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Financial Market Reactions to the 2022 Inflation Reduction Act: A Global Perspective

An event study on U.S., European and Asian stock returns

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Abstract

The Inflation Reduction Act (IRA) of 2022 is the most ambitious climate policy in U.S. history. The law introduces significant subsidies for green companies to combat climate change while also focusing on securing domestic production and reducing reliance on foreign supply chains, particularly from China. In this thesis, we conduct an event study to analyze the market reactions in the U.S., Europe, and Asia following the announcement of the IRA.

Our findings show that U.S. industries focusing on renewable technologies experienced significant positive abnormal returns, reflecting optimism surrounding the IRA's provisions. Despite hard criticism from EU and Asian leaders accusing the IRA of violating WTO trade rules, our results reveal a more nuanced picture. In Europe, we observe positive market reactions in several renewable-focused industries, suggesting optimism linked to increased global demand for renewable technologies and perceived strengthened competitiveness relative to Asia. In contrast, we observe limited reactions in Asian industries, except in the EV industry, which saw a significant negative reaction.

Our findings provide valuable insights into how financial markets adapt to climate policies and protectionist regulations, offering a valuable perspective for shaping future climate regulations and international trade agreements.

Keywords – event study, Inflation Reduction Act, market efficiency

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1 Introduction

The Inflation Reduction Act (IRA), signed into law in August 2022, is commonly deemed the most ambitious climate policy initiative in U.S. history. President Biden described its provisions as "the most aggressive action ever, ever, ever to confront the climate crisis ... - ever in the whole world" (Biden, 2022). In the coming decade, significant tax credits and government spending will support clean technologies and industries. Furthermore, the IRA offers incentives for American households and firms to invest in reducing their carbon emissions. Estimates from Bistline et al. (2023) suggest that the climate-related provisions of the IRA could represent a budgetary impact of approximately $1 trillion over the next decade. These are projected to reduce greenhouse gas emissions substantially, further advancing the U.S. climate (Bistline et al., 2023).

While the IRA's economic and environmental implications are well documented, this thesis focuses on its implications for financial markets. Financial markets play a crucial role in decarbonization, as they supply and allocate the necessary capital to companies driving the green transition. Besides, the forward-looking nature of financial markets provides early insights into how investors assess the policy's impact and its potential to reshape market dynamics.

The act's focus on tax credits contingent on local content and support for domestic production has been criticized for potentially disadvantaging producers outside the U.S. These concerns stem particularly from Europe and Asia, where the IRA has faced allegations of breaