7242), 1158–1162. https://doi.org/10.1038/nature08017.

Patell, J. M. (1976). Corporate Forecasts of earnings per share and stock price behavior: Empirical test. Journal of Accounting Research, 14(2), 246. https://doi.org/10.2307/2490543.

Papandreou, A. (2019). Stranded assets and the financial system. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.4197882.

Pástor, Ľ., Stambaugh, R. F., & Taylor, L. A. (2020). Sustainable investing in equilibrium. Journal of Financial Economics, 142(2), 550–571. https://doi.org/10.1016/j.jfineco.2020.12.01.

Semieniuk, G., Campiglio, E., Mercure, J., Volz, U., & Edwards, N. R. (2020). Low-carbon transition risks for finance. Wiley Interdisciplinary Reviews Climate Change, 12(1). https://doi.org/10.1002/wcc.678.

Semieniuk, G., Holden, P. B., Mercure, J., Salas, P., Pollitt, H., Jobson, K., Vercoulen, P., Chewpreecha, U., Edwards, N. R., & Viñuales, J. E. (2022). Stranded fossil-fuel assets translate to major losses for investors in advanced economies. Nature Climate Change, 12(6), 532–538. https://doi.org/10.1038/s41558-022-01356-y.

Shanaev, S., & Ghimire, B. (2021). When ESG meets AAA: The effect of ESG rating changes on stock returns. Finance Research Letters, 46, 102302. https://doi.org/10.1016/j.frl.2021.102302.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. The Journal of Finance, 19(3), 425–442. https://doi.org/10.1111/j.1540-6261.1964.tb02865.x.

Van Der Ploeg, F., & Rezai, A. (2020). Stranded assets in the transition to a Carbon-Free economy. Annual Review of Resource Economics, 12(1), 281–298. https://doi.org/10.1146/annurev-resource-110519-040938.

Varghese, M. H. P. (2023, January 27). Carbon Policy and Stock Returns: Signals from Financial Markets. IMF. https://www.imf.org/en/Publications/WP/Issues/2023/01/27/Carbon-Policy-Surprises-and-Stock-Returns-Signals-from-Financial-Markets-528644.

Yan, J., Guo, Y., & Wen, F. (2025). Carbon risk and the cost of equity capital: Evidence from China. International Review of Economics & Finance, 103975. https://doi.org/10.1016/j.iref.2025.103975.

Yin, X., Li, J., & Su, C. (2023). How does ESG performance affect stock returns? Empirical evidence from listed companies in China. Heliyon, 9(5), e16320. https://doi.org/10.1016/j.heliyon.2023.e16320.

7 Appendix

8.1 Climate Policy Events

Table 1 Climate Policy Events

Event	Date	Region	Event type	Rationale	Expected impact
Paris Agreement (COP21)	12 December 2015	Global	International Policy	First global climate policy agreement binding over 200 countries to reduce GHG emissions, marking a turning point in climate policy. It heightened uncertainty, increased regulatory pressure and ESG focus for investors.This agreement set the stage for the start of an era of developing stringent climate policies, thereby fueling the transition to low carbon economies. Therefore, it is expected to have a strong negative impact on oil and gas firms due to potential asset stranding and transition risk (Meinshausen et al., 2009).	Negative
Trump 1 (US election 2016)	8 November 2016	US	Election	The election of President implied deregulation, higher domestic and offshore fossil fuel production and US withdrawal from the Paris Agreement. This event signaled lower compliance costs and stronger government support for oil and gas firms. Expected to positively affect financial performance of US oil and gas companies (Ramelli et al., 2021).	Positive
Trump withdraws from Paris agreement	1 June 2017	US	National Policy	The US formally exited the Paris Agreement as President Trump advocated in his campaign, reinforcing his anti-climate policy view. This signaled reduced climate regulation and protective stance for oil and gas industry. Financial markets interpreted this as reduced transition risk for US firms, benefiting short-term performance. Non-US firms likely faced continued regulatory pressure and uncertainty.	Positive
EU Green Deal	11 December 2019	EU	National Policy	Comprehensive climate policy framework of the EU to become the first climate neutral continent in 2050. Strong implications for carbon-intensive firms, as this led to increased regulatory pressure and disclosure rules. Moreover, reallocation of private and institutional capital away from carbon intensive assets by mobilizing up to one trillion euros to sustainable projects the next decade. This implied higher cost of capital, loss of government support mechanisms and divestment by investors for European oil and gas firms. This is expected to negatively impact the European oil and gas industry as this was the beginning of a structural policy shift (Henge et al., 2023).	Negative

Biden 1 (US election 2020)	3 November 2020	US	Election	Biden's election signaled a major climate policy reversal, including a $2 trillion clean energy plan, phasing out fossil fuels subsidies and rejoining the Paris Agreement. Moreover, discontinuation of new federal and offshore oil extraction as well as increasing investor pressure were perceived as negative signals by investors. This election is expected to reduce confidence in the oil and gas sector due to policy and capital constraints (Ramelli et al., 2021).	Negative
Biden rejoins Paris agreement	20 January 2021	US	National Policy	The rejoining of the Paris Agreement signaled the return to international climate commitments and future regulation. It confirmed the Biden administration's pro-climate stance to financial markets. The withdrawal is expected to negatively affect oil and gas firms due to increased future regulation and investor scrutiny.	Negative
EU fit for 55 Package	14 July 2021	EU	National Policy	The EU introduced a climate package with major reforms to cut GHG emissions by 55% by 2030 compared to 1990 levels, increasing transition pressure. The measures included carbon pricing, an expanded ETS, the CBAM mechanism and a complete ban on combustion engines by 2035. This is expected to negatively affect oil and gas firms due to rising costs, decreasing revenues and stranded asset risks Henge et al., 2023). Moreover, this package would indirectly affect oil and gas firms all over the world.	Negative
COP26 Glasgow	13 November 2021	Global	International Policy	COP 26 reaffirmed the global climate goals set by the Paris Agreement and reached for the first consensus on completely phasing out fossil fuel subsidies. Although non-binding, it signaled tightening future regulation and capital reallocation trends. This COP is expected to increase investor uncertainty and transition risk for oil and gas companies.	Negative
US Inflation Reduction Act	16 August 2022	US	National Policy	The primary objective of the Inflation Reduction Act (IRA) was to reduce greenhouse gas emissions by 40% by 2030 relative to 2005 levels. While the legislation did not impose direct restrictions on the oil and gas sector, it introduced substantial subsidies for clean energy initiatives. This indirectly disadvantaged fossil fuel companies by shifting investor sentiment and enhancing competitive pressure. The act is expected to negatively affect oil and gas firms through increased capital costs and reduced demand (Bauer et al., 2024).	Negative
COP 28 Dubai	13 December 2023	Global	International Policy	First global agreement on full phase-out of fossil fuels. COP 28 marked the first global agreement to phase out all fossil fuels, strengthening the	Negative

				transition agenda. It builds on prior COPs and signals long-term incompatibility of fossil industries with climate goals. This is expected to increase transition risks and accelerate capital flight from oil and gas equity markets.	
Trump 2 (US election 2024)	5 November 2024	US	Election	In Trump's 2024 presidential campaign was he advocated for reversal of climate policies such as the IRA, withdrawment from the Paris Agreement, and expand domestic and offshore oil production ("Drill, baby, drill"). His declaration of an "energy emergency" signaled a commitment to deregulation and increased support for the fossil fuel industry. These actions were expected to enhance investor confidence in oil and gas firms by reducing regulatory and compliance pressures.	Positive

8.3 CAAR Results

Table 5 Summary Mean AR results Paris Agreement by region (12 December 2015)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1572	Global	-0.008	0.105	-0.014	-0.003	-3.120	-0.002	-40.024	0.000
[0,2]	1572	Global	-0.001	0.107	-0.015	-0.004	3.482	-0.001	-59.439	0.000
[-5,5]	5764	Global	-0.005	0.116	-0.008	-0.002	-3.212	-0.001	-51.368	0.000
[-10,2]	6812	Global	-0.005	0.114	-0.008	-0.003	-3.993	-0.000	-57.735	0.000
[-10,10]	11004	Global	-0.001	0.117	-0.005	-0.000	-2.203	-0.028	-41.137	0.000
[-20,20]	21484	Global	-0.002	0.111	-0.001	-0.001	-3.086	-0.002	-44.661	0.000
[-1,1]		Australia	-0.003	0.074	-0.712	0.477	-0.653	0.514	-0.049	0.961
[0,2]		Australia	-0.003	0.083	-0.577	0.564	-0.593	0.553	0.207	0.836
[-5,5]		Australia	-0.006	0.081	-2.154	0.031	-2.166	0.030	-1.118	0.264
[-10,2]		Australia	-0.005	0.084	-1.822	0.069	-1.903	0.057	-0.264	0.792
[-10,10]		Australia	-0.004	0.080	-2.239	0.025	-2.211	0.027	-0.63	0.529
[-20,20]		Australia	-0.003	0.079	-2.162	0.031	-2.125	0.034	-0.309	0.757
[-1,1]		Canada	-0.013	0.103	-2.412	0.016	-2.599	0.009	-2.302	0.021
[0,2]		Canada	-0.022	0.105	-4.081	0.000	-4.450	0.000	-6.049	0.000
[-5,5]		Canada	-0.008	0.114	-2.466	0.014	-2.924	0.003	-2.862	0.004
[-10,2]		Canada	-0.007	0.105	-2.498	0.013	-2.743	0.006	-3.693	0.000
[-10,10]		Canada	-0.001	0.117	-0.461	0.645	-0.562	0.574	-2.066	0.039
[-20,20]		Canada	-0.002	0.109	-1.264	0.206	-1.433	0.152	-1.592	0.111
[-1,1]		Europe	-0.006	0.055	-1.832	0.068	-2.157	0.031	-1.730	0.084
[0,2]		Europe	-0.003	0.058	-0.959	0.339	-1.197	0.231	-2.046	0.041
[-5,5]		Europe	-0.002	0.050	-1.109	0.268	-1.197	0.231	-1.169	0.243
[-10,2]		Europe	-0.003	0.047	-2.513	0.012	-2.567	0.010	-1.933	0.053
[-10,10]		Europe	-0.001	0.047	-0.681	0.496	-0.695	0.487	-0.527	0.598
[-20,20]		Europe	-0.001	0.044	-1.646	0.100	-1.572	0.116	-1.793	0.073
[-1,1]		Japan	0.002	0.013	0.540	0.595	0.411	0.681	0.504	0.614
[0,2]		Japan	0.000	0.013	0.123	0.904	0.093	0.926	0.265	0.791
[-5,5]		Japan	-0.002	0.015	-1.463	0.148	-1.266	0.206	-1.138	0.255
[-10,2]		Japan	-0.001	0.013	-0.800	0.426	-0.626	0.531	-0.476	0.634
[-10,10]		Japan	-0.001	0.014	-0.745	0.457	-0.625	0.532	-0.385	0.700
[-20,20]		Japan	-0.001	0.015	-1.206	0.229	-1.039	0.299	-0.475	0.635
[-1,1]		US	-0.009	0.131	-1.719	0.086	-1.632	0.103	-3.301	0.001
[0,2]		US	-0.007	0.131	-1.462	0.144	-1.392	0.164	-3.557	0.000
[-5,5]		US	-0.004	0.146	-1.493	0.135	-1.582	0.114	-4.012	0.000
[-10,2]		US	-0.006	0.145	-2.283	0.023	-2.402	0.016	-4.639	0.000
[-10,10]		US	-0.003	0.147	-1.528	0.127	-1.629	0.103	-3.893	0.000
[-20,20]		US	-0.003	0.140	-1.930	0.054	-1.969	0.049	-4.074	0.000

Table 6 Summary Mean CAR results Paris Agreement by region (12 December 2015)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1572	Global	-0.017	0.131	-5.173	-0.000	-3.124	-0.002	-40.024	0.000
[0,2]	1572	Global	-0.017	0.138	-5.000	-0.000	3.486	-0.001	-59.439	0.000
[-5,5]	5764	Global	-0.034	0.219	-11.850	-0.000	-3.218	-0.001	-51.368	0.000
[-10,2]	6812	Global	-0.031	0.231	-11.035	-0.000	-3.991	-0.000	-57.735	0.000
[-10,10]	11004	Global	-0.043	0.279	-16.077	-0.000	-2.202	-0.028	-41.137	0.000
[-20,20]	21484	Global	-0.062	0.342	-26.432	-0.000	-3.08	-0.002	-44.661	0.000
[-1,1]		Australia	-0.008	0.087	-1,470	0.143	-0.653	0.514	-0.049	0.961
[0,2]		Australia	-0.005	0.114	-0.744	0.458	-0.593	0.553	0.207	0.836
[-5,5]		Australia	-0.048	0.155	-9.365	0.000	-2.166	0.030	-1.118	0.264
[-10,2]		Australia	-0.035	0.162	-7.151	0.000	-1.903	0.057	-0.264	0.792
[-10,10]		Australia	-0.051	0.188	-11.442	0.000	-2.211	0.027	-0.630	0.529
[-20,20]		Australia	-0.049	0.264	-10.967	0.000	-2.125	0.034	-0,309	0.757
[-1,1]		Canada	-0.020	0.115	-3.353	0.001	-2.599	0.009	-2,302	0.021
[0,2]		Canada	-0.040	0.142	-5.383	0.000	-4.450	0.000	-6.049	0.000
[-5,5]		Canada	-0.044	0.202	-7.968	0.000	-2.924	0.003	-2.862	0.004
[-10,2]		Canada	-0.018	0.226	-3.149	0.002	-2.743	0.006	-3.693	0.000
[-10,10]		Canada	-0.030	0.283	-5.360	0.000	-0.562	0.574	-2.066	0.039
[-20,20]		Canada	-0.065	0.286	-16.042	0.000	-1.433	0.152	-1.592	0.111
[-1,1]		Europe	-0.014	0.075	-3.089	0.002	-2.157	0.031	-1.730	0.084
[0,2]		Europe	-0.015	0.074	-3.295	0.001	-1.197	0.231	-2.046	0.041
[-5,5]		Europe	-0.019	0.100	-6.051	0.000	-1.197	0.231	-1.169	0.243
[-10,2]		Europe	-0.030	0.102	-10.118	0.000	-2.567	0.010	-1.933	0.053
[-10,10]		Europe	-0.031	0.127	-10.608	0.000	-0.695	0.487	-0.527	0.598
[-20,20]		Europe	-0.037	0.168	-13.355	0.000	-1.572	0.116	-1.793	0.073
[-1,1]		Japan	0.003	0.015	0.914	0.372	0.411	0.681	0.504	0.614
[0,2]		Japan	0.000	0.014	0.077	0.939	0.093	0.926	0.265	0.791
[-5,5]		Japan	-0.019	0.025	-6.652	0.000	-1.266	0.206	-1.138	0.255
[-10,2]		Japan	-0.013	0.021	-5.784	0.000	-0.626	0.531	-0.476	0.634
[-10,10]		Japan	-0.016	0.027	-7.303	0.000	-0.625	0.532	-0.385	0.700
[-20,20]		Japan	-0.008	0.040	-3.196	0.002	-1.039	0.299	-0.475	0.635
[-1,1]		US	-0.020	0.167	-3.156	0.002	-1.632	0.103	-3.301	0,001
[0,2]		US	-0.011	0.163	-1.741	0.082	-1.392	0.164	-3.557	0.000
[-5,5]		US	-0.030	0.280	-5.349	0.000	-1.582	0.114	-4.012	0.000
[-10,2]		US	-0.037	0.290	-6.899	0.000	-2.402	0.016	-4.639	0.000
[-10,10]		US	-0.052	0.347	-10.265	0.000	-1.629	0.103	-3.893	0.000
[-20,20]		US	-0.077	0.442	-16.527	0.000	-1.969	0.049	-4.074	0.000

Table 7 Summary Mean AR results US election 2016 by region (8 November 2016)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1617	Global	-0.004	0.116	-1.254	0.210	-1.254	0.210	-5.193	0.000
[0,2]	1617	Global	0.000	0.118	-0.104	0.917	-0.104	0.917	-0.834	0.404
[-5,5]	5929	Global	0.001	0.117	0.384	0.701	0.384	0.701	-0.351	0.726
[-10,2]	7007	Global	-0.001	0.117	-0.501	0.616	-0.501	0.616	-3.796	0.000
[-10,10]	11319	Global	0.000	0.115	-0.239	0.811	-0.239	0.811	-2.929	0.003
[-20,20]	22099	Global	0.001	0,114	1.045	0.296	1.045	0.296	-2.404	0.016
[-1,1]		Australia	-0.01	0.066	-2.486	0.014	-1.863	0.062	-2.941	0.003
[0,2]		Australia	-0.005	0.067	-1.230	0.220	-0.934	0.350	-0.999	0.318
[-5,5]		Australia	-0.005	0.065	-2.454	0.014	-1.822	0.069	-1.092	0.275
[-10,2]		Australia	-0.002	0.079	-0.770	0.442	-0.693	0.488	-0.739	0.460
[-10,10]		Australia	-0,002	0.074	-1.284	0.199	-1.080	0.280	-1.068	0.285
[-20,20]		Australia	0.000	0.082	0.217	0.828	0.203	0.839	0.507	0.612
[-1,1]		Canada	-0.005	0.081	-1.097	0.273	-0.921	0.357	-3.128	0.002
[0,2]		Canada	-0.001	0.088	-0.279	0.780	-0.253	0.800	-1.589	0.112
[-5,5]		Canada	-0.002	0.075	-0.884	0.377	-0.683	0.494	0.721	0.471
[-10,2]		Canada	-0.003	0.091	-1.127	0.260	-1.057	0.290	-2.313	0.021
[-10,10]		Canada	-0.004	0.085	-2.320	0.020	-2.035	0,042	-2.733	0.006
[-20,20]		Canada	-0.001	0.093	-1.030	0.303	-0.991	0.322	-2.300	0.021
[-1,1]		Europe	-0.005	0.030	-2.735	0,007	-0.818	0.069	-3.361	0.001
[0,2]		Europe	-0.002	0.031	-1.229	0.220	-0.840	0.401	-0.106	0.915
[-5,5]		Europe	-0.001	0.049	-0.501	0.616	-0.537	0.592	-0.468	0.640
[-10,2]		Europe	-0.001	0.044	-0.395	0.693	-0.379	0.705	-0.865	0.387
[-10,10]		Europe	0.000	0.047	-0.085	0.933	-0.088	0.930	-0.519	0.604
[-20,20]		Europe	0.000	0.049	-0.521	0.603	-0.554	0.580	-0.112	0.911
[-1,1]		Japan	-0.001	0.011	-0.469	0.644	-0.259	0.796	-0.222	0.824
[0,2]		Japan	0.008	0.019	2.004	0.059	1.928	0.054	1.828	0.067
[-5,5]		Japan	0.001	0.015	0.288	0.774	0.229	0.819	0594	0.552
[-10,2]		Japan	-0.002	0.015	-1.497	0.138	-1.190	0.234	-1.208	0.227
[-10,10]		Japan	-0.001	0.015	-0.985	0.326	-0.750	0.453	-0.215	0.830
[-20,20]		Japan	0.000	0.018	0.187	0.852	0.170	0.865	0.008	0.994
[-1,1]		US	0.000	0.161	-0.012	0.990	-0.014	0.989	-1.739	0.082
[0,2]		US	0.003	0.164	0.413	0.680	0.483	0.629	0.370	0.711
[-5,5]		US	0.005	0.163	1.420	0.156	1.653	0.098	-0.213	0.831
[-10,2]		US	0.001	0.157	0.246	0.805	0.276	0.783	-2.890	0.004
[-10,10]		US	0.002	0.156	1.081	0.280	1.199	0.231	-1.503	0.133
[-20,20]		US	0.003	0.151	1.725	0.085	1.856	0.063	-2.258	0.024

Table 8 Summary Mean CAR results US election 2016 by region (8 November 2016)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1617	Global	-0.008	0.148	-2.119	0.034	-1.254	0.210	-5.193	0.000
[0,2]	1617	Global	-0.004	0.146	-0.966	0.334	-0.104	0.917	-0.834	0.404
[-5,5]	5929	Global	-0.003	0.217	-1.120	0.263	0.384	0.701	-0.351	0.726
[-10,2]	7007	Global	-0.004	0.234	-1.485	0.138	-0.501	0.616	-3.796	0.000
[-10,10]	11319	Global	-0.004	0.275	-1.396	0.163	-0.239	0.811	-2.929	0.003
[-20,20]	22099	Global	0.012	0.372	4.731	0.000	1.045	0.296	-2.404	0.016
[-1,1]		Australia	-0.019	0.083	-3.588	0.000	-1.863	0.062	-2.941	0.003
[0,2]		Australia	-0.016	0.061	-4.212	0.000	-0.934	0.350	-0.999	0.318
[-5,5]		Australia	-0.032	0.117	-8.388	0.000	-1.822	0.069	-1.092	0.275
[-10,2]		Australia	0.001	0.174	0.145	0.885	-0.693	0.488	-0.739	0.460
[-10,10]		Australia	-0.013	0.191	-2.892	0.004	-1.080	0.280	-1.068	0.285
[-20,20]		Australia	0.044	0.323	7.930	0.000	0.203	0.839	0.507	0.612
[-1,1]		Canada	-0.011	0.092	-2.368	0.018	-0.921	0.357	-3.128	0.002
[0,2]		Canada	-0.005	0.115	-0.810	0.419	-0.253	0.800	-1.589	0.112
[-5,5]		Canada	-0.016	0.148	-3.974	0.000	-0.683	0.494	0.721	0.471
[-10,2]		Canada	-0.02	0.212	-3.686	0.000	-1.057	0.29	-2.313	0.021
[-10,10]		Canada	-0.031	0.242	-6.499	0.000	-2.035	0.042	-2.733	0.006
[-20,20]		Canada	-0.011	0.376	-2.021	0.043	-0.991	0.322	-2.300	0.021
[-1,1]		Europe	-0.009	0.049	-3.088	0.002	-1.818	0.069	-3.361	0.001
[0,2]		Europe	-0.010	0.039	-4.380	0.000	-0.840	0.401	-0.106	0.915
[-5,5]		Europe	-0.012	0.079	-4.903	0.000	-0.537	0.592	-0.468	0.640
[-10,2]		Europe	0.006	0.124	1.719	0.086	-0.379	0.705	-0.865	0.387
[-10,10]		Europe	0.006	0.142	1.736	0.083	-0.088	0.93	-0.519	0.604
[-20,20]		Europe	-0.013	0.195	-4.096	0.000	-0.554	0.58	-0.112	0.911
[-1,1]		Japan	-0.003	0.014	-0.987	0.335	-0.259	0.796	-0.222	0.824
[0,2]		Japan	0.005	0.020	1.067	0.299	1.928	0.054	1.828	0.067
[-5,5]		Japan	-0.010	0.027	-3.123	0.003	0.229	0.819	0.594	0.552
[-10,2]		Japan	-0.040	0.036	-10.759	0.000	-1.190	0.234	-1.208	0.227
[-10,10]		Japan	-0.036	0.041	-10.717	0.000	-0.750	0.453	-0.215	0.830
[-20,20]		Japan	-0.012	0.053	-3.904	0.000	0.170	0.865	0.008	0.994
[-1,1]		US	-0.002	0.210	-0.197	0.844	-0.014	0.989	-1.739	0.082
[0,2]		US	0.005	0.203	0.574	0.566	0.483	0.629	0.370	0.711
[-5,5]		US	0.019	0.302	3.094	0.002	1.653	0.098	-0.213	0.831
[-10,2]		US	-0.001	0.295	-0.119	0.905	0.276	0.783	-2.890	0.004
[-10,10]		US	0.012	0.353	2.389	0.017	1.199	0.231	-1.503	0.133
[-20,20]		US	0.024	0.440	5.096	0.000	1.856	0.063	-2.258	0.024

Table 9 Summary Mean AR results Trump Withdraws Paris Agreement by region (1 June 2017)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1617	Global	-0.003	0.109	-1.079	0.281	-1.079	0.281	-4.748	0.000
[0,2]	1617	Global	-0.002	0.110	-0.902	0.367	-0.902	0.367	-3.400	0.001
[-5,5]	5929	Global	-0.004	0.107	-2.702	0.007	-2.702	0.007	-6.680	0.000
[-10,2]	7007	Global	-0.002	0.108	-1.629	0.103	-1.629	0.103	-5.688	0.000
[-10,10]	11319	Global	-0.001	0.115	-1.170	0.242	-1.170	0.242	-5.107	0.000
[-20,20]	22099	Global	-0.001	0.116	-1.814	0.070	-1.814	0.070	-3.221	0.001
[-1,1]		Australia	-0.001	0.063	-0.322	0.748	-0.287	0.774	-2.579	0.010
[0,2]		Australia	-0.006	0.057	-1.818	0.070	-1.472	0.141	-1.836	0.066
[-5,5]		Australia	-0.003	0.069	-1.139	0.255	-1.107	0.268	-0.871	0.384
[-10,2]		Australia	-0.002	0.073	-0.694	0.488	-0.717	0.474	-0.496	0.620
[-10,10]		Australia	-0.002	0.070	-1.442	0.150	-1.431	0.152	-1.619	0.105
[-20,20]		Australia	-0.002	0.075	-1.264	0.206	-1.344	0.179	-1.081	0.280
[-1,1]		Canada	-0.003	0.081	-0.736	0.462	-0.663	0.507	-3.292	0.001
[0,2]		Canada	-0.005	0.075	-1.335	0.183	-1.112	0.266	-2.654	0.008
[-5,5]		Canada	-0.006	0.085	-2.821	0.005	-2.673	0.008	-4.534	0.000
[-10,2]		Canada	-0.006	0.078	-2.877	0.004	-2.506	0.012	-3.613	0.000
[-10,10]		Canada	-0.005	0.086	-2.933	0.003	-2.787	0.005	-3.080	0.002
[-20,20]		Canada	-0.004	0.081	-3.237	0.001	-2.899	0.004	-1.119	0.263
[-1,1]		Europe	-0.003	0.038	-1.458	0.146	-1.223	0.221	-1.757	0.079
[0,2]		Europe	-0.003	0.038	-1.375	0.170	-1.169	0.242	-1.497	0.134
[-5,5]		Europe	-0.004	0.035	-3.753	0.000	-2.920	0.004	-3.166	0.002
[-10,2]		Europe	-0.003	0.036	-2.762	0.006	-2.195	0.028	-2.746	0.006
[-10,10]		Europe	-0.001	0.048	-1.249	0.212	-1.333	0.183	-2.478	0.013
[-20,20]		Europe	-0.002	0.044	-3.291	0.001	-3.218	0.001	-3.058	0.002
[-1,1]		Japan	-0.004	0.014	-1.381	0.181	-1.218	0.223	-1.154	0.249
[0,2]		Japan	-0.006	0.013	-2.012	0.056	-1.73	0.084	-1.588	0.112
[-5,5]		Japan	-0.003	0.012	-2.614	0.011	-2.035	0.042	-2.177	0.030
[-10,2]		Japan	-0.003	0.010	-2.782	0.006	-1.855	0.064	-1.517	0.129
[-10,10]		Japan	-0.002	0.011	-2.146	0.033	-1.563	0.118	-1.059	0.290
[-20,20]		Japan	-0.002	0.013	-2.835	0.005	-2.308	0.021	-1.662	0.097
[-1,1]		US	-0.003	0.151	-0.565	0.572	-0.548	0.583	-2.056	0.040
[0,2]		US	0.001	0.156	0.161	0.872	0.162	0.872	-1.126	0.260
[-5,5]		US	0.003	0.146	0.879	0.380	0.825	0.409	4.042	0.000
[-10,2]		US	0.000	0.149	-0.014	0.989	-0.013	0.989	-3.639	0.000
[-10,10]		US	0.001	0.158	0.546	0.585	0.555	0.579	-2.789	0.005
[-20,20]		US	0.000	0.161	0.185	0.854	0.191	0.848	-1.350	0.177

Table 11 Summary Mean CAR results Trump Withdraws Paris Agreement by region (1 June 2017)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1617	Global	-0.007	0.138	-2.175	0.030	-1.079	0.281	-4.748	0.000
[0,2]	1617	Global	-0.004	0.157	-1.125	0.261	-0.902	0.367	-3.400	0.001
[-5,5]	5929	Global	-0.027	0.200	-10.314	0.000	-2.702	0.007	-6.680	0.000
[-10,2]	7007	Global	-0.006	0.224	-2.430	0.015	-1.629	0.103	-5.688	0.000
[-10,10]	11319	Global	-0.014	0.278	-5.226	0.000	-1.170	0.242	-5.107	0.000
[-20,20]	22099	Global	-0.022	0.383	-8.531	0.000	-1.814	0.070	-3.221	0.001
[-1,1]		Australia	0.001	0.091	0.174	0.862	-0.287	0.774	-2.579	0.010
[0,2]		Australia	-0.013	0.075	-2.702	0.007	-1.472	0.141	-1.835	0.066
[-5,5]		Australia	-0.016	0.108	-4.657	0.000	-1.107	0.268	-0.871	0.384
[-10,2]		Australia	-0.006	0.135	-1.370	0.171	-0.717	0.473	-0.496	0.620
[-10,10]		Australia	-0.014	0.161	-3.677	0.000	-1.431	0.152	-1.619	0.105
[-20,20]		Australia	-0.035	0.252	-8.257	0.000	-1.344	0.179	-1.081	0.280
[-1,1]		Canada	-0.010	0.102	-1.910	0.057	-0.663	0.507	-3.292	0.001
[0,2]		Canada	-0.012	0.100	-2.256	0.025	-1.112	0.266	-2.654	0.008
[-5,5]		Canada	-0.045	0.184	-9.104	0.000	-2.673	0.007	-4.534	0.000
[-10,2]		Canada	-0.033	0.181	-7.502	0.000	-2.506	0.012	-3.613	0.000
[-10,10]		Canada	-0.053	0.218	-12.440	0.000	-2.787	0.005	-3.080	0.002
[-20,20]		Canada	-0.066	0.265	-17.898	0.000	-2.899	0.004	-1.119	0.263
[-1,1]		Europe	-0.007	0.050	-2.558	0.011	-1.223	0.221	-1.757	0.079
[0,2]		Europe	-0.006	0.052	-1.895	0.059	-1.169	0.242	-1.497	0.134
[-5,5]		Europe	-0.030	0.097	-10.040	0.000	-2.920	0.004	-3.166	0.002
[-10,2]		Europe	-0.014	0.102	-4.830	0.000	-2.195	0.028	-2.747	0.006
[-10,10]		Europe	-0.024	0.133	-7.992	0.000	-1.333	0.183	-2.478	0.013
[-20,20]		Europe	-0.051	0.206	-15.488	0.000	-3.218	0.001	-3.058	0.002
[-1,1]		Japan	-0.009	0.014	-3.113	0.005	-1.218	0.223	-1.154	0.249
[0,2]		Japan	-0.014	0.017	-4.056	0.001	-1.730	0.084	-1.588	0.112
[-5,5]		Japan	-0.022	0.022	-9.457	0.000	-2.035	0.042	-2.177	0.029
[-10,2]		Japan	-0.015	0.019	-7.969	0.000	-1.855	0.064	-1.517	0.129
[-10,10]		Japan	-0.025	0.023	-13.786	0.000	-1.563	0.118	-1.059	0.290
[-20,20]		Japan	-0.053	0.049	-19.797	0.000	-2.308	0.021	-1.662	0.097
[-1,1]		US	-0.009	0.190	-1.254	0.210	-0.548	0.583	-2.057	0.040
[0,2]		US	0.004	0.225	0.443	0.658	0.162	0.872	-1.126	0.260
[-5,5]		US	0.019	0.262	3.627	0.000	0.003	2.209	4.042	0.000
[-10,2]		US	0.012	0.301	2.142	0.032	-0.013	0.989	-3.639	0.000
[-10,10]		US	0.013	0.376	2.419	0.016	0.555	0.579	-2.789	0.005
[-20,20]		US	0.022	0.518	3.995	0.000	0.191	0.848	-1.351	0.177

Table 12 Summary Mean AR results Green Deal by region (11 December 2019)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1734	Global	0.003	0.107	1.043	0.297	1.043	0.297	4.115	0.000
[0,2]	1734	Global	0.005	0.118	1.830	0.067	1.830	0.067	1.969	0.049
[-5,5]	6358	Global	0.002	0.123	1.437	0.151	1.437	0.151	5.167	0.000
[-10,2]	7514	Global	0.003	0.114	2.109	0.035	2.109	0.035	4.944	0.000
[-10,10]	12138	Global	0.003	0.117	2.733	0.006	2.733	0.006	6.954	0.000
[-20,20]	23698	Global	0.002	0.121	2.960	0.003	2.960	0.003	4.444	0.000
[-1,1]		Australia	-0.002	0.077	-0.435	0.664	-0.435	0.663	0.546	0.585
[0,2]		Australia	0.002	0.083	0.284	0.776	0.306	0.760	0.341	0.733
[-5,5]		Australia	-0.004	0.078	-1.469	0.142	-1.492	0.136	-1.117	0.264
[-10,2]		Australia	-0.003	0.080	-1.406	0.160	-1.462	0.144	-0.533	0.594
[-10,10]		Australia	-0.001	0.080	-0.603	0.547	-0.629	0.529	0.495	0.621
[-20,20]		Australia	-0.000	0.080	-0.117	0.907	-0.122	0.903	0.978	0.328
[-1,1]		Canada	0.001	0.062	0.424	0.672	0.372	0.710	2.538	0.011
[0,2]		Canada	-0.001	0.064	-0.178	0.859	-0.160	0.873	1.326	0.185
[-5,5]		Canada	0.006	0.095	2.458	0.014	3.302	0.001	4.907	0.000
[-10,2]		Canada	0.003	0.078	1.517	0.130	1.664	0.096	3.929	0.000
[-10,10]		Canada	0.005	0.089	3.245	0.001	4.085	0.000	5.133	0.000
[-20,20]		Canada	0.004	0.088	3.318	0.001	4.107	0.000	4.776	0.000
[-1,1]		Europe	0.004	0.070	0.997	0.319	1.499	0.134	0.941	0.347
[0,2]		Europe	0.006	0.071	1.414	0.158	2.171	0.030	1.202	0.229
[-5,5]		Europe	-0.001	0.061	-0.405	0.685	-0.533	0.594	0.412	0.680
[-10,2]		Europe	0.000	0.054	0.182	0.856	0.211	0.833	1.021	0.307
[-10,10]		Europe	0.000	0.054	0.296	0.767	0.347	0.728	2.112	0.035
[-20,20]		Europe	-0.000	0.051	-0.271	0.786	-0.299	0.765	0.261	0.794
[-1,1]		Japan	0.004	0.018	1.276	0.213	1.153	0.249	0.896	0.370
[0,2]		Japan	-0.001	0.020	-0.135	0.893	-0.136	0.891	-0.181	0.856
[-5,5]		Japan	0.005	0.026	2.031	0.045	2.635	0.008	2.010	0.044
[-10,2]		Japan	-0.000	0.018	-0.086	0.932	-0.077	0.938	0.352	0.725
[-10,10]		Japan	0.001	0.022	0.696	0.487	0.778	0.436	0.749	0.454
[-20,20]		Japan	-0.002	0.028	-1.213	0.226	-1.672	0.095	-0.631	0.528
[-1,1]		US	0.004	0.144	0.845	0.398	0.901	0.367	3.233	0.001
[0,2]		US	0.010	0.162	1.618	0.106	1.943	0.052	1.028	0.304
[-5,5]		US	0.003	0.164	1.046	0.295	1.271	0.204	4.282	0.000
[-10,2]		US	0.006	0.156	2.215	0.027	2.552	0.011	4.301	0.000
[-10,10]		US	0.004	0.156	1.867	0.062	2.160	0.031	5.187	0.000
[-20,20]		US	0.004	0.164	2.165	0.030	2.631	0.009	2.616	0.009

Table 13 Summary Mean CAR results EU Green Deal by region (11 December 2019)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1734	Global	0.002	0.146	0.630	0.529	1.043	0.297	4.115	0.000
[0,2]	1734	Global	0.008	0.151	2.317	0.021	1.830	0.067	1.969	0.049
[-5,5]	6358	Global	0.015	0.243	4.959	0.000	2.437	0.021	5.167	0.000
[-10,2]	7514	Global	0.015	0.224	5.682	0.000	2.109	0.035	4.944	0.000
[-10,10]	12138	Global	0.028	0.277	11.135	0.000	2.733	0.006	6.954	0.000
[-20,20]	23698	Global	0.027	0.393	10.718	0.000	2.960	0.003	4.444	0.000
[-1,1]		Australia	-0.003	0.097	-0.498	0.619	-0.435	0.663	0.546	0.585
[0,2]		Australia	0.000	0.096	0.002	0.999	0.306	0.760	0.341	0.733
[-5,5]		Australia	-0.025	0.139	-5.561	0.000	-1.492	0.136	-1.117	0.264
[-10,2]		Australia	-0.032	0.146	-7.418	0.000	-1.462	0.144	-0.533	0.594
[-10,10]		Australia	-0.038	0.165	-9.883	0.000	-0.629	0.529	0.495	0.621
[-20,20]		Australia	-0.004	0.200	-1.112	0.266	-0.122	0.903	0.978	0.328
[-1,1]		Canada	-0.002	0.087	-0.356	0.722	0.372	0.710	2.538	0.011
[0,2]		Canada	0.000	0.091	0.011	0.991	-0.160	0.873	1.326	0.185
[-5,5]		Canada	0.036	0.195	7.198	0.000	3.302	0.001	4.907	0.000
[-10,2]		Canada	0.020	0.144	5.825	0.000	1.664	0.096	3.929	0.000
[-10,10]		Canada	0.046	0.197	12.480	0.000	4.085	0.000	5.133	0.000
[-20,20]		Canada	0.051	0.298	12.777	0.000	4.107	0.000	4.776	0.000
[-1,1]		Europe	0.003	0.075	0.693	0.489	1.499	0.134	0.941	0.347
[0,2]		Europe	0.009	0.099	1.564	0.119	2.171	0.030	1.202	0.229
[-5,5]		Europe	-0.009	0.110	-2.813	0.005	-0.533	0.594	0.412	0.680
[-10,2]		Europe	-0.002	0.130	-0.432	0.666	-0.211	0.833	1.021	0.307
[-10,10]		Europe	-0.001	0.170	-0.219	0.827	0.347	0.728	2.112	0.035
[-20,20]		Europe	-0.014	0.247	-3.620	0.000	-0.299	0.765	0.261	0.794
[-1,1]		Japan	0.011	0.032	1.766	0.089	1.153	0.249	0.896	0.370
[0,2]		Japan	0.009	0.022	2.126	0.043	-0.136	0.891	-0.181	0.856
[-5,5]		Japan	0.025	0.045	5.506	0.000	2.635	0.008	2.010	0.044
[-10,2]		Japan	-0.007	0.039	-1.905	0.059	-0.077	0.938	0.352	0.725
[-10,10]		Japan	0.005	0.044	1.457	0.147	0.778	0.436	0.749	0.454
[-20,20]		Japan	-0.075	0.190	-7.595	0.000	-1.672	0.095	-0.631	0.528
[-1,1]		US	0.005	0.202	0.738	0.461	0.901	0.367	3.233	0.001
[0,2]		US	0.016	0.205	2.086	0.037	1.943	0.052	1.028	0.304
[-5,5]		US	0.028	0.326	4.391	0.000	1.271	0.204	4.282	0.000
[-10,2]		US	0.035	0.303	6.465	0.000	2.552	0.011	4.301	0.000
[-10,10]		US	0.055	0.368	10.601	0.000	2.160	0.031	5.187	0.000
[-20,20]		US	0.047	0.522	8.906	0.000	2.631	0.009	2.616	0.009

Table 14 Summary Mean AR results US Election 2020 by region (3 November 2020)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1776	Global	-0.006	0.116	-2.173	0.030	-2.173	0.030	-7.969	0.000
[0,2]	1776	Global	-0.008	0.115	-2.931	0.003	-2.931	0.003	-7.120	0.000
[-5,5]	6512	Global	-0.002	0.117	-1.710	0.087	-1.710	0.087	-2.347	0.019
[-10,2]	7696	Global	-0.004	0.117	-2.795	0.005	-2.795	0.005	-2.863	0.004
[-10,10]	12433	Global	-0.001	0.114	-0.499	0.618	-0.499	0.618	1.826	0.068
[-20,20]	24272	Global	0.001	0.118	0.873	0.382	0.873	0.382	4.515	0.000
[-1,1]		Australia	-0.003	0.098	-0.554	0.580	-0.554	0.579	0.121	0.904
[0,2]		Australia	0.004	0.081	0.788	0.432	0.788	0.431	0.779	0.436
[-5,5]		Australia	-0.000	0.080	-0.139	0.890	-0.139	0.890	0.623	0.533
[-10,2]		Australia	-0.004	0.078	-1.985	0.047	-1.985	0.047	-0.133	0.894
[-10,10]		Australia	-0.003	0.074	-1.547	0.122	-1.547	0.122	0.980	0.327
[-20,20]		Australia	-0.001	0.080	-0.609	0.543	-0.609	0.543	2.615	0.009
[-1,1]		Canada	-0.006	0.064	-1.835	0.067	-1.835	0.067	-1.759	0.079
[0,2]		Canada	-0.004	0.059	-1.391	0.165	-1.391	0.164	-0.517	0.605
[-5,5]		Canada	-0.001	0.067	-0.804	0.421	-0.804	0.421	2.507	0.012
[-10,2]		Canada	-0.004	0.065	-2.256	0.024	-2.256	0.024	3.409	0.001
[-10,10]		Canada	-0.001	0.068	-0.424	0.672	-0.424	0.672	6.137	0.000
[-20,20]		Canada	0.002	0.075	1.743	0.081	1.743	0.081	11.159	0.000
[-1,1]		Europe	-0.004	0.059	-1.101	0.272	-1.101	0.271	-1.802	0.071
[0,2]		Europe	-0.001	0.060	-0.376	0.707	-0.376	0.707	-0.029	0.977
[-5,5]		Europe	-0.002	0.053	-1.232	0.218	-1.232	0.218	2.270	0.023
[-10,2]		Europe	-0.002	0.051	-1.099	0.272	-1.099	0.272	4.022	0.000
[-10,10]		Europe	-0.000	0.049	-0.429	0.668	-0.429	0.668	6.488	0.000
[-20,20]		Europe	0.000	0.056	-0.053	0.958	-0.053	0.958	9.525	0.000
[-1,1]		Japan	-0.003	0.028	-0.460	0.649	-0.460	0.645	0.206	0.837
[0,2]		Japan	-0.004	0.028	-0.658	0.516	-0.658	0.510	0.228	0.820
[-5,5]		Japan	0.001	0.038	0.215	0.830	0.215	0.829	1.007	0.314
[-10,2]		Japan	-0.002	0.032	-0.504	0.615	-0.504	0.615	1.346	0.178
[-10,10]		Japan	0.001	0.036	0.348	0.728	0.348	0.728	2.141	0.032
[-20,20]		Japan	-0.001	0.029	-0.663	0.508	-0.663	0.507	2.796	0.005
[-1,1]		US	-0.008	0.157	-1.423	0.155	-1.423	0.155	-10.016	0.000
[0,2]		US	-0.018	0.159	-3.004	0.003	-3.004	0.003	-11.169	0.000
[-5,5]		US	-0.004	0.162	-1.355	0.175	-1.355	0.175	-7.586	0.000
[-10,2]		US	-0.005	0.163	-1.600	0.110	-1.600	0.110	-9.829	0.000
[-10,10]		US	0.000	0.159	0.090	0.928	0.090	0.928	-6.587	0.000
[-20,20]		US	0.001	0.161	0.597	0.550	0.597	0.550	-8.176	0.000

Table 15 Summary Mean CAR results US Election 2020 by region (3 November 2020)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1776	Global	-0.011	0.157	-3.000	0.003	-2.173	0.030	-7.969	0.000
[0,2]	1776	Global	-0.017	0.155	-4.714	0.000	-2.931	0.003	-7.120	0.000
[-5,5]	6512	Global	-0.023	0.214	-8.532	0.000	-1.710	0.087	-2.347	0.019
[-10,2]	7696	Global	-0.017	0.219	-6.622	0.000	-2.795	0.005	-2.863	0.004
[-10,10]	12433	Global	-0.020	0.261	-8.473	0.000	-0.499	0.618	1.826	0.068
[-20,20]	24272	Global	0.006	0.370	2.396	0.017	0.873	0.382	4.515	0.000
[-1,1]		Australia	-0.017	0.096	-2.854	0.005	-0.554	0.579	0.121	0.904
[0,2]		Australia	0.010	0.111	1.530	0.127	0.788	0.431	0.779	0.436
[-5,5]		Australia	-0.014	0.138	-3.098	0.002	-0.139	0.890	0.623	0.533
[-10,2]		Australia	-0.040	0.143	-9.658	0.000	-1.985	0.047	-0.133	0.894
[-10,10]		Australia	-0.045	0.170	-11.395	0.000	-1.547	0.122	0.980	0.327
[-20,20]		Australia	-0.018	0.250	-4.258	0.000	-0.609	0.543	2.615	0.009
[-1,1]		Canada	-0.011	0.072	-3.026	0.003	-1.835	0.067	-1.759	0.079
[0,2]		Canada	-0.009	0.083	-2.306	0.022	-1.391	0.164	-0.517	0.605
[-5,5]		Canada	-0.019	0.120	-6.263	0.000	-0.804	0.421	2.507	0.012
[-10,2]		Canada	-0.022	0.108	-8.568	0.000	-2.256	0.024	3.409	0.001
[-10,10]		Canada	-0.021	0.151	-7.497	0.000	-0.424	0.672	6.137	0.000
[-20,20]		Canada	0.045	0.274	12.154	0.000	1.743	0.081	11.159	0.000
[-1,1]		Europe	-0.010	0.068	-2.643	0.009	-1.101	0.271	-1.802	0.071
[0,2]		Europe	-0.006	0.074	-1.419	0.157	-0.376	0.707	-0.029	0.977
[-5,5]		Europe	-0.016	0.109	-5.099	0.000	-1.232	0.218	2.270	0.023
[-10,2]		Europe	-0.010	0.107	-3.345	0.001	-1.099	0.272	4.022	0.000
[-10,10]		Europe	-0.012	0.137	-4.147	0.000	-0.429	0.668	6.488	0.000
[-20,20]		Europe	0.007	0.206	2.183	0.029	-0.053	0.958	9.525	0.000
[-1,1]		Japan	-0.003	0.023	-0.653	0.520	-0.460	0.645	0.206	0.837
[0,2]		Japan	-0.008	0.020	-1.940	0.063	-0.658	0.510	0.228	0.820
[-5,5]		Japan	-0.019	0.054	-3.532	0.001	0.215	0.829	1.007	0.314
[-10,2]		Japan	0.001	0.040	0.133	0.894	-0.504	0.615	1.346	0.178
[-10,10]		Japan	0.002	0.052	0.561	0.576	0.348	0.728	2.141	0.032
[-20,20]		Japan	-0.027	0.070	-7.523	0.000	-0.663	0.507	2.796	0.005
[-1,1]		US	-0.010	0.225	-1.250	0.212	-1.423	0.155	-10.016	0.000
[0,2]		US	-0.037	0.213	-4.720	0.000	-3.004	0.003	-11.169	0.000
[-5,5]		US	-0.031	0.298	-5.377	0.000	-1.355	0.175	-7.586	0.000
[-10,2]		US	-0.009	0.308	-1.575	0.115	-1.600	0.110	-9.829	0.000
[-10,10]		US	-0.014	0.361	-2.877	0.004	0.090	0.928	-6.587	0.000
[-20,20]		US	-0.006	0.493	-1.301	0.193	0.597	0.550	-8.176	0.000

Table 16 Summary Mean AR results Biden Rejoins Paris Agreement by region (21 January 2021)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1785	Global	0.008	0.153	2.168	0.030	2.168	0.030	-0.633	0.527
[0,2]	1785	Global	0.007	0.158	1.963	0.050	1.963	0.050	-1.858	0.063
[-5,5]	6545	Global	0.008	0.146	4.236	0.000	4.236	0.000	0.442	0.659
[-10,2]	7735	Global	0.008	0.140	5.106	0.000	5.106	0.000	4.551	0.000
[-10,10]	12495	Global	0.009	0.150	6.409	0.000	6.409	0.000	5.452	0.000
[-20,20]	24395	Global	0.011	0.150	11.145	0.000	11.145	0.000	10.411	0.000
[-1,1]		Australia	0.003	0.092	0.519	0.605	0.531	0.595	-1.262	0.207
[0,2]		Australia	0.006	0.096	1.089	0.277	1.171	0.242	0.351	0.725
[-5,5]		Australia	0.005	0.101	1.420	0.156	1.607	0.108	-0.328	0.743
[-10,2]		Australia	0.006	0.086	2.298	0.022	2.215	0.027	1.315	0.189
[-10,10]		Australia	0.004	0.093	1.779	0.075	1.857	0.063	-0.061	0.951
[-20,20]		Australia	0.003	0.096	1.952	0.051	2.096	0.036	0.456	0.649
[-1,1]		Canada	0.001	0.082	0.216	0.829	0.208	0.835	0.243	0.808
[0,2]		Canada	-0.002	0.075	-0.494	0.622	-0.434	0.664	-1.590	0.112
[-5,5]		Canada	0.001	0.078	0.604	0.546	0.553	0.581	0.107	0.915
[-10,2]		Canada	0.004	0.076	2.171	0.030	1.935	0.053	1.978	0.048
[-10,10]		Canada	0.004	0.085	2.683	0.007	2.667	0.008	2.589	0.010
[-20,20]		Canada	0.005	0.082	4.962	0.000	4.782	0.000	5.095	0.000
[-1,1]		Europe	0.001	0.058	0.432	0.666	0.406	0.685	1.044	0.296
[0,2]		Europe	0.003	0.056	0.878	0.381	0.791	0.429	-0.250	0.803
[-5,5]		Europe	-0.001	0.060	-0.473	0.636	-0.461	0.645	-1.286	0.198
[-10,2]		Europe	0.001	0.053	0.722	0.471	0.621	0.534	1.165	0.244
[-10,10]		Europe	0.001	0.056	1.219	0.223	1.101	0.271	1.549	0.121
[-20,20]		Europe	0.002	0.051	2.296	0.022	1.890	0.059	2.866	0.004
[-1,1]		Japan	-0.005	0.038	-0.696	0.493	-1.068	0.286	-0.146	0.884
[0,2]		Japan	-0.005	0.039	-0.685	0.499	-1.075	0.282	-0.021	0.983
[-5,5]		Japan	0.002	0.027	0.642	0.522	0.700	0.484	0.869	0.385
[-10,2]		Japan	0.002	0.024	0.840	0.403	0.828	0.407	1.375	0.169
[-10,10]		Japan	0.003	0.025	1.709	0.089	1.699	0.089	1.625	0.104
[-20,20]		Japan	0.004	0.057	1.322	0.187	3.081	0.002	1.310	0.190
[-1,1]		US	0.017	0.218	2.106	0.036	2.772	0.006	-1.440	0.150
[0,2]		US	0.015	0.227	1.831	0.068	2.513	0.012	-2.121	0.034
[-5,5]		US	0.016	0.205	4.139	0.000	5.132	0.000	1.141	0.254
[-10,2]		US	0.015	0.197	4.189	0.000	4.998	0.000	3.417	0.001
[-10,10]		US	0.016	0.211	5.479	0.000	7.003	0.000	4.521	0.000
[-20,20]		US	0.020	0.211	9.761	0.000	12.457	0.000	8.812	0.000

Table 17 Summary Mean CAR results Biden Rejoins Paris Agreement by region (21 January 2021)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1785	Global	0.018	0.189	3.956	0.000	2.168	0.030	-0.633	0.527
[0,2]	1785	Global	0.012	0.207	2.454	0.014	1.963	0.050	-1.858	0.063
[-5,5]	6545	Global	0.042	0.305	11.102	0.000	4.236	0.000	0.442	0.659
[-10,2]	7735	Global	0.059	0.296	17.626	0.000	5.106	0.000	4.551	0.000
[-10,10]	12495	Global	0.090	0.383	26.322	0.000	6.409	0.000	5.452	0.000
[-20,20]	24395	Global	0.181	0.552	51.277	0.000	11.145	0.000	10.411	0.000
[-1,1]		Australia	-0.001	0.118	-0.071	0.943	0.531	0.595	-1.262	0.207
[0,2]		Australia	0.020	0.126	2.558	0.011	1.171	0.242	0.351	0.725
[-5,5]		Australia	0.031	0.199	4.840	0.000	1.607	0.108	-0.328	0.743
[-10,2]		Australia	0.054	0.156	11.753	0.000	2.215	0.027	1.315	0.189
[-10,10]		Australia	0.066	0.222	12.956	0.000	1.857	0.063	-0.061	0.951
[-20,20]		Australia	0.085	0.331	15.692	0.000	2.096	0.036	0.456	0.649
[-1,1]		Canada	0.009	0.111	1.572	0.117	0.208	0.835	0.243	0.808
[0,2]		Canada	-0.006	0.087	-1.335	0.183	-0.434	0.664	-1.590	0.112
[-5,5]		Canada	0.015	0.140	4.218	0.000	0.553	0.581	0.107	0.915
[-10,2]		Canada	0.040	0.195	8.587	0.000	1.935	0.053	1.978	0.048
[-10,10]		Canada	0.046	0.244	9.948	0.000	2.667	0.008	2.589	0.010
[-20,20]		Canada	0.106	0.324	24.434	0.000	4.782	0.000	5.095	0.000
[-1,1]		Europe	-0.001	0.078	-0.274	0.784	0.406	0.685	1.044	0.296
[0,2]		Europe	0.006	0.084	1.292	0.197	0.791	0.429	-0.250	0.803
[-5,5]		Europe	-0.009	0.131	-2.309	0.021	-0.461	0.645	-1.286	0.198
[-10,2]		Europe	0.009	0.142	2.444	0.015	0.621	0.534	1.165	0.244
[-10,10]		Europe	0.011	0.173	3.136	0.002	1.101	0.271	1.549	0.121
[-20,20]		Europe	0.037	0.219	11.395	0.000	1.890	0.059	2.866	0.004
[-1,1]		Japan	-0.005	0.037	-0.731	0.471	-1.068	0.286	-0.146	0.884
[0,2]		Japan	-0.003	0.050	-0.332	0.742	-1.075	0.282	-0.021	0.983
[-5,5]		Japan	0.017	0.056	3.095	0.003	0.700	0.484	0.869	0.385
[-10,2]		Japan	0.029	0.057	5.488	0.000	0.828	0.407	1.375	0.169
[-10,10]		Japan	0.037	0.078	6.517	0.000	1.699	0.089	1.625	0.104
[-20,20]		Japan	0.022	0.096	4.338	0.000	3.081	0.002	1.310	0.190
[-1,1]		US	0.038	0.264	3.966	0.000	2.772	0.006	-2.440	0.025
[0,2]		US	0.022	0.298	2.037	0.042	2.513	0.012	-2.121	0.034
[-5,5]		US	0.083	0.429	10.162	0.000	5.132	0.000	1.141	0.254
[-10,2]		US	0.094	0.407	13.244	0.000	4.998	0.000	3.417	0.001
[-10,10]		US	0.159	0.524	22.006	0.000	7.003	0.000	4.521	0.000
[-20,20]		US	0.324	0.753	43.672	0.000	12.457	0.000	8.812	0.000

Table 18 Summary Mean AR results EU Fit For 55 by region (12 July 2021)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1785	Global	-0.019	0.112	-7.234	0.000	-7.234	0.000	-8.711	0.000
[0,2]	1785	Global	-0.017	0.118	-6.228	0.000	-6.228	0.000	-8.838	0.000
[-5,5]	6545	Global	-0.011	0.115	-7.543	0.000	-7.543	0.000	-8.674	0.000
[-10,2]	7735	Global	-0.008	0.112	-6.458	0.000	-6.458	0.000	-6.837	0.000
[-10,10]	12495	Global	-0.008	0.113	-7.582	0.000	-7.582	0.000	-7.781	0.000
[-20,20]	24395	Global	-0.006	0.114	-8.849	0.000	-8.849	0.000	-8.211	0.000
[-1,1]		Australia	-0.003	0.055	-0.732	0.465	-0.732	0.464	2.104	0.035
[0,2]		Australia	-0.001	0.084	-0.188	0.851	-0.188	0.851	1.048	0.295
[-5,5]		Australia	-0.004	0.081	-1.710	0.088	-1.710	0.087	-0.517	0.605
[-10,2]		Australia	0.003	0.078	1.127	0.260	1.127	0.260	5.090	0.000
[-10,10]		Australia	-0.001	0.075	-0.740	0.460	-0.740	0.460	2.978	0.003
[-20,20]		Australia	-0.003	0.072	-2.426	0.015	-2.426	0.015	2.507	0.012
[-1,1]		Canada	-0.008	0.085	-1.978	0.049	-1.978	0.048	-1.245	0.213
[0,2]		Canada	-0.011	0.084	-2.735	0.006	-2.735	0.006	-2.388	0.017
[-5,5]		Canada	-0.005	0.082	-2.563	0.011	-2.563	0.010	0.637	0.524
[-10,2]		Canada	-0.004	0.082	-2.308	0.021	-2.308	0.021	0.700	0.484
[-10,10]		Canada	-0.004	0.084	-2.359	0.018	-2.359	0.018	1.869	0.062
[-20,20]		Canada	-0.004	0.082	-3.150	0.002	-3.150	0.002	3.658	0.000
[-1,1]		Europe	-0.007	0.035	-3.832	0.000	-3.832	0.000	1.361	0.173
[0,2]		Europe	-0.004	0.050	-1.544	0.124	-1.544	0.123	1.851	0.064
[-5,5]		Europe	-0.003	0.063	-1.613	0.107	-1.613	0.107	2.349	0.019
[-10,2]		Europe	-0.003	0.048	-2.288	0.022	-2.288	0.022	4.352	0.000
[-10,10]		Europe	-0.002	0.056	-1.637	0.102	-1.637	0.102	5.936	0.000
[-20,20]		Europe	-0.003	0.050	-3.444	0.001	-3.444	0.001	7.871	0.000
[-1,1]		Japan	-0.007	0.036	-0.950	0.351	-0.950	0.342	1.228	0.219
[0,2]		Japan	0.003	0.027	0.551	0.586	0.551	0.581	1.445	0.149
[-5,5]		Japan	-0.003	0.051	-0.480	0.632	-0.480	0.631	1.202	0.229
[-10,2]		Japan	0.001	0.044	0.272	0.786	0.272	0.786	2.681	0.007
[-10,10]		Japan	-0.001	0.039	-0.469	0.640	-0.469	0.639	2.916	0.004
[-20,20]		Japan	-0.002	0.030	-1.096	0.274	-1.096	0.273	4.279	0.000
[-1,1]		US	-0.037	0.154	-6.527	0.000	-6.527	0.000	-14.984	0.000
[0,2]		US	-0.033	0.158	-5.709	0.000	-5.709	0.000	-14.076	0.000
[-5,5]		US	-0.020	0.153	-6.707	0.000	-6.707	0.000	-15.663	0.000
[-10,2]		US	-0.017	0.150	-6.354	0.000	-6.354	0.000	-17.717	0.000
[-10,10]		US	-0.015	0.151	-7.108	0.000	-7.108	0.000	-20.083	0.000
[-20,20]		US	-0.011	0.156	-7.332	0.000	-7.332	0.000	-23.705	0.000

Table 19 Summary Mean CAR results EU Fit For 55 by region (12 July 2021)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1785	Global	-0.039	0.147	-11.106	0.000	-7.234	0.000	-8.711	0.000
[0,2]	1785	Global	-0.041	0.143	-12.165	0.000	-6.228	0.000	-8.838	0.000
[-5,5]	6545	Global	-0.071	0.218	-26.270	0.000	-7.543	0.000	-8.674	0.000
[-10,2]	7735	Global	-0.034	0.239	-12.504	0.000	-6.458	0.000	-6.837	0.000
[-10,10]	12495	Global	-0.074	0.304	-27.318	0.000	-7.582	0.000	-7.781	0.000
[-20,20]	24395	Global	-0.144	0.383	-58.741	0.000	-8.849	0.000	-8.211	0.000
[-1,1]		Australia	-0.006	0.063	-1.566	0.119	-0.732	0.464	2.104	0.035
[0,2]		Australia	-0.009	0.072	-1.937	0.054	-0.188	0.851	1.048	0.295
[-5,5]		Australia	-0.025	0.109	-7.084	0.000	-1.710	0.087	-0.517	0.605
[-10,2]		Australia	0.034	0.126	9.343	0.000	1.127	0.260	5.090	0.000
[-10,10]		Australia	0.019	0.141	5.967	0.000	-0.740	0.460	2.978	0.003
[-20,20]		Australia	-0.078	0.192	-24.598	0.000	-2.426	0.015	2.507	0.012
[-1,1]		Canada	-0.015	0.103	-2.994	0.003	-1.978	0.048	-1.245	0.213
[0,2]		Canada	-0.025	0.119	-4.170	0.000	-2.735	0.006	-2.388	0.017
[-5,5]		Canada	-0.040	0.139	-10.998	0.000	-2.563	0.010	0.637	0.524
[-10,2]		Canada	-0.013	0.199	-2.668	0.008	-2.308	0.021	0.700	0.484
[-10,10]		Canada	-0.035	0.227	-8.304	0.000	-2.359	0.018	1.869	0.062
[-20,20]		Canada	-0.058	0.248	-17.479	0.000	-3.150	0.002	3.658	0.000
[-1,1]		Europe	-0.014	0.048	-5.202	0.000	-3.832	0.000	1.361	0.173
[0,2]		Europe	-0.012	0.059	-3.563	0.000	-1.544	0.123	1.851	0.064
[-5,5]		Europe	-0.023	0.133	-5.945	0.000	-1.613	0.107	2.349	0.019
[-10,2]		Europe	-0.017	0.122	-5.304	0.000	-2.288	0.022	4.352	0.000
[-10,10]		Europe	-0.025	0.223	-5.441	0.000	-1.637	0.102	5.936	0.000
[-20,20]		Europe	-0.067	0.269	-16.764	0.000	-3.444	0.001	7.871	0.000
[-1,1]		Japan	-0.019	0.061	-1.635	0.114	-0.950	0.342	1.228	0.219
[0,2]		Japan	0.001	0.026	0.134	0.894	0.551	0.581	1.445	0.149
[-5,5]		Japan	-0.003	0.071	-0.348	0.729	-0.480	0.631	1.202	0.229
[-10,2]		Japan	0.002	0.047	0.397	0.692	0.272	0.786	2.681	0.007
[-10,10]		Japan	-0.007	0.051	-1.917	0.057	-0.469	0.639	2.916	0.004
[-20,20]		Japan	-0.024	0.069	-6.604	0.000	-1.096	0.273	4.279	0.000
[-1,1]		US	-0.074	0.201	-10.129	0.000	-6.527	0.000	-14.984	0.000
[0,2]		US	-0.076	0.188	-11.141	0.000	-5.709	0.000	-14.076	0.000
[-5,5]		US	-0.127	0.290	-23.077	0.000	-6.707	0.000	-15.663	0.000
[-10,2]		US	-0.078	0.312	-14.371	0.000	-6.354	0.000	-17.717	0.000
[-10,10]		US	-0.152	0.388	-28.508	0.000	-7.108	0.000	-20.083	0.000
[-20,20]		US	-0.252	0.499	-51.178	0.000	-7.332	0.000	-23.705	0.000

Table 20 Summary Mean AR results COP 26 Glasgow by region (13 November 2021)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1785	Global	-0.009	0.071	-5.324	0.000	-5.324	0.000	-6.670	0.000
[0,2]	1785	Global	-0.011	0.074	-6.411	0.000	-6.411	0.000	-5.907	0.000
[-5,5]	6545	Global	-0.010	0.078	-9.903	0.000	-9.903	0.000	-9.546	0.000
[-10,2]	7735	Global	-0.009	0.076	-10.126	0.000	-10.126	0.000	-10.036	0.000
[-10,10]	12495	Global	-0.008	0.076	-12.059	0.000	-12.059	0.000	-10.987	0.000
[-20,20]	24395	Global	-0.008	0.087	-13.510	0.000	-13.510	0.000	-11.019	0.000
[-1,1]		Australia	0.002	0.057	0.498	0.619	0.365	0.715	0.065	0.948
[0,2]		Australia	-0.004	0.048	-1.512	0.132	-0.921	0.357	-0.637	0.524
[-5,5]		Australia	-0.003	0.063	-1.580	0.114	-1.268	0.205	-0.891	0.373
[-10,2]		Australia	-0.004	0.058	-2.640	0.008	-1.960	0.050	-2.062	0.039
[-10,10]		Australia	-0.005	0.067	-3.100	0.002	-2.648	0.008	-3.114	0.002
[-20,20]		Australia	-0.004	0.064	-4.106	0.000	-3.340	0.001	-2.724	0.006
[-1,1]		Canada	-0.005	0.052	-1.865	0.063	-1.145	0.252	-3.630	0.000
[0,2]		Canada	-0.002	0.055	-0.870	0.385	-0.563	0.574	-1.010	0.312
[-5,5]		Canada	-0.007	0.062	-4.221	0.000	-3.049	0.002	-4.778	0.000
[-10,2]		Canada	-0.005	0.057	-3.515	0.001	-2.361	0.018	-5.726	0.000
[-10,10]		Canada	-0.005	0.059	-4.952	0.000	-3.436	0.001	-5.332	0.000
[-20,20]		Canada	-0.005	0.072	-5.364	0.000	-4.556	0.000	-4.197	0.000
[-1,1]		Europe	-0.002	0.042	-0.842	0.400	-0.782	0.434	-0.836	0.403
[0,2]		Europe	-0.003	0.032	-1.910	0.057	-1.347	0.178	-0.333	0.739
[-5,5]		Europe	-0.003	0.035	-2.809	0.005	-2.169	0.030	-1.467	0.142
[-10,2]		Europe	-0.004	0.034	-3.840	0.000	-2.950	0.003	-2.071	0.038
[-10,10]		Europe	-0.004	0.035	-5.678	0.000	-4.423	0.000	-3.105	0.002
[-20,20]		Europe	-0.002	0.043	-3.750	0.000	-3.590	0.000	-2.413	0.016
[-1,1]		Japan	-0.004	0.015	-1.616	0.118	-0.554	0.579	-1.339	0.180
[0,2]		Japan	-0.001	0.014	-0.401	0.692	-0.131	0.896	-0.414	0.679
[-5,5]		Japan	-0.002	0.025	-0.715	0.476	-0.413	0.680	-0.313	0.754
[-10,2]		Japan	-0.005	0.026	-1.881	0.063	-1.177	0.239	-1.544	0.123
[-10,10]		Japan	-0.003	0.027	-1.654	0.100	-1.038	0.299	-0.469	0.639
[-20,20]		Japan	-0.002	0.025	-1.613	0.108	-0.957	0.339	-0.304	0.761
[-1,1]		US	-0.018	0.092	-5.450	0.000	-2.799	0.005	-5.418	0.000
[0,2]		US	-0.022	0.100	-6.147	0.000	-3.418	0.001	-6.024	0.000
[-5,5]		US	-0.017	0.102	-8.571	0.000	-4.878	0.000	-7.637	0.000
[-10,2]		US	-0.015	0.101	-8.441	0.000	-4.753	0.000	-6.636	0.000
[-10,10]		US	-0.013	0.099	-9.520	0.000	-5.244	0.000	-6.879	0.000
[-20,20]		US	-0.012	0.113	-11.086	0.000	-6.977	0.000	-8.208	0.000

Table 21 Summary Mean CAR results COP 26 Glasgow by region (13 November 2021)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1785	Global	-0.019	0.098	-8.310	0.000	-5.324	0.000	-6.670	0.000
[0,2]	1785	Global	-0.020	0.097	-8.475	0.000	-6.411	0.000	-5.907	0.000
[-5,5]	6545	Global	-0.048	0.170	-22.902	0.000	-9.903	0.000	-9.546	0.000
[-10,2]	7735	Global	-0.061	0.182	-29.265	0.000	-10.126	0.000	-10.036	0.000
[-10,10]	12495	Global	-0.096	0.237	-45.537	0.000	-12.059	0.000	-10.987	0.000
[-20,20]	24395	Global	-0.161	0.363	-69.101	0.000	-13.510	0.000	-11.019	0.000
[-1,1]		Australia	0.007	0.085	1.379	0.169	0.365	0.715	0.065	0.948
[0,2]		Australia	-0.004	0.059	-1.138	0.256	-0.921	0.357	-0.637	0.524
[-5,5]		Australia	-0.009	0.106	-2.825	0.005	-1.268	0.205	-0.891	0.373
[-10,2]		Australia	-0.040	0.097	-14.150	0.000	-1.960	0.050	-2.062	0.039
[-10,10]		Australia	-0.055	0.133	-17.874	0.000	-2.648	0.008	-3.114	0.002
[-20,20]		Australia	-0.079	0.242	-19.935	0.000	-3.340	0.001	-2.724	0.006
[-1,1]		Canada	-0.016	0.075	-4.267	0.000	-1.145	0.252	-3.630	0.000
[0,2]		Canada	0.001	0.076	0.240	0.810	-0.563	0.574	-1.010	0.312
[-5,5]		Canada	-0.034	0.144	-9.117	0.000	-3.049	0.002	-4.778	0.000
[-10,2]		Canada	-0.032	0.139	-9.577	0.000	-2.361	0.018	-5.726	0.000
[-10,10]		Canada	-0.057	0.178	-17.222	0.000	-3.436	0.001	-5.332	0.000
[-20,20]		Canada	-0.100	0.279	-26.642	0.000	-4.556	0.000	-4.197	0.000
[-1,1]		Europe	-0.002	0.060	-0.727	0.468	-0.782	0.434	-0.836	0.403
[0,2]		Europe	-0.007	0.048	-2.507	0.013	-1.347	0.178	-0.333	0.739
[-5,5]		Europe	-0.010	0.076	-4.453	0.000	-2.169	0.030	-1.467	0.142
[-10,2]		Europe	-0.030	0.090	-12.386	0.000	-2.950	0.003	-2.071	0.038
[-10,10]		Europe	-0.044	0.113	-18.452	0.000	-4.423	0.000	-3.105	0.002
[-20,20]		Europe	-0.050	0.170	-19.595	0.000	-3.590	0.000	-2.413	0.016
[-1,1]		Japan	-0.011	0.018	-3.143	0.004	-0.554	0.579	-1.339	0.180
[0,2]		Japan	-0.002	0.015	-0.622	0.539	-0.131	0.896	-0.414	0.679
[-5,5]		Japan	0.001	0.049	0.261	0.795	-0.413	0.680	-0.313	0.754
[-10,2]		Japan	-0.037	0.075	-5.394	0.000	-1.177	0.239	-1.544	0.123
[-10,10]		Japan	-0.046	0.086	-7.329	0.000	-1.038	0.299	-0.469	0.639
[-20,20]		Japan	-0.052	0.084	-11.915	0.000	-0.957	0.339	-0.304	0.761
[-1,1]		US	-0.038	0.122	-8.609	0.000	-2.799	0.005	-5.418	0.000
[0,2]		US	-0.042	0.127	-9.131	0.000	-3.418	0.001	-6.024	0.000
[-5,5]		US	-0.088	0.218	-21.185	0.000	-4.878	0.000	-7.637	0.000
[-10,2]		US	-0.098	0.242	-23.085	0.000	-4.753	0.000	-6.636	0.000
[-10,10]		US	-0.157	0.311	-36.665	0.000	-5.244	0.000	-6.879	0.000
[-20,20]		US	-0.274	0.462	-60.348	0.000	-6.977	0.000	-8.208	0.000

Table 22 Summary Mean AR results Inflation Reduction Act by region (16 August 2022)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1806	Global	-0.006	0.085	-2.814	0.005	-2.814	0.005	-6.309	0.000
[0,2]	1806	Global	0.005	0.084	2.404	0.016	2.404	0.016	2.529	0.011
[-5,5]	6622	Global	0.004	0.090	3.456	0.001	3.456	0.001	7.342	0.000
[-10,2]	7826	Global	-0.001	0.092	-0.640	0.522	-0.640	0.522	-0.612	0.540
[-10,10]	12642	Global	0.000	0.093	0.162	0.871	0.162	0.871	4.523	0.000
[-20,20]	24682	Global	0.000	0.089	0.349	0.727	0.349	0.727	2.209	0.027
[-1,1]		Australia	-0.005	0.071	-1.068	0.286	-1.161	0.245	-3.059	0.002
[0,2]		Australia	0.000	0.073	0.010	0.992	0.011	0.991	-1.794	0.073
[-5,5]		Australia	0.005	0.072	2.068	0.039	2.274	0.023	2.371	0.018
[-10,2]		Australia	0.000	0.061	0.003	0.998	0.002	0.998	-0.655	0.512
[-10,10]		Australia	0.002	0.069	1.549	0.121	1.628	0.104	1.053	0.292
[-20,20]		Australia	0.002	0.073	1.692	0.091	1.874	0.061	0.439	0.660
[-1,1]		Canada	-0.004	0.050	-1.768	0.078	-1.282	0.200	-2.742	0.006
[0,2]		Canada	0.004	0.052	1.546	0.123	1.159	0.246	1.688	0.091
[-5,5]		Canada	0.004	0.069	2.036	0.042	2.051	0.040	3.441	0.001
[-10,2]		Canada	-0.002	0.070	-1.286	0.199	-1.316	0.188	-2.061	0.039
[-10,10]		Canada	-0.001	0.069	-0.357	0.721	-0.356	0.722	1.779	0.075
[-20,20]		Canada	-0.001	0.065	-1.409	0.159	-1.331	0.183	-0.164	0.870
[-1,1]		Europe	0.000	0.062	0.060	0.952	0.076	0.940	-1.973	0.049
[0,2]		Europe	0.003	0.062	0.958	0.339	1.202	0.230	0.532	0.595
[-5,5]		Europe	0.004	0.051	2.460	0.014	2.538	0.011	3.221	0.001
[-10,2]		Europe	0.001	0.046	0.474	0.636	0.448	0.654	0.553	0.580
[-10,10]		Europe	0.002	0.047	2.300	0.021	2.216	0.027	2.883	0.004
[-20,20]		Europe	0.001	0.049	1.282	0.200	1.270	0.204	1.921	0.055
[-1,1]		Japan	-0.007	0.027	-1.381	0.179	-1.290	0.197	-2.027	0.043
[0,2]		Japan	0.004	0.021	1.027	0.314	0.728	0.467	0.510	0.610
[-5,5]		Japan	0.005	0.032	1.562	0.122	1.710	0.087	2.245	0.025
[-10,2]		Japan	0.002	0.028	0.889	0.376	0.848	0.397	0.251	0.802
[-10,10]		Japan	0.003	0.027	1.434	0.153	1.343	0.179	1.533	0.125
[-20,20]		Japan	0.001	0.023	0.506	0.613	0.399	0.690	0.334	0.738
[-1,1]		US	-0.009	0.111	-2.284	0.023	-2.555	0.011	-3.830	0.000
[0,2]		US	-0.008	0.108	-1.933	0.054	2.106	0.035	-3.602	0.000
[-5,5]		US	-0.004	0.116	-1.659	0.097	1.933	0.053	-4.806	0.000
[-10,2]		US	-0.001	0.122	-0.350	0.726	-0.429	0.667	0.748	0.454
[-10,10]		US	-0.001	0.123	-0.823	0.411	-1.022	0.307	3.046	0.002
[-20,20]		US	0.000	0.115	-0.019	0.985	-0.022	0.983	-2.153	0.031

Table 23 Summary Mean CAR results Inflation Reduction Act by region (16 August 2022)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1806	Global	-0.018	0.122	-6.151	0.000	-2.814	0.005	-6.309	0.000
[0,2]	1806	Global	0.003	0.112	1.173	0.241	2.404	0.016	2.529	0.011
[-5,5]	6622	Global	0.014	0.179	6.183	0.000	3.456	0.001	7.342	0.000
[-10,2]	7826	Global	-0.020	0.210	-8.322	0.000	-0.640	0.522	-0.612	0.540
[-10,10]	12642	Global	-0.011	0.255	-4.725	0.000	0.162	0.871	4.523	0.000
[-20,20]	24682	Global	0.011	0.336	5.037	0.000	0.349	0.727	2.209	0.027
[-1,1]		Australia	-0.008	0.102	-1.230	0.220	-1.161	0.245	-3.059	0.002
[0,2]		Australia	0.001	0.117	0.142	0.887	0.011	0.991	-1.794	0.073
[-5,5]		Australia	0.011	0.138	2.426	0.015	2.274	0.023	2.371	0.018
[-10,2]		Australia	-0.007	0.120	-1.895	0.058	0.002	0.998	-0.655	0.512
[-10,10]		Australia	0.011	0.169	2.767	0.006	1.628	0.104	1.053	0.292
[-20,20]		Australia	0.054	0.329	10.046	0.000	1.874	0.061	0.439	0.660
[-1,1]		Canada	-0.017	0.063	-5.461	0.000	-1.282	0.200	-2.742	0.006
[0,2]		Canada	-0.000	0.071	-0.070	0.944	1.159	0.246	1.688	0.091
[-5,5]		Canada	0.011	0.117	3.826	0.000	2.051	0.040	3.441	0.001
[-10,2]		Canada	-0.036	0.131	-11.638	0.000	-1.316	0.188	-2.061	0.039
[-10,10]		Canada	-0.026	0.151	-9.231	0.000	-0.356	0.722	1.779	0.075
[-20,20]		Canada	-0.022	0.213	-7.691	0.000	-1.331	0.183	-0.164	0.870
[-1,1]		Europe	-0.003	0.091	-0.547	0.585	0.076	0.940	-1.973	0.049
[0,2]		Europe	0.004	0.116	0.702	0.483	1.202	0.230	0.532	0.595
[-5,5]		Europe	0.016	0.126	4.413	0.000	2.538	0.011	3.221	0.001
[-10,2]		Europe	-0.006	0.108	-2.201	0.028	0.448	0.654	0.553	0.580
[-10,10]		Europe	0.007	0.142	2.491	0.013	2.216	0.027	2.883	0.004
[-20,20]		Europe	0.012	0.194	4.119	0.000	1.270	0.204	1.921	0.055
[-1,1]		Japan	-0.021	0.030	-3.723	0.001	-1.290	0.197	-2.027	0.043
[0,2]		Japan	0.005	0.036	0.669	0.509	0.728	0.467	0.510	0.610
[-5,5]		Japan	0.050	0.064	7.815	0.000	1.710	0.087	2.245	0.025
[-10,2]		Japan	0.004	0.054	0.749	0.456	0.848	0.397	0.251	0.802
[-10,10]		Japan	0.016	0.063	3.563	0.001	1.343	0.179	1.533	0.125
[-20,20]		Japan	0.031	0.077	7.795	0.000	0.399	0.690	0.334	0.738
[-1,1]		US	-0.028	0.160	-4.845	0.000	-2.555	0.011	-3.830	0.000
[0,2]		US	0.005	0.129	1.081	0.280	2.106	0.035	3.602	0.000
[-5,5]		US	-0.013	0.233	-3.054	0.002	1.933	0.053	-4.806	0.000
[-10,2]		US	-0.022	0.291	-4.428	0.000	-0.429	0.667	0.748	0.454
[-10,10]		US	-0.019	0.349	-3.962	0.000	-1.022	0.307	-3.046	0.002
[-20,20]		US	-0.012	0.431	-2.749	0.006	-0.022	0.983	-2.153	0.031

Table 24 Summary Mean AR results COP 28 Dubai by region (13 December 2023)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1926	Global	0.003	0.097	1.291	0.197	1.291	0.197	-1.953	0.051
[0,2]	1926	Global	0.008	0.100	3.385	0.001	3.385	0.001	2.981	0.003
[-5,5]	7062	Global	-0.001	0.095	-0.558	0.577	-0.558	0.577	-2.806	0.005
[-10,2]	8346	Global	-0.003	0.099	-2.529	0.011	-2.529	0.011	-7.854	0.000
[-10,10]	13482	Global	-0.001	0.098	-1.171	0.242	-1.171	0.242	-3.841	0.000
[-20,20]	26322	Global	-0.000	0.092	-0.344	0.731	-0.344	0.731	-5.697	0.000
[-1,1]		Australia	-0.001	0.065	-0.194	0.846	-0.184	0.854	-2.602	0.009
[0,2]		Australia	-0.001	0.067	-0.369	0.713	-0.361	0.718	-2.527	0.011
[-5,5]		Australia	-0.003	0.062	-1.651	0.099	-1.502	0.133	-3.026	0.003
[-10,2]		Australia	-0.002	0.065	-0.906	0.365	-0.866	0.387	-2.614	0.009
[-10,10]		Australia	-0.001	0.063	-0.367	0.714	-0.339	0.735	-1.360	0.174
[-20,20]		Australia	-0.000	0.063	-0.343	0.732	-0.316	0.752	-0.544	0.586
[-1,1]		Canada	-0.000	0.076	-0.060	0.952	-0.072	0.943	-2.803	0.005
[0,2]		Canada	0.007	0.094	1.523	0.129	2.269	0.023	0.715	0.475
[-5,5]		Canada	-0.001	0.080	-0.560	0.575	-0.706	0.480	-2.877	0.004
[-10,2]		Canada	-0.004	0.083	-1.958	0.050	-2.574	0.010	-7.506	0.000
[-10,10]		Canada	-0.003	0.081	-1.818	0.069	-2.340	0.019	-7.051	0.000
[-20,20]		Canada	-0.001	0.071	-1.569	0.117	-1.764	0.078	-6.705	0.000
[-1,1]		Europe	-0.001	0.047	-0.528	0.598	-0.544	0.586	-1.671	0.095
[0,2]		Europe	0.002	0.048	0.924	0.356	0.980	0.327	1.265	0.206
[-5,5]		Europe	0.002	0.055	1.355	0.176	1.651	0.099	0.602	0.547
[-10,2]		Europe	-0.000	0.051	-0.127	0.899	-0.144	0.885	-2.438	0.015
[-10,10]		Europe	0.003	0.056	2.546	0.011	3.168	0.002	0.390	0.696
[-20,20]		Europe	0.001	0.051	1.903	0.057	2.129	0.033	-0.321	0.748
[-1,1]		Japan	-0.002	0.012	-0.849	0.404	-0.460	0.646	-1.022	0.307
[0,2]		Japan	0.001	0.014	0.396	0.695	0.252	0.801	0.152	0.879
[-5,5]		Japan	0.000	0.016	0.020	0.984	0.015	0.988	-0.188	0.851
[-10,2]		Japan	-0.002	0.013	-1.428	0.156	-0.879	0.379	-1.053	0.292
[-10,10]		Japan	0.001	0.021	0.855	0.394	0.815	0.415	0.480	0.631
[-20,20]		Japan	0.000	0.030	0.084	0.933	0.117	0.907	0.023	0.981
[-1,1]		US	0.008	0.131	1.720	0.086	2.018	0.044	2.278	0.023
[0,2]		US	0.014	0.128	3.155	0.002	3.618	0.000	5.233	0.000
[-5,5]		US	-0.001	0.125	-0.288	0.773	-0.323	0.747	-0.380	0.704
[-10,2]		US	-0.004	0.131	-1.717	0.086	-2.018	0.044	-3.174	0.002
[-10,10]		US	-0.002	0.129	-1.196	0.232	-1.378	0.168	-0.191	0.849
[-20,20]		US	-0.000	0.122	-0.149	0.881	-0.163	0.870	-3.576	0.000

Table 25 Summary Mean CAR results COP 28 Dubai by region (13 December 2023)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1926	Global	-0.005	0.124	-1.896	0.058	1.291	0.197	-1.953	0.051
[0,2]	1926	Global	0.017	0.137	5.365	0.000	3.385	0.001	2.981	0.003
[-5,5]	7062	Global	-0.013	0.183	-6.158	0.000	-0.558	0.577	-2.806	0.005
[-10,2]	8346	Global	-0.031	0.223	-12.682	0.000	-2.529	0.011	-7.854	0.000
[-10,10]	13482	Global	-0.031	0.265	-13.463	0.000	-1.171	0.242	-3.841	0.000
[-20,20]	26322	Global	-0.018	0.330	-8.872	0.000	-0.344	0.731	-5.697	0.000
[-1,1]		Australia	-0.004	0.074	-1.043	0.298	-0.184	0.854	-2.602	0.009
[0,2]		Australia	-0.006	0.082	-1.348	0.178	-0.361	0.718	-2.527	0.011
[-5,5]		Australia	-0.016	0.127	-4.263	0.000	-1.502	0.133	-3.026	0.003
[-10,2]		Australia	-0.007	0.143	-1.907	0.057	-0.866	0.387	-2.614	0.009
[-10,10]		Australia	-0.014	0.159	-4.164	0.000	-0.339	0.735	-1.360	0.174
[-20,20]		Australia	-0.016	0.198	-5.099	0.000	-0.316	0.752	-0.544	0.586
[-1,1]		Canada	-0.010	0.082	-2.542	0.011	-0.072	0.943	-2.803	0.005
[0,2]		Canada	0.007	0.107	1.432	0.153	2.269	0.023	0.715	0.475
[-5,5]		Canada	-0.014	0.147	-3.705	0.000	-0.706	0.480	-2.877	0.004
[-10,2]		Canada	-0.045	0.170	-11.617	0.000	-2.574	0.010	-7.506	0.000
[-10,10]		Canada	-0.050	0.195	-14.054	0.000	-2.340	0.019	-7.051	0.000
[-20,20]		Canada	-0.055	0.224	-18.943	0.000	-1.764	0.078	-6.705	0.000
[-1,1]		Europe	-0.009	0.065	-2.639	0.009	-0.544	0.586	-1.671	0.095
[0,2]		Europe	0.002	0.061	0.571	0.568	0.980	0.327	1.265	0.206
[-5,5]		Europe	0.001	0.110	0.428	0.668	1.651	0.099	0.602	0.547
[-10,2]		Europe	-0.004	0.145	-1.171	0.242	-0.144	0.885	-2.438	0.015
[-10,10]		Europe	0.008	0.184	2.097	0.036	3.168	0.002	0.390	0.696
[-20,20]		Europe	0.018	0.227	5.565	0.000	2.129	0.033	-0.321	0.748
[-1,1]		Japan	-0.005	0.014	-1.770	0.088	-0.460	0.646	-1.022	0.307
[0,2]		Japan	0.000	0.013	0.070	0.945	0.252	0.801	0.152	0.879
[-5,5]		Japan	-0.008	0.036	-2.104	0.038	0.015	0.988	-0.188	0.851
[-10,2]		Japan	-0.019	0.043	-4.842	0.000	-0.879	0.379	-1.053	0.292
[-10,10]		Japan	-0.012	0.056	-3.029	0.003	0.815	0.415	0.480	0.631
[-20,20]		Japan	0.002	0.080	0.490	0.624	0.117	0.907	0.023	0.981
[-1,1]		US	-0.002	0.172	-0.253	0.800	2.018	0.044	2.278	0.023
[0,2]		US	0.038	0.185	5.825	0.000	3.618	0.000	5.233	0.000
[-5,5]		US	-0.019	0.239	-4.303	0.000	-0.323	0.747	-0.380	0.704
[-10,2]		US	-0.045	0.293	-8.907	0.000	-2.018	0.044	-3.174	0.002
[-10,10]		US	-0.045	0.350	-9.533	0.000	-1.378	0.168	-0.191	0.849
[-20,20]		US	-0.016	0.442	-3.708	0.000	-0.163	0.870	-3.576	0.000

Table 26 Summary Mean AR results US Election 2024 by region (5 November 2024)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1926	Global	0.004	0.093	2.125	0.034	2.125	0.034	5.578	0.000
[0,2]	1926	Global	0.002	0.099	0.831	0.406	0.831	0.406	1.773	0.076
[-5,5]	7062	Global	0.001	0.096	0.834	0.404	0.834	0.404	0.173	0.863
[-10,2]	8346	Global	0.000	0.096	0.310	0.757	0.310	0.757	1.496	0.135
[-10,10]	13482	Global	0.000	0.097	0.010	0.992	0.010	0.992	0.149	0.881
[-20,20]	26322	Global	-0.001	0.099	-0.928	0.353	-0.928	0.353	-2.891	0.004
[-1,1]		Australia	-0.002	0.063	-0.561	0.575	-0.561	0.575	-1.803	0.071
[0,2]		Australia	-0.004	0.066	-1.108	0.269	-1.108	0.268	-1.790	0.073
[-5,5]		Australia	-0.002	0.061	-1.124	0.261	-1.124	0.261	-2.175	0.030
[-10,2]		Australia	-0.003	0.059	-1.829	0.068	-1.829	0.067	-1.749	0.080
[-10,10]		Australia	-0.002	0.062	-1.585	0.113	-1.585	0.113	-2.516	0.012
[-20,20]		Australia	-0.002	0.070	-1.549	0.121	-1.549	0.121	-3.500	0.001
[-1,1]		Canada	0.001	0.060	0.161	0.872	0.161	0.872	1.432	0.152
[0,2]		Canada	-0.001	0.076	-0.236	0.814	-0.236	0.813	-2.367	0.018
[-5,5]		Canada	0.002	0.084	0.854	0.393	0.854	0.393	-2.264	0.024
[-10,2]		Canada	-0.000	0.083	-0.093	0.926	-0.093	0.926	0.215	0.830
[-10,10]		Canada	0.000	0.081	-0.033	0.974	-0.033	0.974	-1.599	0.110
[-20,20]		Canada	-0.001	0.078	-0.559	0.576	-0.559	0.576	-4.176	0.000
[-1,1]		Europe	-0.000	0.040	-0.065	0.949	-0.065	0.949	1.809	0.070
[0,2]		Europe	-0.001	0.040	-0.520	0.603	-0.520	0.603	1.645	0.100
[-5,5]		Europe	0.002	0.055	1.400	0.162	1.400	0.161	2.778	0.005
[-10,2]		Europe	0.001	0.055	0.412	0.681	0.412	0.681	2.504	0.012
[-10,10]		Europe	-0.001	0.050	-0.591	0.555	-0.591	0.555	2.382	0.017
[-20,20]		Europe	-0.001	0.051	-0.652	0.515	-0.652	0.515	1.995	0.046
[-1,1]		Japan	-0.008	0.028	-1.489	0.148	-1.489	0.136	-0.987	0.323
[0,2]		Japan	-0.006	0.012	-2.586	0.016	-2.586	0.010	-1.378	0.168
[-5,5]		Japan	-0.008	0.027	-2.846	0.005	-2.846	0.004	-1.228	0.220
[-10,2]		Japan	-0.005	0.024	-2.376	0.019	-2.376	0.018	-0.782	0.434
[-10,10]		Japan	-0.005	0.025	-2.751	0.006	-2.751	0.006	-0.479	0.632
[-20,20]		Japan	-0.005	0.026	-3.894	0.000	-3.894	0.000	-2.089	0.037
[-1,1]		US	0.012	0.129	2.570	0.010	2.570	0.010	7.792	0.000
[0,2]		US	0.007	0.134	1.538	0.124	1.538	0.124	4.801	0.000
[-5,5]		US	0.001	0.126	0.612	0.541	0.612	0.540	1.652	0.099
[-10,2]		US	0.002	0.125	0.921	0.357	0.921	0.357	1.810	0.070
[-10,10]		US	0.001	0.129	0.758	0.448	0.758	0.448	1.457	0.145
[-20,20]		US	0.000	0.131	0.008	0.994	0.008	0.994	0.863	0.388

Table 27 Summary Mean CAR results US Election 2024 by region (5 November 2024)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1926	Global	0.005	0.115	1.960	0.050	2.125	0.034	5.578	0.000
[0,2]	1926	Global	0.008	0.125	2.703	0.007	0.831	0.406	1.773	0.076
[-5,5]	7062	Global	0.009	0.178	4.427	0.000	0.834	0.404	0.173	0.863
[-10,2]	8346	Global	-0.002	0.192	-1.007	0.314	0.310	0.757	1.496	0.135
[-10,10]	13482	Global	-0.001	0.221	-0.267	0.789	0.010	0.992	0.149	0.881
[-20,20]	26322	Global	-0.020	0.310	-10.513	0.000	-0.928	0.353	-2.891	0.004
[-1,1]		Australia	-0.007	0.082	-1.436	0.152	-0.561	0.575	-1.803	0.071
[0,2]		Australia	-0.007	0.077	-1.561	0.120	-1.108	0.268	-1.790	0.073
[-5,5]		Australia	-0.004	0.094	-1.394	0.164	-1.124	0.261	-2.175	0.030
[-10,2]		Australia	-0.024	0.120	-7.325	0.000	-1.829	0.067	-1.749	0.080
[-10,10]		Australia	-0.035	0.145	-11.098	0.000	-1.585	0.113	-2.516	0.012
[-20,20]		Australia	-0.041	0.212	-12.589	0.000	-1.549	0.121	-3.500	0.001
[-1,1]		Canada	0.003	0.079	0.864	0.388	0.161	0.872	1.432	0.152
[0,2]		Canada	-0.002	0.083	-0.495	0.621	-0.236	0.813	-2.367	0.018
[-5,5]		Canada	0.027	0.163	6.699	0.000	0.854	0.393	-2.264	0.024
[-10,2]		Canada	-0.009	0.159	-2.483	0.013	-0.093	0.926	0.215	0.830
[-10,10]		Canada	-0.008	0.184	-2.509	0.012	-0.033	0.974	-1.599	0.110
[-20,20]		Canada	-0.019	0.294	-4.891	0.000	-0.559	0.576	-4.176	0.000
[-1,1]		Europe	0.001	0.050	0.490	0.624	-0.065	0.949	1.809	0.070
[0,2]		Europe	-0.002	0.052	-0.858	0.392	-0.520	0.603	1.645	0.100
[-5,5]		Europe	0.027	0.153	6.382	0.000	1.400	0.161	2.778	0.005
[-10,2]		Europe	-0.004	0.111	-1.527	0.127	0.412	0.681	2.504	0.012
[-10,10]		Europe	-0.005	0.138	-1.712	0.087	-0.591	0.555	2.382	0.017
[-20,20]		Europe	-0.014	0.187	-5.087	0.000	-0.652	0.515	1.995	0.046
[-1,1]		Japan	-0.012	0.045	-1.427	0.166	-1.489	0.136	-0.987	0.323
[0,2]		Japan	-0.013	0.014	-4.822	0.000	-2.586	0.010	-1.378	0.168
[-5,5]		Japan	-0.053	0.097	-5.418	0.000	-2.846	0.004	-1.228	0.220
[-10,2]		Japan	-0.036	0.098	-3.934	0.000	-2.376	0.018	-0.782	0.434
[-10,10]		Japan	-0.058	0.118	-6.718	0.000	-2.751	0.006	-0.479	0.632
[-20,20]		Japan	-0.139	0.234	-11.364	0.000	-3.894	0.000	-2.089	0.037
[-1,1]		US	0.013	0.157	2.346	0.019	2.570	0.010	7.792	0.000
[0,2]		US	0.024	0.174	3.876	0.000	1.538	0.124	4.801	0.000
[-5,5]		US	-0.001	0.218	-0.285	0.776	0.612	0.540	1.652	0.099
[-10,2]		US	0.012	0.253	2.876	0.004	0.921	0.357	1.810	0.070
[-10,10]		US	0.021	0.286	5.443	0.000	0.758	0.448	1.457	0.145
[-20,20]		US	0.012	0.387	3.131	0.002	0.008	0.994	0.863	0.388

8.4 CAAR Results Fama-French 5-factor model including Carhart Momentum Factor

Table 28 Summary Mean CAR results Paris Agreement by region (12 December 2015)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1602	Global	-0.008	0.137	-2.265	0.024	-1.572	0.116	-0.016	0.987
[0,2]	1602	Global	-0.008	0.141	-2.332	0.020	-1.963	0.050	-1.842	0.066
[-5,5]	5874	Global	-0.014	0.250	-4.239	0.000	-1.354	0.176	-0.864	0.388
[-10,2]	6942	Global	-0.012	0.255	-4.047	0.000	-1.872	0.061	-1.113	0.266
[-10,10]	11214	Global	-0.016	0.339	-5.108	0.000	-0.307	0.759	1.266	0.206
[-20,20]	21894	Global	-0.021	0.472	-6.639	0.000	-0.287	0.774	1.872	0.061
[-1,1]		Australia	-0.004	0.093	-0.746	0.456	-0.511	0.610	0.226	0.821
[0,2]		Australia	-0.006	0.113	-0.869	0.386	-0.470	0.639	0.549	0.583
[-5,5]		Australia	-0.038	0.176	-6.628	0.000	-1.422	0.155	-0.168	0.867
[-10,2]		Australia	-0.033	0.176	-6.206	0.000	-1.586	0.113	-0.895	0.371
[-10,10]		Australia	-0.042	0.228	-7.854	0.000	-1.641	0.101	-0.006	0.995
[-20,20]		Australia	-0.035	0.369	-5.569	0.000	-1.257	0.209	-0.322	0.748
[-1,1]		Canada	-0.004	0.118	-0.707	0.480	-0.955	0.340	1.419	0.156
[0,2]		Canada	-0.021	0.142	-2.926	0.004	-2.331	0.020	-0.925	0.355
[-5,5]		Canada	-0.007	0.207	-1.307	0.192	-0.498	0.618	2.072	0.038
[-10,2]		Canada	0.019	0.245	3.129	0.002	-0.176	0.861	2.060	0.039
[-10,10]		Canada	0.028	0.307	4.646	0.000	1.793	0.073	5.181	0.000
[-20,20]		Canada	0.027	0.347	5.482	0.000	1.801	0.072	7.303	0.000
[-1,1]		Europe	-0.010	0.078	-2.137	0.033	-0.763	0.446	0.807	0.420
[0,2]		Europe	-0.006	0.077	-1.245	0.214	0.156	0.876	0.773	0.439
[-5,5]		Europe	-0.009	0.112	-2.545	0.011	-0.170	0.865	1.803	0.071
[-10,2]		Europe	-0.020	0.113	-6.105	0.000	-1.432	0.152	1.802	0.072
[-10,10]		Europe	-0.016	0.152	-4.799	0.000	0.466	0.641	4.344	0.000
[-20,20]		Europe	-0.005	0.213	-1.596	0.111	-0.183	0.855	4.273	0.000
[-1,1]		Japan	0.005	0.016	1.603	0.123	1.801	0.072	1.746	0.081
[0,2]		Japan	0.016	0.017	4.743	0.000	3.242	0.001	2.665	0.008
[-5,5]		Japan	-0.013	0.036	-3.504	0.001	-0.326	0.744	0.804	0.422
[-10,2]		Japan	-0.008	0.030	-2.836	0.006	0.339	0.734	1.550	0.121
[-10,10]		Japan	-0.003	0.046	-0.861	0.390	0.652	0.515	2.023	0.043
[-20,20]		Japan	0.017	0.060	5.045	0.000	-0.005	0.996	2.017	0.044
[-1,1]		US	-0.011	0.177	-1.528	0.127	-1.038	0.299	-2.094	0.036
[0,2]		US	-0.004	0.171	-0.535	0.593	-1.030	0.303	-3.544	0.000
[-5,5]		US	-0.010	0.330	-1.538	0.124	-0.845	0.398	-4.151	0.000
[-10,2]		US	-0.019	0.325	-3.194	0.001	-1.305	0.192	-4.238	0.000
[-10,10]		US	-0.032	0.439	-4.941	0.000	-0.999	0.318	-4.902	0.000
[-20,20]		US	-0.051	0.629	-7.734	0.000	-0.912	0.362	-4.932	0.000

Table 29 Summary Mean CAR results Trump withdraws from Paris Agreement by region (12 December 2015)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1617	Global	0.000	0.163	0.123	0.902	0.552	0.581	0.289	0.772
[0,2]	1617	Global	0.002	0.179	0.365	0.715	0.274	0.784	-0.767	0.443
[-5,5]	5929	Global	0.002	0.276	0.683	0.495	0.240	0.810	-0.901	0.368
[-10,2]	7007	Global	0.015	0.320	3.964	0.000	0.951	0.341	-0.784	0.433
[-10,10]	11319	Global	0.018	0.402	4.772	0.000	1.071	0.284	-1.227	0.220
[-20,20]	22099	Global	0.026	0.683	5.660	0.000	0.827	0.408	-0.520	0.603
[-1,1]		Australia	0.006	0.110	0.875	0.382	0.629	0.529	0.292	0.770
[0,2]		Australia	-0.007	0.090	-1.172	0.242	-0.964	0.335	-1.178	0.239
[-5,5]		Australia	-0.005	0.213	-0.676	0.499	-0.630	0.529	-0.426	0.670
[-10,2]		Australia	0.020	0.252	2.637	0.008	0.648	0.517	1.172	0.241
[-10,10]		Australia	0.007	0.305	0.939	0.348	-1.365	0.172	-0.996	0.319
[-20,20]		Australia	-0.065	0.531	-7.227	0.000	-2.923	0.003	-3.218	0.001
[-1,1]		Canada	-0.005	0.112	-0.791	0.430	0.109	0.914	-0.867	0.386
[0,2]		Canada	-0.006	0.111	-1.028	0.305	-0.162	0.871	-0.830	0.407
[-5,5]		Canada	-0.009	0.244	-1.399	0.162	0.329	0.742	0.482	0.630
[-10,2]		Canada	-0.007	0.230	-1.215	0.224	-0.674	0.500	-0.949	0.343
[-10,10]		Canada	-0.007	0.298	-1.180	0.238	-0.213	0.831	-0.483	0.629
[-20,20]		Canada	0.028	0.549	3.727	0.000	1.273	0.203	2.312	0.021
[-1,1]		Europe	0.001	0.050	0.347	0.729	0.723	0.470	-0.032	0.974
[0,2]		Europe	0.002	0.051	0.828	0.408	0.307	0.759	-0.309	0.757
[-5,5]		Europe	-0.008	0.105	-2.618	0.009	-0.871	0.384	-0.484	0.629
[-10,2]		Europe	-0.006	0.107	-1.987	0.047	-0.700	0.484	-1.504	0.133
[-10,10]		Europe	-0.006	0.149	-1.904	0.057	0.417	0.676	-0.401	0.689
[-20,20]		Europe	-0.008	0.301	-1.746	0.081	-1.060	0.289	-0.040	0.968
[-1,1]		Japan	-0.003	0.012	-1.051	0.304	-0.837	0.403	-0.622	0.534
[0,2]		Japan	-0.008	0.014	-2.794	0.010	-1.713	0.087	-1.080	0.280
[-5,5]		Japan	-0.011	0.023	-4.446	0.000	-1.726	0.084	-1.036	0.300
[-10,2]		Japan	0.009	0.019	4.815	0.000	0.027	0.979	0.465	0.642
[-10,10]		Japan	0.003	0.032	1.276	0.204	0.541	0.589	0.795	0.426
[-20,20]		Japan	-0.003	0.074	-0.700	0.484	0.456	0.649	0.673	0.501
[-1,1]		US	0.001	0.227	0.130	0.897	0.306	0.759	1.076	0.282
[0,2]		US	0.009	0.258	0.903	0.367	0.580	0.562	0.476	0.634
[-5,5]		US	0.017	0.357	2.347	0.019	0.471	0.638	-1.259	0.208
[-10,2]		US	0.035	0.434	4.379	0.000	1.238	0.216	-0.599	0.549
[-10,10]		US	0.048	0.542	5.999	0.000	1.594	0.111	-1.462	0.144
[-20,20]		US	0.075	0.898	8.024	0.000	1.456	0.145	-1.160	0.246

Table 30 Summary Mean CAR US Election 2020 by region (3 November 2020)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1776	Global	-0.006	0.167	-1.503	0.133	-1.374	0.169	-5.069	0.000
[0,2]	1776	Global	-0.008	0.164	-2.176	0.030	-1.850	0.064	-3.309	0.001
[-5,5]	6512	Global	-0.036	0.217	-13.533	0.000	-2.919	0.004	-3.639	0.000
[-10,2]	7696	Global	-0.031	0.222	-12.244	0.000	-3.729	0.000	-6.491	0.000
[-10,10]	12432	Global	-0.042	0.265	-17.641	0.000	-2.309	0.021	-2.541	0.011
[-20,20]	24272	Global	-0.026	0.370	-10.747	0.000	-1.085	0.278	-1.038	0.299
[-1,1]		Australia	-0.018	0.101	-2.873	0.004	-0.974	0.330	-1.558	0.119
[0,2]		Australia	0.005	0.113	0.678	0.499	0.392	0.695	0.020	0.984
[-5,5]		Australia	-0.004	0.153	-0.874	0.382	0.776	0.438	1.903	0.057
[-10,2]		Australia	-0.032	0.145	-7.436	0.000	-1.639	0.101	-0.509	0.611
[-10,10]		Australia	-0.029	0.185	-6.740	0.000	-0.692	0.489	0.947	0.344
[-20,20]		Australia	0.001	0.264	0.314	0.753	-0.094	0.925	1.794	0.073
[-1,1]		Canada	-0.007	0.074	-1.872	0.062	-1.471	0.141	-0.888	0.374
[0,2]		Canada	-0.009	0.087	-2.105	0.036	-1.142	0.254	-0.210	0.833
[-5,5]		Canada	-0.032	0.121	-10.108	0.000	-1.126	0.260	0.765	0.444
[-10,2]		Canada	-0.038	0.108	-14.692	0.000	-3.286	0.001	-0.924	0.355
[-10,10]		Canada	-0.038	0.147	-13.698	0.000	-0.936	0.349	2.550	0.011
[-20,20]		Canada	0.018	0.272	4.943	0.000	1.160	0.246	6.047	0.000
[-1,1]		Europe	-0.011	0.067	-2.846	0.005	-1.369	0.171	-2.386	0.017
[0,2]		Europe	0.001	0.073	0.228	0.820	-0.261	0.794	-0.246	0.806
[-5,5]		Europe	-0.017	0.112	-5.322	0.000	-1.249	0.212	0.058	0.954
[-10,2]		Europe	-0.022	0.109	-7.708	0.000	-2.150	0.032	-0.209	0.835
[-10,10]		Europe	-0.030	0.140	-10.100	0.000	-2.535	0.011	-0.035	0.972
[-20,20]		Europe	-0.030	0.215	-9.395	0.000	-2.559	0.010	1.315	0.189
[-1,1]		Japan	0.003	0.027	0.562	0.579	0.174	0.862	0.969	0.333
[0,2]		Japan	-0.001	0.021	-0.167	0.869	-0.291	0.771	0.498	0.618
[-5,5]		Japan	0.002	0.051	0.483	0.630	1.134	0.257	2.417	0.016
[-10,2]		Japan	0.000	0.049	-0.076	0.939	-0.273	0.785	1.316	0.188
[-10,10]		Japan	0.011	0.059	2.529	0.012	0.767	0.443	2.571	0.010
[-20,20]		Japan	-0.010	0.076	-2.467	0.014	-0.065	0.948	2.842	0.004
[-1,1]		US	0.000	0.240	0.054	0.957	-0.442	0.659	-4.908	0.000
[0,2]		US	-0.017	0.230	-2.054	0.040	-1.798	0.072	-4.930	0.000
[-5,5]		US	-0.060	0.297	-10.596	0.000	-2.907	0.004	-7.950	0.000
[-10,2]		US	-0.032	0.312	-5.818	0.000	-2.213	0.027	-9.499	0.000
[-10,10]		US	-0.056	0.365	-11.135	0.000	-1.569	0.117	-6.983	0.000
[-20,20]		US	-0.057	0.486	-11.917	0.000	-0.993	0.321	-8.415	0.000

Table 31 Summary Mean CAR Biden Rejoins Paris Agreement by region (20 January 2021)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1785	Global	0.026	0.193	5.690	0.000	3.470	0.001	3.723	0.000
[0,2]	1785	Global	0.023	0.210	4.582	0.000	3.203	0.001	2.428	0.015
[-5,5]	6545	Global	0.059	0.311	15.417	0.000	6.050	0.000	5.606	0.000
[-10,2]	7735	Global	0.059	0.312	16.616	0.000	5.822	0.000	6.838	0.000
[-10,10]	12495	Global	0.101	0.405	27.809	0.000	7.353	0.000	8.386	0.000
[-20,20]	24395	Global	0.199	0.591	52.657	0.000	12.104	0.000	12.744	0.000
[-1,1]		Australia	0.004	0.116	0.514	0.608	0.749	0.454	0.152	0.880
[0,2]		Australia	0.017	0.119	2.331	0.020	0.970	0.332	0.823	0.410
[-5,5]		Australia	0.042	0.200	6.651	0.000	1.751	0.080	1.702	0.089
[-10,2]		Australia	0.060	0.184	11.147	0.000	2.638	0.008	3.507	0.000
[-10,10]		Australia	0.077	0.252	13.255	0.000	2.307	0.021	2.824	0.005
[-20,20]		Australia	0.092	0.382	14.565	0.000	2.517	0.012	3.403	0.001
[-1,1]		Canada	0.006	0.114	1.046	0.296	-0.033	0.974	1.150	0.250
[0,2]		Canada	-0.007	0.092	-1.633	0.103	-0.470	0.639	-0.394	0.694
[-5,5]		Canada	0.020	0.147	5.268	0.000	1.123	0.262	2.385	0.017
[-10,2]		Canada	0.037	0.229	6.743	0.000	2.067	0.039	4.125	0.000
[-10,10]		Canada	0.047	0.293	8.560	0.000	2.876	0.004	5.267	0.000
[-20,20]		Canada	0.106	0.404	19.563	0.000	5.000	0.000	9.198	0.000
[-1,1]		Europe	0.002	0.079	0.559	0.576	0.731	0.465	2.386	0.017
[0,2]		Europe	0.008	0.084	1.803	0.072	1.709	0.087	2.350	0.019
[-5,5]		Europe	0.021	0.134	5.516	0.000	2.238	0.025	5.157	0.000
[-10,2]		Europe	0.039	0.154	9.468	0.000	3.374	0.001	7.754	0.000
[-10,10]		Europe	0.055	0.187	14.162	0.000	4.256	0.000	9.356	0.000
[-20,20]		Europe	0.100	0.255	26.284	0.000	6.316	0.000	12.951	0.000
[-1,1]		Japan	-0.003	0.040	-0.450	0.657	-0.648	0.517	0.944	0.345
[0,2]		Japan	-0.009	0.053	-0.867	0.394	-0.728	0.467	0.813	0.416
[-5,5]		Japan	0.017	0.065	2.677	0.009	0.540	0.589	2.341	0.019
[-10,2]		Japan	0.037	0.072	5.568	0.000	1.249	0.212	3.226	0.001
[-10,10]		Japan	0.041	0.095	5.998	0.000	1.765	0.078	3.712	0.000
[-20,20]		Japan	0.033	0.120	5.341	0.000	1.445	0.148	4.586	0.000
[-1,1]		US	0.056	0.268	5.738	0.000	3.487	0.000	3.100	0.002
[0,2]		US	0.048	0.300	4.438	0.000	3.076	0.002	1.869	0.062
[-5,5]		US	0.104	0.437	12.551	0.000	5.373	0.000	2.371	0.018
[-10,2]		US	0.080	0.423	10.843	0.000	4.412	0.000	0.228	0.820
[-10,10]		US	0.160	0.546	21.338	0.000	5.781	0.000	1.530	0.126
[-20,20]		US	0.337	0.790	43.278	0.000	9.987	0.000	4.360	0.000

Table 32 Table 7 Summary Mean CAR EU Fit For 55 by region (14 July 2021)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1785	Global	-0.027	0.160	-7.251	0.000	-5.394	0.000	-3.790	0.000
[0,2]	1785	Global	-0.034	0.153	-9.320	0.000	-5.042	0.000	-5.745	0.000
[-5,5]	6545	Global	-0.065	0.242	-21.779	0.000	-7.538	0.000	-8.389	0.000
[-10,2]	7735	Global	-0.029	0.267	-9.472	0.000	-5.363	0.000	-3.762	0.000
[-10,10]	12495	Global	-0.069	0.347	-22.222	0.000	-7.775	0.000	-7.879	0.000
[-20,20]	24395	Global	-0.152	0.517	-45.874	0.000	-9.718	0.000	-9.527	0.000
[-1,1]		Australia	-0.008	0.071	-1.761	0.079	-0.878	0.380	1.339	0.181
[0,2]		Australia	-0.011	0.083	-2.186	0.030	-0.522	0.602	-0.013	0.989
[-5,5]		Australia	-0.025	0.131	-5.990	0.000	-1.719	0.086	-1.478	0.139
[-10,2]		Australia	0.030	0.167	6.127	0.000	0.755	0.450	3.624	0.000
[-10,10]		Australia	0.013	0.210	2.782	0.005	-0.830	0.407	1.798	0.072
[-20,20]		Australia	-0.087	0.310	-17.010	0.000	-2.088	0.037	1.921	0.055
[-1,1]		Canada	-0.001	0.112	-0.167	0.868	-0.667	0.505	1.036	0.300
[0,2]		Canada	-0.018	0.125	-2.924	0.004	-2.154	0.031	-1.836	0.066
[-5,5]		Canada	-0.044	0.167	-10.140	0.000	-3.289	0.001	-2.297	0.022
[-10,2]		Canada	-0.013	0.222	-2.504	0.012	-2.038	0.042	-0.332	0.740
[-10,10]		Canada	-0.039	0.261	-7.972	0.000	-3.039	0.002	-1.709	0.087
[-20,20]		Canada	-0.080	0.330	-18.025	0.000	-4.613	0.000	-1.885	0.059
[-1,1]		Europe	-0.008	0.052	-2.733	0.007	-2.849	0.004	1.171	0.242
[0,2]		Europe	-0.014	0.062	-3.934	0.000	-1.753	0.080	-0.117	0.907
[-5,5]		Europe	-0.016	0.146	-3.697	0.000	-1.082	0.279	1.260	0.208
[-10,2]		Europe	-0.008	0.141	-2.165	0.031	-1.268	0.205	3.217	0.001
[-10,10]		Europe	-0.014	0.249	-2.647	0.008	-1.222	0.222	3.250	0.001
[-20,20]		Europe	-0.040	0.340	-7.913	0.000	-2.103	0.035	5.170	0.000
[-1,1]		Japan	-0.034	0.062	-2.907	0.007	-2.100	0.036	-1.164	0.244
[0,2]		Japan	-0.018	0.029	-3.236	0.003	-0.873	0.382	-0.770	0.441
[-5,5]		Japan	-0.029	0.078	-3.716	0.000	-1.294	0.196	-1.452	0.147
[-10,2]		Japan	-0.014	0.055	-2.825	0.006	-0.538	0.590	0.178	0.859
[-10,10]		Japan	-0.039	0.072	-7.465	0.000	-1.661	0.097	-0.471	0.638
[-20,20]		Japan	-0.072	0.106	-13.056	0.000	-2.693	0.007	0.257	0.798
[-1,1]		US	-0.057	0.222	-7.070	0.000	-5.038	0.000	-7.987	0.000
[0,2]		US	-0.059	0.203	-8.022	0.000	-4.354	0.000	-7.342	0.000
[-5,5]		US	-0.114	0.322	-18.576	0.000	-6.501	0.000	-11.314	0.000
[-10,2]		US	-0.068	0.347	-11.139	0.000	-5.246	0.000	-10.006	0.000
[-10,10]		US	-0.140	0.442	-22.920	0.000	-7.070	0.000	-14.641	0.000
[-20,20]		US	-0.265	0.682	-39.434	0.000	-8.068	0.000	-19.304	0.000

Table 33 Summary Mean CAR COP26 Glasgow by region (13 November 2021)

Window	N	Region	Mean	Sd.	t-statistic	p-value	Patell-stat	Patell-p	Corrado-stat	Corrado-p
[-1,1]	1785	Global	-0.010	0.135	-3.007	0.003	-2.225	0.026	-3.068	0.002
[0,2]	1785	Global	-0.013	0.145	-3.923	0.000	-3.451	0.001	-4.322	0.000
[-5,5]	6545	Global	-0.035	0.368	-7.761	0.000	-5.420	0.000	-7.557	0.000
[-10,2]	7735	Global	-0.056	0.408	-12.144	0.000	-5.945	0.000	-7.529	0.000
[-10,10]	12495	Global	-0.083	0.600	-15.547	0.000	-6.773	0.000	-7.875	0.000
[-20,20]	24395	Global	-0.135	1.078	-19.501	0.000	-7.233	0.000	-7.494	0.000
[-1,1]		Australia	0.005	0.105	0.794	0.428	-0.008	0.994	-2.127	0.033
[0,2]		Australia	-0.007	0.096	-1.265	0.207	-1.630	0.103	-3.524	0.000
[-5,5]		Australia	-0.027	0.273	-3.063	0.002	-2.111	0.035	-4.420	0.000
[-10,2]		Australia	-0.070	0.281	-8.549	0.000	-3.886	0.000	-6.062	0.000
[-10,10]		Australia	-0.090	0.444	-8.804	0.000	-3.554	0.000	-7.086	0.000
[-20,20]		Australia	-0.139	0.794	-10.666	0.000	-4.403	0.000	-7.193	0.000
[-1,1]		Canada	-0.015	0.101	-3.015	0.003	-1.420	0.156	-3.206	0.001
[0,2]		Canada	-0.007	0.111	-1.280	0.201	-1.649	0.099	-2.612	0.009
[-5,5]		Canada	-0.034	0.312	-4.169	0.000	-3.973	0.000	-6.562	0.000
[-10,2]		Canada	-0.018	0.336	-2.240	0.025	-1.896	0.058	-5.404	0.000
[-10,10]		Canada	-0.059	0.494	-6.321	0.000	-5.124	0.000	-8.175	0.000
[-20,20]		Canada	-0.151	0.789	-14.249	0.000	-7.227	0.000	-10.598	0.000
[-1,1]		Europe	0.001	0.070	0.251	0.802	-0.108	0.914	-0.005	0.996
[0,2]		Europe	-0.004	0.058	-1.320	0.188	-1.195	0.232	-0.449	0.653
[-5,5]		Europe	-0.001	0.151	-0.288	0.773	-1.241	0.214	-0.947	0.344
[-10,2]		Europe	-0.011	0.182	-2.311	0.021	-1.148	0.251	-0.275	0.783
[-10,10]		Europe	-0.022	0.250	-4.266	0.000	-3.353	0.001	-1.832	0.067
[-20,20]		Europe	-0.027	0.445	-4.037	0.000	-2.304	0.021	-2.157	0.031
[-1,1]		Japan	0.005	0.041	0.610	0.547	1.140	0.254	1.297	0.194
[0,2]		Japan	0.025	0.031	4.131	0.000	2.912	0.004	2.293	0.022
[-5,5]		Japan	0.026	0.103	2.453	0.016	0.499	0.618	1.616	0.106
[-10,2]		Japan	-0.012	0.184	-0.707	0.481	0.100	0.920	2.201	0.028
[-10,10]		Japan	-0.019	0.240	-1.095	0.275	-1.262	0.207	0.501	0.617
[-20,20]		Japan	-0.047	0.376	-2.381	0.018	-1.444	0.149	-0.385	0.700
[-1,1]		US	-0.017	0.177	-2.641	0.008	-2.008	0.045	-1.618	0.106
[0,2]		US	-0.024	0.194	-3.441	0.001	-2.637	0.008	-3.148	0.002
[-5,5]		US	-0.056	0.480	-6.166	0.000	-3.615	0.000	-6.173	0.000
[-10,2]		US	-0.093	0.535	-9.968	0.000	-4.629	0.000	-6.892	0.000
[-10,10]		US	-0.123	0.785	-11.416	0.000	-3.684	0.000	-5.338	0.000
[-20,20]		US	-0.174	1.445	-12.215	0.000	-3.296	0.001	-5.560	0.000

Fama French 5 Factor Model

The market risk premium (CAPM)
The market risk premium implies the extra return you receive by investing in the market over the risk-free rate. Firms that are more vulnerable to systematic shocks are considered riskier, therefore they should earn higher returns (Sharpe, 1964). The market risk premium is calculated by taking the market return and subtracting it by the risk-free rate.

The size factor (SMB)
The size factor, or 'small minus big' factor, controls for the fact that in the long-run smaller firms tend to outperform larger firms. The intuition behind the size factor lies in the fact that historically seen stocks with a smaller market capitalization outperform stocks with higher market capitalizations (Banz, 1981; Fama & French, 1993). Integrating the size effect into our regression model will correct for the differences in size affecting the abnormal returns of oil and gas companies.

The value factor (HML)
The value factor, also called 'highminus low' factor, refers to the fact that in the long-run high book-to-market value stocks (value stocks) acquire higher average returns than low-book stocks (growth stocks) (Fama & French, 1993). Value stocks are often companies that are either undervalued relative to their fundamentals or companies that are in financial distress. These companies are perceived as riskier; investors demand a higher compensation for holding these stocks. On the contrary, growth stocks are companies with bright future expectations, which can be overvalued. These stocks are perceived as less risky; investors do not demand a higher return for holding them. Moreover, this effect could be enhanced by the overreaction of investors to good news about growth stocks, while at the same time underreacting to good news about value stocks (Lakonishok et al., 1994). The majority of the oil and gas firms can also be categorized as value stocks. Therefore, by including the HML factor into our regression model we can control for the so called 'value risk premium' and guarantee that abnormal returns are purely driven by the climate policy event.

The profitability factor (RMW)
The probability factor, also called the robust minus weak' factor, captures the tendency of firms with high operating profitability ('robust') to outperform those with low profitability ('weak'). Operating profitability is calculated by taking the operating profits and dividing it by the book equity. It resembles a quality premium, indicating that more profitable firms earn higher returns in the long-run. Investors demand a higher return for holding stocks with low profitability in their portfolio, because these companies are more susceptible to economic shocks and economic downturns. High-profitable companies on the contrary can more easily absorb these shocks and reinvest in long-term growth. Another explanation for this premium concerns the fact that investors underreact to strong fundamentals of firms such as operating profitability and are more focused on firms with future growth prospects or investment trends. This can result in the underpricing of stocks with high profitability. Consequently, high excess returns can be achieved when the markets correct for this. Currently, highly profitable oil and gas companies are often neglected in investment portfolios due to a shift in investor preferences to ESG investing and growth tech. This underinvestment in oil and gas stocks can lead to excess returns in case you do invest in these

stocks. The RMW factor incorporates and adjusts for this premium when calculating the abnormal returns.

The investment factor (CMA)
The CMA factor, also called 'conservative minus aggressive' factor, captures the phenomenon that firms who invest conservatively outperform those who invest aggressively. Firms that implement a conservative investment strategy are the firms which have slower asset growth, meaning they rely on organic growth and stable reinvestments. On the contrary, firms with a more aggressive investment strategy are the firms with higher assets growth, such as firms engaging in M&A's or firms with higher capital spending. This CMA premium is driven by several factors. First of all, it can be explained by the risk associated with overinvestment. According to real options theory, firms are encouraged in times of uncertainty to delay their investments in order avoid capital misallocation and lower future returns (Dixit and Pindyck, 1994; McDonald and Siegel, 1986). Firms with an aggressive investment strategy do invest heavily even in times of uncertainty, thereby possibly stepping into investment projects which may not yield adequate returns. This is particularly relevant for firms in the oil and gas industry, as the economical viability of investments is highly reliant on the change in climate policy and technological innovation. Secondly, overconfident managers of firms might overestimate the growth potential of firms and neglecting negative signals, due to their strong belief in the success of their strategic decisions. This can result into excessive capital expenditure, suboptimal project selection and eventually lead to underperformance. Furthermore, firms with an aggressive investment strategy exhibit decreasing marginal returns over time, indicating a mean reversion in asset growth. By incorporating the CMA factor into our regression model, we are able to control for investment aggressiveness. This means we can examine variations in returns by separating the transition risk at firm-level from capital investment behavior. This is essential for a capital-intensive industry such as the oil and gas industry. In this way the cumulative abnormal returns can be estimated more precisely.

The Momentum factor (MOM)
The Carhart momentum factor resembles the empirical observation that stocks which have performed well in the last 6 to 12 months keep performing well in the next 3 to 12 months and stocks which performed poorly in the last 6 to 12 months keep performing poorly in the next 3 to 12 months. By implementing a momentum strategy in your portfolio, significant abnormal returns can be generated (Jagadeesh & Titman, 1993). This is the so-called momentum effect and can be explained by several factors. First of all, investors underreact or overreact to new information due to herding behavior and delayed reaction to fundamental news. Moreover, markets do not directly incorporate all available information and adjust gradually, in particular for firms in complex or politically sensitive sectors such as the oil and gas industry. The momentum theory contradicts the EMH theory, which states that all publicly available information is already incorporated in stock prices. You should not be able to predict future returns by using historical returns. The momentum factor is calculated by taking the returns of stocks with high performance and subtracting it by returns of stocks with low past performance. Incorporating the momentum factor in the regression model when calculating the abnormal returns during climate policy events is highly relevant, as climate policy events can align with momentum trends. For example, when there is a recent declining trend in the stock returns of oil and gas assets due to increasing ESG regulations and pressure, momentum could enhance the (negative) impact of a new climate policy shock. By controlling for momentum, we are able to separate momentum effects from pure climate policy event effects.

8.5 BHAR Results

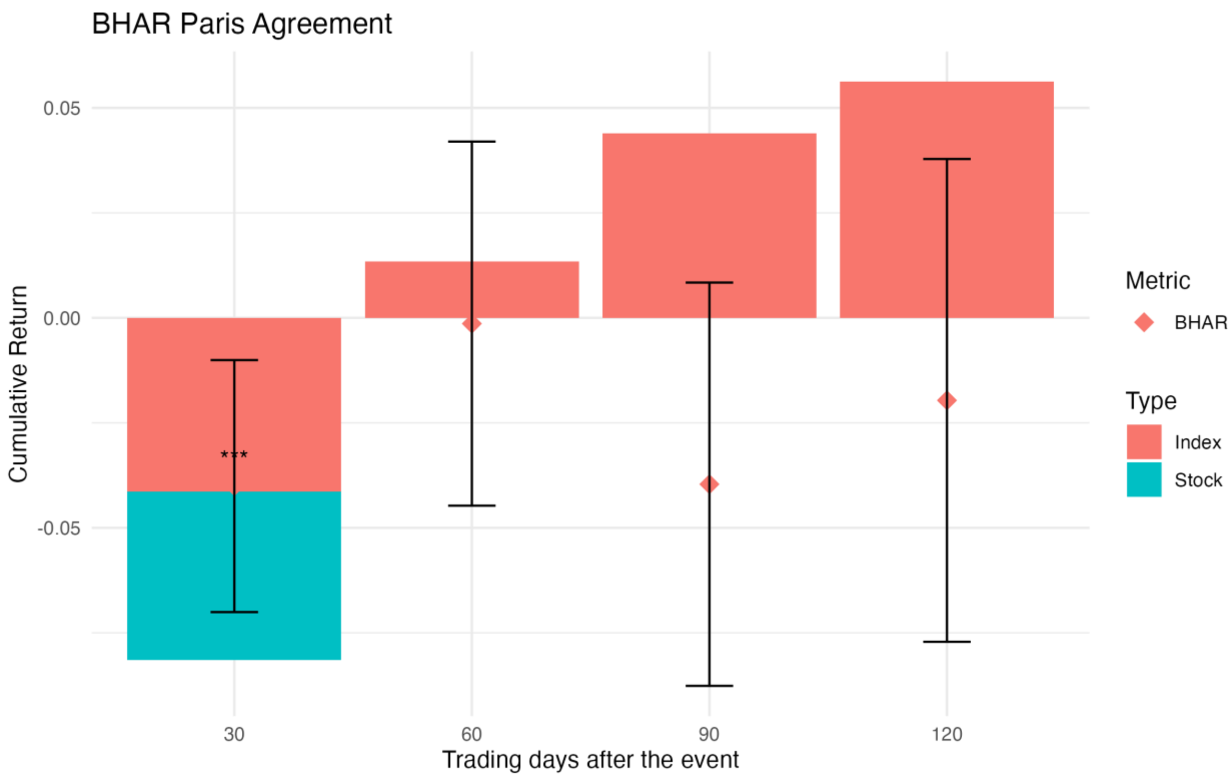


Figure 10

Table 34 BHAR results Paris Agreement

t	*N*	*Cum R*	*Cum IR*	*BHAR*	*Sd.*
30	*543*	*-0.081*	*-0.041****	*-0.0401*	*0.356*
60	*543*	*0.012*	*0.013*	*-0.001*	*0.511*
90	*543*	*0.004*	*0.044*	*-0.040*	*0.566*
120	*543*	*0.037*	*0.056*	*-0.020*	*0.678*

*Significance indicators: *** p < 0.01, ** p < 0.05, * p < 0.1*

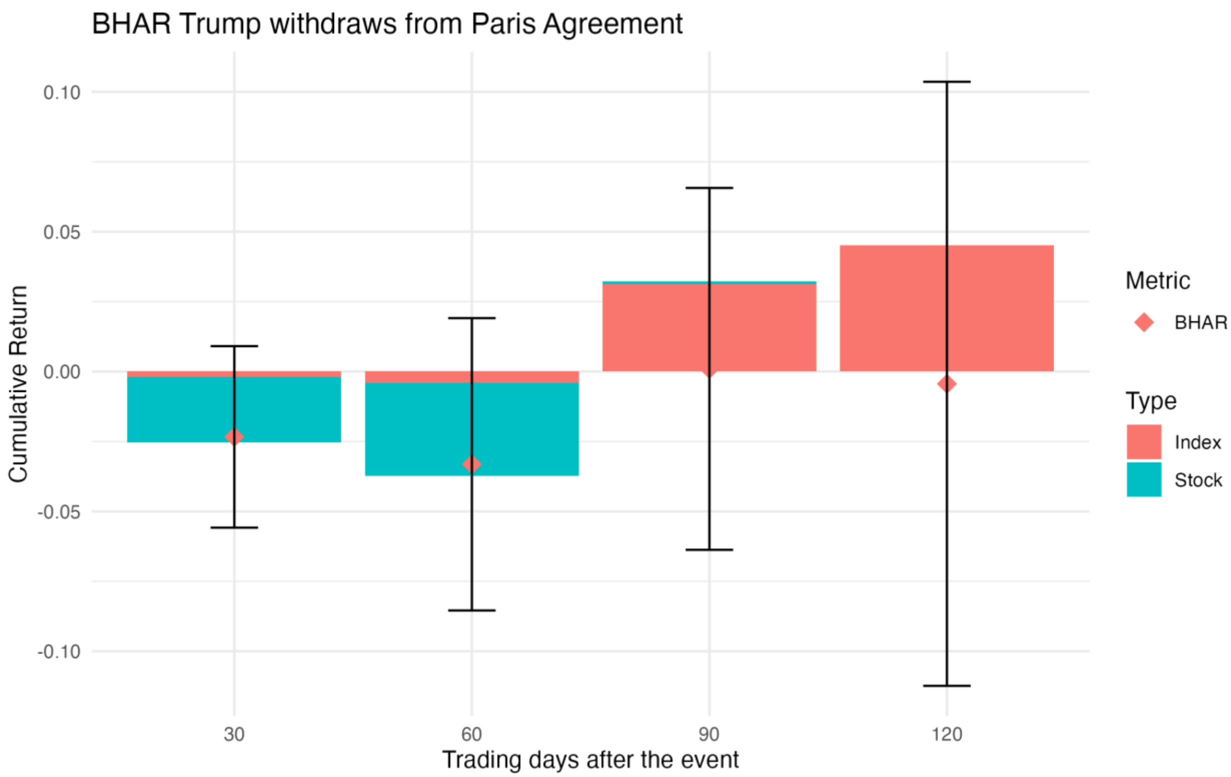


Figure 11

Table 35 BHAR results Trump Withdraws from Agreement

t	*N*	*Cum R*	*Cum IR*	*BHAR*	*Sd.*
30	*557*	*-0.025*	*-0.002*	*-0.023*	*0.391*
60	*557*	*-0.037*	*-0.004*	*-0.033*	*0.629*
90	*557*	*0.032*	*0.031*	*0.001*	*0.779*
120	*557*	*0.041*	*0.045*	*-0.004*	*1.300*

*Significance indicators: *** p < 0.01, ** p < 0.05, * p < 0.1*

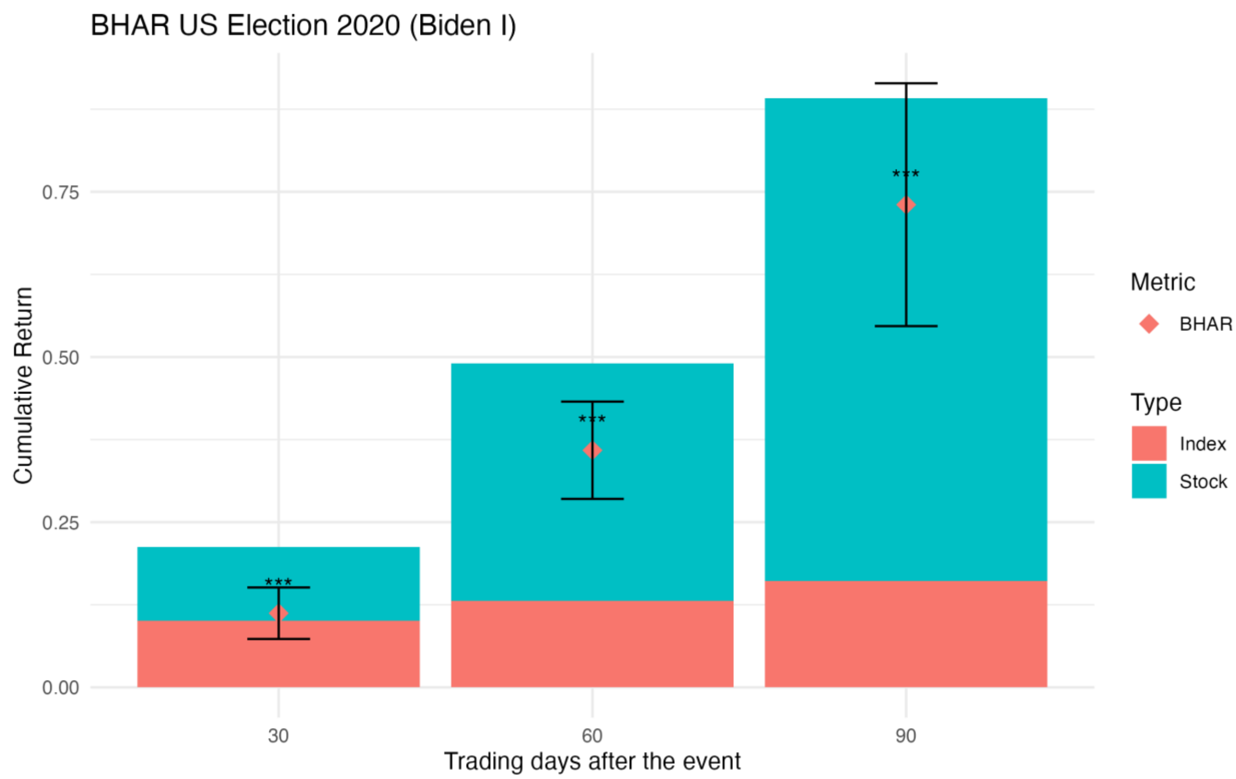


Figure 12

Table 36 BHAR results US Election 2020 (Biden I)

t	*N*	*Cum R*	*Cum IR*	*BHAR*	*Sd.*
30	*595*	*0.212*	*0.101*	*0.112****	*0.842*
60	*595*	*0.490*	*0.131*	*0.359 ****	*0.991*
90	*595*	*0.243*	*0.161*	*0.730****	*2.287*

*Significance indicators: *** p < 0.01, ** p < 0.05, * p < 0.1*

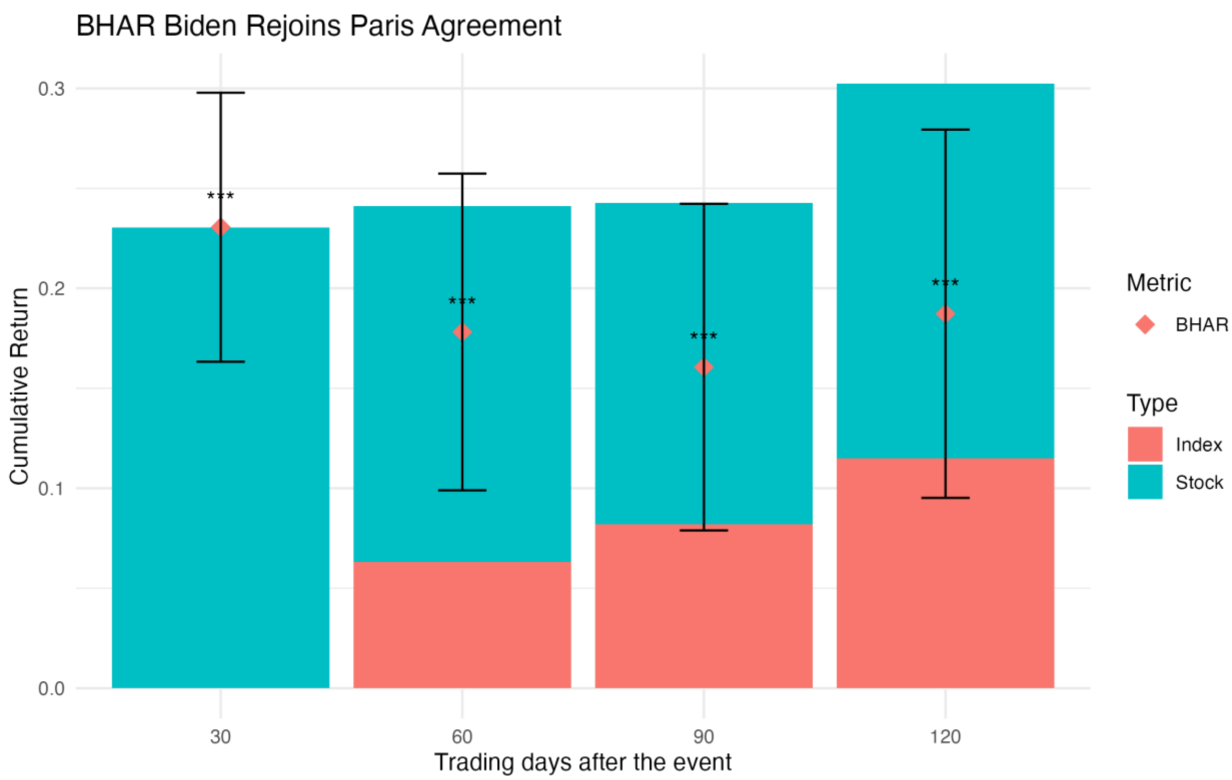
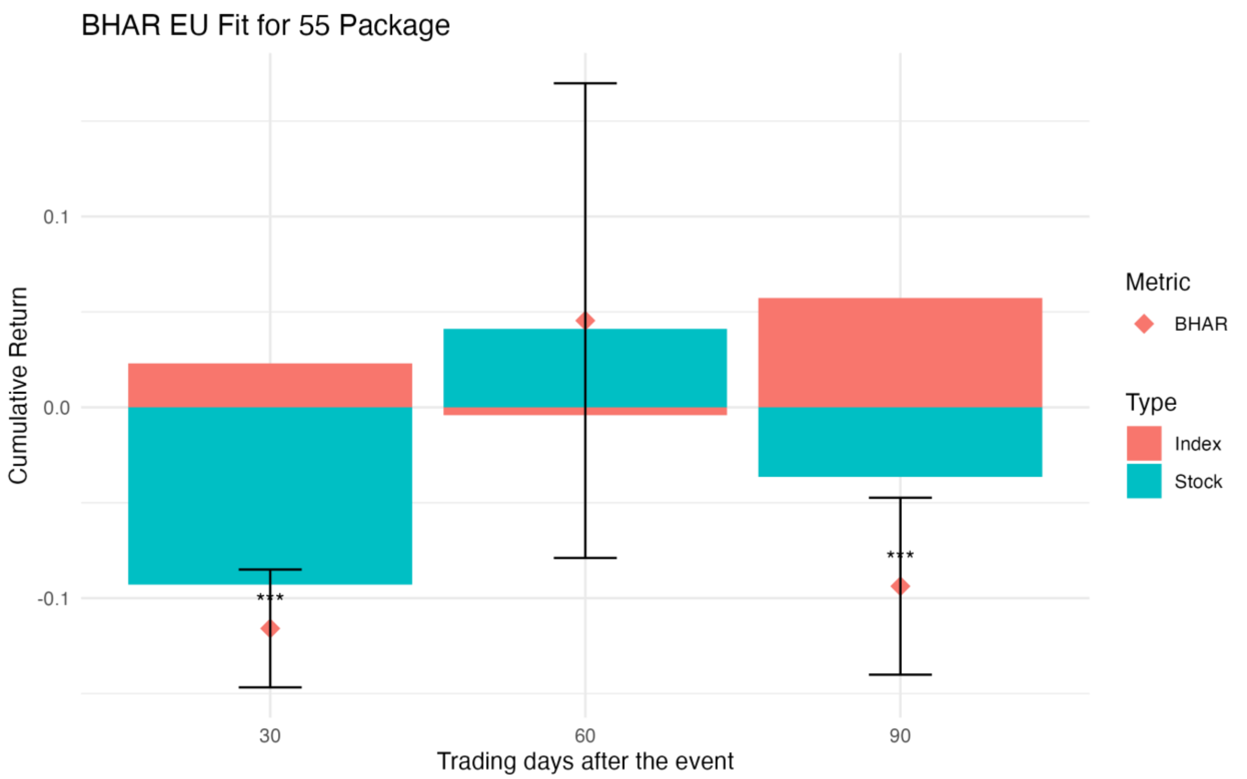


Figure 13

Table 37 BHAR results Biden rejoins Paris Agreement

t	*N*	*Cum R*	*Cum IR*	*BHAR*	*Sd.*
30	*602*	*0.231*	*0.000*	*0.231****	*0.842*
60	*602*	*0.241*	*0.063*	*0.178****	*0.991*
90	*602*	*0.243*	*0.080*	*0.161****	*1.022*
120	*602*	*0.302*	*0.115*	*0.187****	*1.153*

*Significance indicators: *** p < 0.01, ** p < 0.05, * p < 0.1*



Figuur 14

Table 38 Results BHAR EU fit for 55

t	*N*	*Cum R*	*Cum IR*	*BHAR*	*Sd.*
30	*602*	*-0.093*	*0.023*	*-0.116****	*0.386*
60	*602*	*0.041*	*-0.004*	*0.045*	*1.587*
90	*602*	*-0.037*	*0.057*	*-0.095****	*0.580*

*Significance indicators: *** p < 0.01, ** p < 0.05, * p < 0.1*

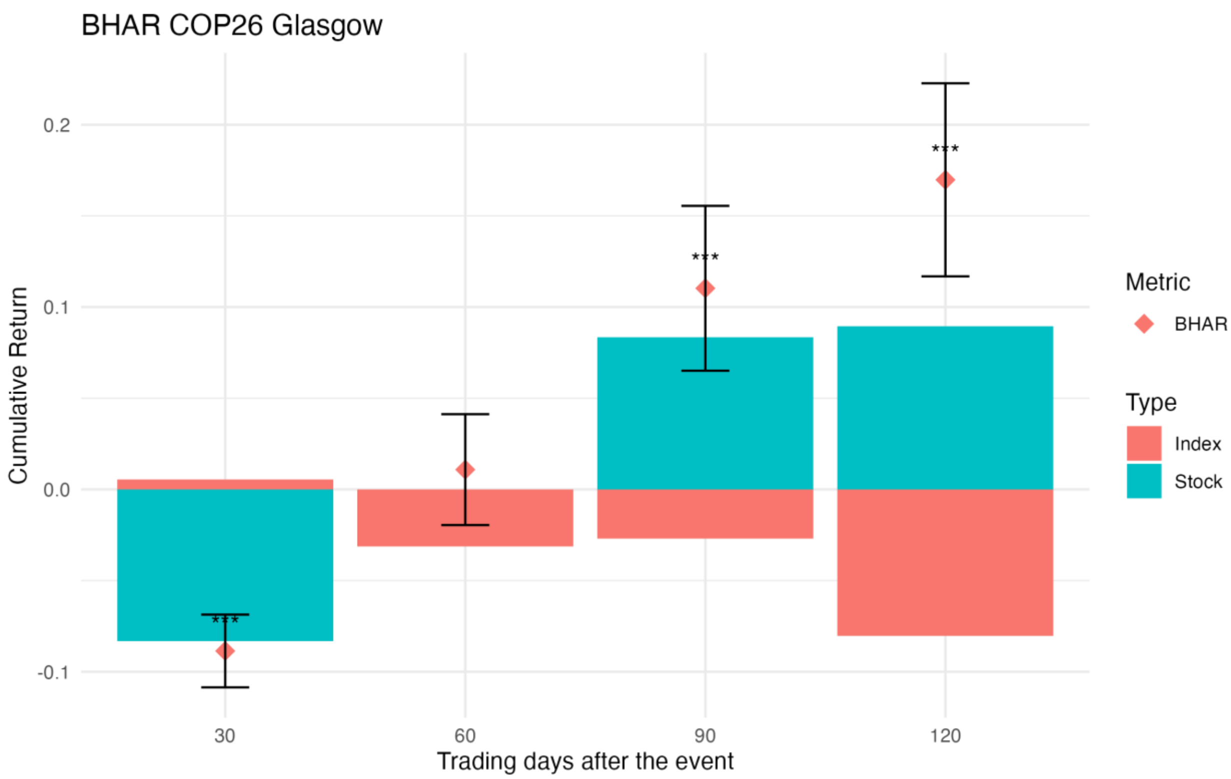


Figure 15

Table 39 BHAR COP26 Glasgow

t	*N*	*Cum R*	*Cum IR*	*BHAR*	*Sd.*
30	*602*	*-.0832*	*0.006*	*-0.089******	*0.250*
60	*602*	*-0.026*	*-0.025*	*-0.001*	*0.393*
90	*602*	*0.087*	*-0.024*	*0.111******	*0.559*
120	*602*	*0.105*	*-0.081*	*0.185******	*0.665*

*Significance indicators: *** p < 0.01, ** p < 0.05, * p < 0.1*

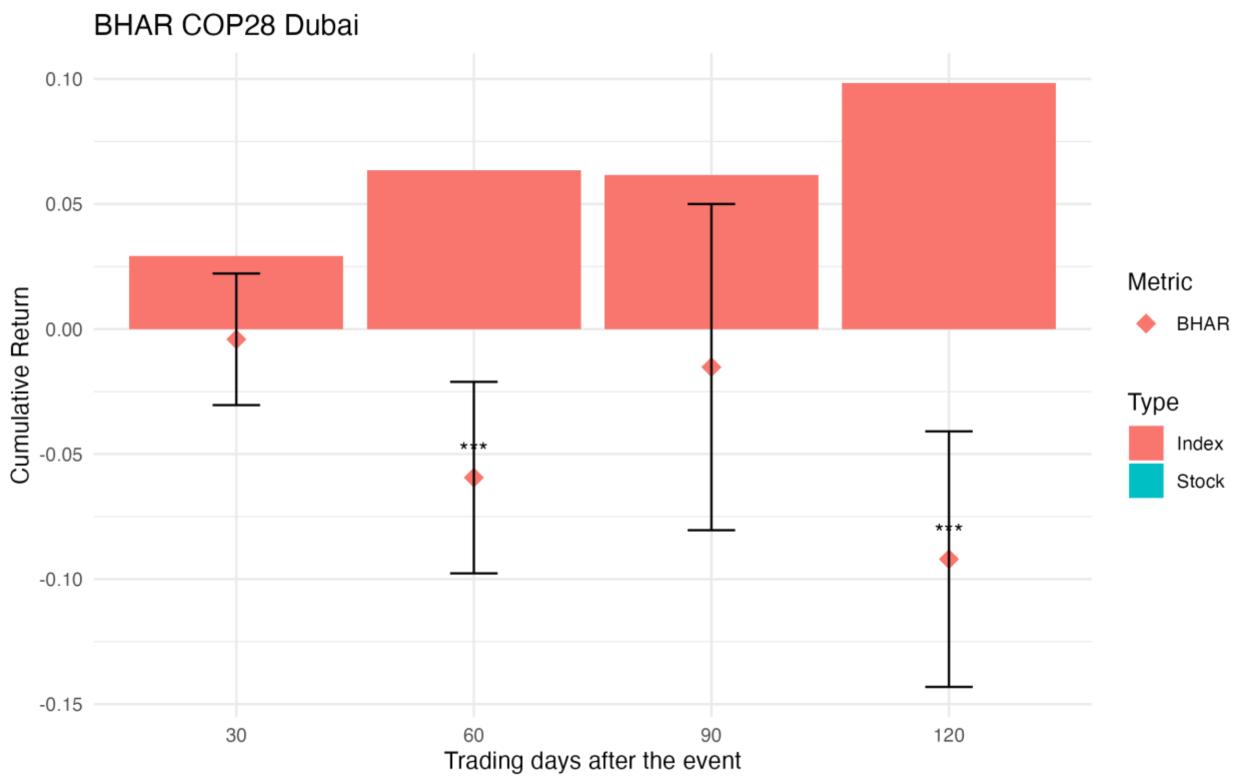


Figure 16

Table 40 BHAR COP28 Dubai

t	*N*	*Cum R*	*Cum IR*	*BHAR*	*Sd.*
30	*642*	*0.025*	*0.029*	*-0.004*	*0.340*
60	*642*	*0.021*	*0.063*	*-0.059***	*0.495*
90	*642*	*0.046*	*0.062*	*-0.015*	*0.976*
120	*642*	*0.006*	*0.098*	*-0.092****	*0.661*

*Significance indicators: *** p < 0.01, ** p < 0.05, * p < 0.1*

8.5 CAR Regression Results

8.5.1 CAR Regression Results Alternative Windows

Table 41 Table 8 CAR Regression results Window [-1,1]

	(1)	(2)	(3)	(4)	(5)
(Intercept)	-0.040***	0.017	-0.091***	0.003	0.028
	(0.008)	(0.018)	(0.009)	(0.016)	(0.018)
ROE	0.0001*				
	(0.000)				
TQ	0.001***	0.001***	0.002***	0.001***	0.002***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)
Volatility		-0.022***		-0.018***	-0.015***
		(0.000)		(0.004)	(0.005)
PUI		0.000		0.000**	-0.000**
		(0.000)		(0.000)	(0.000)
VIX		-0.002***		-0.002***	-0.004***
		(0.001)		(0.001)	(0.001)
Volume		0.00000***			
		(0.000)			
ESG			-0.0003***		-0.000
			(0.0001)		(0.000)
CR	-0.0002				
	(0.000)				
Log MV	-0.002**	0.002**	0.004***	-0.002**	0.002***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Firm Age	0.000				
	(0.000)				
Brent Oil Price	0.001***	0.000	0.001***	0.0002	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Gas Price	-0.006***	-0.005***	-0.007***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
IP	-0.003	-0.004	0.002	0.001	-0.003
	(0.003)	(0.005)	(0.004)	(0.005)	(0.005)
NP	-0.005	-0.004	-0.001	-0.003	0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
EU_dum	0.014***	0.013**	0.025***	0.011**	0.023***
	(0.005)	(0.006)	(0.004)	(0.005)	(0.005)
CAn_dum	0.000	-0.005	0.009**	-0.010	-0.005
	(0.005)	(0.007)	(0.004)	(0.006)	(0.006)
AU_dum	0.009*	0.001	0.021***	0.006	0.006
	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)
JAP_dum	0.015	0.019	0.023**	0.022*	0.035***
	(0.011)	(0.013)	(0.010)	(0.012)	(0.010)
N	3,618	3,736	1,397	4,450	1,397
R^2	0.020	0.034	0.092	0.024	0.145
Adjusted R	0.016	0.031	0.085	0.021	0.137
DW	2.016	1.990	1.789***	2.030	1.7988***
Breusch-Pagan	77.26 (13)***	202.49 (14)***	55.30 (11)***	170.85(13)***	52.11(14)***

Table 42 CAR Regression results Window [0,2]

	(1)	(2)	(3	(4)	(5)
(Intercept)	0.046***	-0.011	-0.075***	-0.016	0.006
	(0.008)	(0.017)	(0.008)	(0.016)	(0.017)
ROE	0.0001*				
	(0.00003)				
TQ	0.0004	0.001***	0.002***	0.001***	0.002***
	(0.0001)	(0.0002)	(0.001)	(0.002)	(0.001)
Volatility		-0.022***		-0.018***	-0.015***
		(0.00003)		(0.004)	(0.005)
PUI		0.00002		-0.00005	-0.0000
		(0.00003)		(0.00003)	(0.0003)
VIX		-0.0004		-0.001	-0.002***
		(0.001)		(0.0005)	(0.0004)
Volume		0.00000***			
		(0.00000)			
ESG			-0.0004***		-0.003***
			(0.0001)		(0.0001)
CR	-0.0001				
	(0.002)				
Log MV	-0.001	0.002***	0.004***	-0.001**	0.002***
	(0.001)	(0.001)	(0.001)	(0.0002)	(0.001)
Firm Age	0.0001*				
	(0.0001)				
Brent Oil Price	0.001***	0.001***	0.001***	0.0005***	0.0003*
	(0.0001)	(0.002)	(0.0001)	(0.0002)	(0.0002)
Gas Price	-0.006***	-0.005***	-0.007***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
IP	-0.003	-0.004	0.002	0.001	-0.003
	(0.003)	(0.005)	(0.004)	(0.005)	(0.0002)
NP	-0.005	-0.004	-0.001	-0.003	0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
EU_dum	0.013***	0.005	0.023***	0.007	0.021***
	(0.005)	(0.006)	(0.004)	(0.006)	(0.005)
CAN_dum	0.007	0.003	0.009**	-0.002	0.005
	(0.005)	(0.007)	(0.004)	(0.006)	(0.006)
AU_dum	0.012**	0.008	0.023**	0.010*	0.012**
	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)
JAP_dum	0.012	-0.011	-0.075***	-0.016	0.006
	(0.010)	(0.017)	(0.008)	(0.016)	(0.017)
N	3,619	3,739	1,395	4,450	1,395
R^2	0.023	0.027	0.090	0.017	0.115
Adjusted R	0.020	0.023	0.083	0.014	0.106
DW	2.022	2.000	1.968***	2.005	1.678***
Breusch-Pagan	77.702(13)***	237.2(14)***	83.103(11)***	158.89(13)***	79.214(14)***

*Significance indicators: *p < 0.1; **p < 0.05; ***p < 0.01*

Table 43 CAR Regression results Window [-10,2]

	(1)	(2)	(3	(4)	(5)
(Intercept)	-0.103***	-0.110***	-0.070***	-0.104***	0.155***
	(0.014)	(0.027)	(0.018)	(0.025)	(0.033)
ROE	-0.0002***				
	(0.0001)				
TQ	0.001*	0.002***	-0.0003	0.001***	-0.001
	(0.001)	(0.0004)	(0.001)	(0.0003)	(0.001)
Volatility		-0.004		-0.005	-0.004
		(0.008)		(0.008)	(0.010)
PUI		0.0002***		0.0002***	0.0004***
		(0.0001)		(0.0001)	(0.0001)
VIX		-0.002*		-0.002*	-0.001
		(0.001)		(0.001)	(0.001)
Volume		0.00000			
		(0.00000)			
ESG			-0.001**		-0.001***
			(0.0002)		(0.0002)
CR	0.0003				
	(0.0004)				
Log MV	0.008***	0.007***	0.015***	0.005***	0.016***
	(0.01)	(0.001)	(0.002)	(0.001)	(0.002)
Firm Age	0.00001				
	(0.0001)				
Brent Oil Price	0.001***	0.0003	-0.00003	0.0003	-0.00001
	(0.0002)	(0.0003)	(0.0003)	(0.0003)	(0.0004)
Gas Price	0.001	0.004*	-0.0001	0.005**	0.002
	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
IP	-0.040***	-0.029***	-0.075***	-0.016*	-0.034***
	(0.006)	(0.009)	(0.009)	(0.009)	(0.011)
NP	0.010	0.023***	0.024***	0.017**	0.036***
	(0.007)	(0.008)	(0.009)	(0.007)	(0.009)
EU_dum	0.008	-0.005	-0.004	-0.006	-0.031***
	(0.008)	(0.010)	(0.009)	(0.010)	(0.010)
CAN_dum	0.008	-0.017	0.004	-0.023**	-0.050***
	(0.008)	(0.011)	(0.009)	(0.011)	(0.012)
AU_dum	0.002	0.013	-0.006	0.017*	0.019**
	(0.008)	(0.010)	(0.010)	(0.009)	(0.011)
JAP_dum	0.002	0.032	-0.029	0.030	0.010
	(0.018)	(0.021)	(0.020)	(0.021)	(0.021)
N	3,618	3,764	1,395	4,448	1,395
R^2	0.042	0.048	0.126	0.035	0.155
Adjusted R	0.039	0.044	0.119	0.032	0.146
DW	1.908***	1.909***	1.5297***	1.896***	1.564***
Breusch-Pagan	396.631(13)***	881.572(14)***	251.742(11)***	110.013(13)***	272.132 (14)***

Table 44 CAR Regression results Window [-10,10]

	(1)	(2)	(3)	(4)	(5)
(Intercept)	-0.107***	-0.231***	0.023	-0.104***	-0.214***
	(0.021)	(0.033)	(0.027)	(0.030)	(0.042)
ROE	-0.000				
	(0.000)				
TQ	0.001	0.002***	-0.002	0.002***	0.003***
	(0.001)	(0.001)	(0.002)	(0.000)	(0.002)
Volatility		0.004		-0.005	0.000
		(0.012)		(0.011) ***	(0.015)***
PUI		0.001	0.000***	0.001	0.001
		(0.000)	(0.000)	(0.000)	(0.000)
VIX		0.000		-0.001	0.002*
		(0.001)		(0.001)	(0.001)
Volume		0.000			
		(0.000)			
ESG			-0.001***		-0.001***
			(0.000)		(0.000)
CR	0.001				
	(0.001)				
Log MV	0.014***	0.012***	0.019***	0.010***	0.023***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Firm Age	0.000				
	(0.000)				
Brent Oil Price	0.001	0.000	-0.001***	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Gas Price	-0.004*	0.005	-0.004	-0.002	0.000
	(0.003)	(0.004)	(0.004)	(0.003)	(0.002)
IP	-0.061***	0.006	-0.102***	-0.027**	-0.039***
	(0.008)	(0.013)	(0.012)	(0.012)	(0.014)
NP	0.031***	0.031***	0.044***	0.034***	0.058***
	(0.009)	(0.010)	(0.014)	(0.010)	(0.014)
EU_dum	0.015	-0.010	-0.004	0.005	-0.045***
	(0.012)	(0.014)	(0.013)	(0.013)	(0.015)
CA_dum	-0.004	-0.082***	-0.020	-0.028*	-0.093***
	(0.011)	(0.018)	(0.013)	(0.015)	(0.017)
AU_dum	-0.006	0.057***	-0.019	0.010	0.013
	(0.012)	(0.015)	(0.014)	(0.030)	(0.029)
JAP_dum	-0.016	0.044	-0.040	0.010	0.013
	(0.025)	(0.033)	(0.029)	(0.030)	(0.029)
N	3,620	3,486	1,396	4,450	1,396
R^2	0.051	0.046	0.136	0.033	0.176
Adjusted R	0.048	0.042	0.129	0.030	0.168
DW	1.935***	1.908***	1.649***	1.882***	1.751***
Breusch-Pagan	147.041 (13)***	307.881 (14)***	130.023(11)***	430.243(13)***	136.962 (14)***

Significance indicators: *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

Table 45 CAR Regression results Window [-20,20]

	(1)	(2)	(3)	(4)	(5)
(Intercept)	-0.033	-0.007	0.123***	0.006	0.236
	(0.033)	(0.046)	(0.047)	(0.045)	(0.065)
ROE	-0.001***				
TQ	-0.001	0-.001	-0.001	0.002***	0.002
	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)
Volatility		-0.043***		-0.031**	-0.003
		(0.016)		(0.015)	(0.023)
PUI		0.001***		0.001***	0.002***
		(0.000)		(0.000)	(0.000)
VIX		0.000		-0.001	-0.001
		(0.001)		(0.001)	(0.002)
Volume		0.000			
		(0.000)			
ESG			-0.002***		-0.002***
			(0.001)		(0.001)
CR	0.001				
	(0.001)				
Log MV	0.017	0.011***	0.032	0.011***	0.037***
	(0.003)	(0.003)	(0.006)	(0.002)	(0.006)
Firm Age	0.000				
	(0.000)				
Brent Oil Price	-0.002***	-0.004***	-0.003***	-0.004***	-0.004
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Gas Price	0.017***	0.016***	0.004	0.018***	0.000
	(0.004)	(0.005)	(0.006)	(0.005)	(0.007)
IP	-0.112***	-0.085***	-0.227***	-0.068***	-0.126***
	(0.013)	(0.014)	(0.021)	(0.014)	(0.022)
NP	0.020	0.067***	-0.024	0.063***	0.054**
	(0.014)	(0.015)	(0.021)	(0.015)	(0.021)
EU_dum	0.021	-0.040***	-0.012	-0.028	-0.069***
	(0.018)	(0.018)	(0.022)	(0.019)	(0.022)
CA_dum	0.023	-0.042***	0.006	-0.045**	-0.096***
	(0.017)	(0.019)	(0.021)	(0.019)	(0.022)
AU_dum	0.001	0.058***	-0.010***	0.040**	0.137***
	(0.018)	(0.020)	(0.024)	(0.020)	(0.026)
JAP_dum	-0.043	-0.001	-0.075	-0.007	0.081*
	(0.038)	(0.041)	(0.046)	(0.043)	(0.046)
N	3,556	3,723	1,287	4,386	1,287
R^2	0.044	0.056	0.151	0.039	0.248
Adjusted R	0.044	0.053	0.144	0.036	0.239
DW	1.925**	1.940**	1.645***	1.910***	1.823***
Breusch-Pagan	128.112 (13)***	223.141 (14)***	85.553 (11)***	331.154 (13)***	90.096 (14)***

Significance indicators: *p < 0.1; **p < 0.05; ***p < 0.01

8.5.2 CAR Regression VIF-test

Table 46 VIF test CAR Regression Window [-5,5]

	Model 1	Model 2	Model 3	Model 4	Model 5
	VIF	VIF	VIF	VIF	VIF
ROE	1.361				
TQ	1.082	1.137	1.021	1.160	1.023
Volatility	1.136	1.408		1.429	1.369
PUI		3.915		4.026	3.803
VIX_price		2.515		2.443	2.734
Volume					
ESG			1.952		2.013
Log_MV	1.433	1.392	1.859	1.429	2.101
Firm Age	1.061				
Brent_oil_price	2.314	3.387	3.828	3.383	4.892
GP	1.865	3.431	2.845	3.322	4.917
IP	1.148	2.081	1.684	2.123	2.486
NP	1.442	1.562	2.001	1.575	2.115
EU_dum	1.541	2.042	1.386	2.048	1.806
CA_dum	1.685	2.661	1.289	2.808	2.385
AUS_dum	1.744	1.844	1.208	1.902	1.559
JAP_dum	1.090	1.822	1.100	1.169	1.239

8.5.3 Correlation Matrix

Table 47 Correlation Matrix

	PUI	VIX	Brent Price	ROE	CR	Log_mv	volatility	ESG	Gas Price	Return	Indreturn
PUI	1	0.45	-0.21	0.04	-0.06	0.04	-0.08	0.15	-0.07	0.12	0.00
VIX		1	-0.20	0.03	-0.04	0.03	0.01	0.12	0.08	-0.09	0.00
Brent			1	0.15	0.01	0.07	0.01	0.03	0.55	0.14	0.01
ROE				1	0.03	0.40	-0.24	0.12	0.13	0.12	0.00
CR					1	-0.17	-0.05	-0.23	0.01	-0.03	0.00
Log_MV						1	-0.56	0.60	0.02	0.04	0.00
Volatility							1	-0.17	-0.01	0.09	0.00
ESG								1	0.02	0.08	0.00
GasPrice									1	-0.23	0.01
Return										1	0.00
Indreturn											1
TQ											
Volume											
FirmAge											
IP											
NP											
Election											
US											
EU											
CAN											
AUS											
Jap											

TQ	Volume	FirmAge	IP	NP	Election	US	EU	CAN	AUS	Japan
-0.01	0.02	0.01	-0.48	-0.01	0.44	-0.29	0.25	0.52	-0.42	-0.14
-0.02	0.01	0.03	-0.33	0.10	0.04	0.02	0.22	0.01	-0.28	0.06
-0.03	0.00	0.00	-0.03	0.47	-0.29	0.00	0.01	0.00	0.00	0.00
0.15	-0.01	0.09	-0.03	0.10	-0.09	0.06	0.06	0.02	-0.15	0.04
0.06	0.01	0.06	0.02	-0.04	0.01	0.11	0.05	0.00	0.17	-0.04
-0.30	-0.01	0.10	0.07	0.13	0.18	0.43	-0.23	0.06	0.09	0.00
0.33	0.02	-0.07	-0.01	0.02	0.03	0.43	0.29	-0.13	-0.16	-0.10
-0.12	0.21	0.18	0.02	0.06	-0.03	-0.18	0.00	0.02	-0.18	0.12
-0.01	0.00	0.00	-0.14	0.32	-0.31	0.00	0.02	0.00	0.00	0.00
-0.01	0.02	0.12	-0.04	0.04	0.00	0.43	0.02	0.00	0.01	0.00
0.00	0.00	0.00	-0.35	-0.05	0.17	-0.08	-0.10	0.03	0.06	0.00
1	-0.01	0.07	-0.03	0.00	0.02	0.18	0.05	-0.01	-0.07	0.04
	1	0.01	-0.01	0.01	0.00	0.01	-0.02	-0.05	-0.01	0.00
		1	-0.02	0.03	0.01	0.04	0.00	-0.08	0.02	0.09
			1	-0.28	-0.46	0.00	0.00	0.00	0.00	0.00
				1	-0.58	0.00	0.00	0.00	-0.01	0.00
					1	0.01	0.00	0.00	0.00	0.00
						1	-0.40	-0.46	-0.36	-0.10
							1	-0.26	-0.20	-0.06
								1	-0.23	-0.07
									1	-0.05
										1

8.6 Brent Oil Price and Henry Hub Natural Gas Price

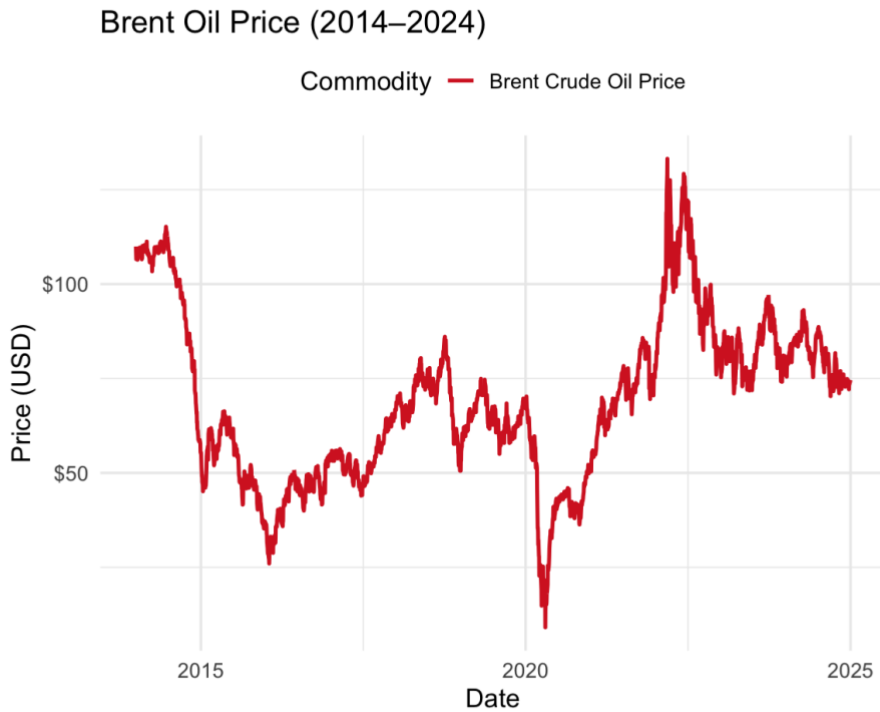


Figure 16 Brent Oil Price 2014-2024

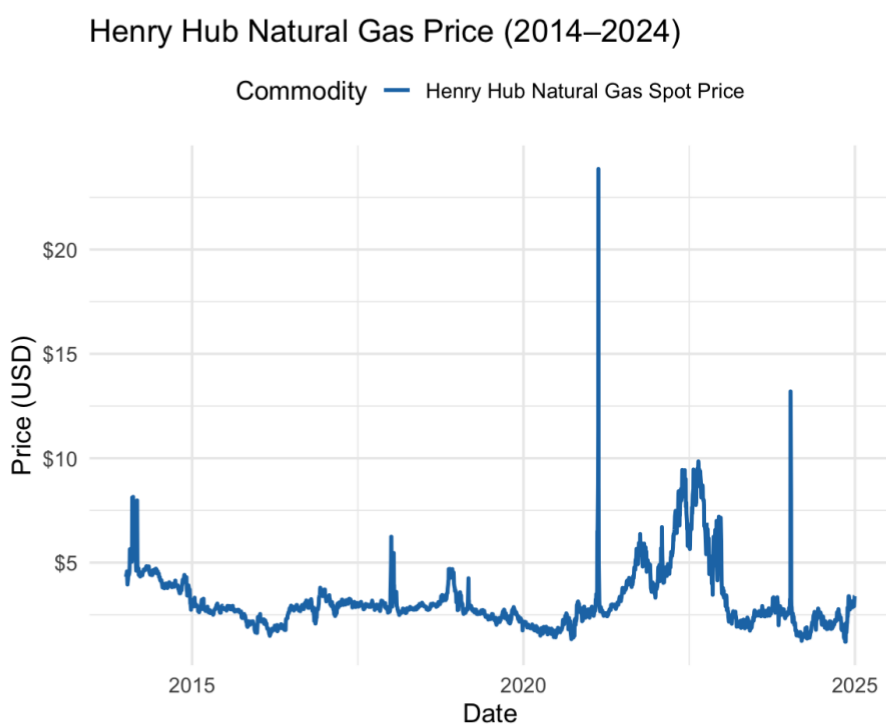


Figure 16 Henry Hub Natural Gas Price 2014-2024

8 GenAI statements

Generative AI tools (e.g., ChatGPT, Copilot) were used to assist in coding, data analysis, and/or refining the language of this thesis. Appendix I of this thesis provides a detailed account of the use of Generative AI tools during the development of this thesis. By submitting this thesis, I declare that I am fully responsible for the accuracy and completeness of its content.

8.1 Writing and Grammar Refinement

Description:

- Tool: Grammarly
- Purpose: Improved clarity and fluency in writing.
- My Role:
- inclusion. No sections were directly copied verbatim without editing.
- My reflection: AI helped me to better structure my text, and to be more concise.
- in writing while expressing the same content.
- Applied in the whole thesis.

A complete log of AI interactions:

- No prompts used for Grammarly

9.2 Coding use

1) Description:
- Tool: CHAT GPT
- Purpose: Improved clarity and fluency in writing.
- My Role: I asked chat GPT how to code the market model and Fama French 5 factor model in
- inclusion. No sections were directly copied verbatim without editing.
- My reflection: AI helped me to better structure my text, and to be more concise..
- Applied: for coding purposes

A complete log of AI interactions:

AI interactions

Market model and Fama French 5 Factor model including Carhart momentum Factor:
("Could you give me base code that regarding the Market model used in event studies?")

BHAR:
("Could you give me the base code which is used to calculate the BHAR in event studies ")

Packages:
("Could you give me the correct package regarding this function?")

Robust Standard errors:
("Could you give me the correct Code regarding this robust standard errors?")

In total, around 35 queries are used to refine and adjust the draft codes to the final codes.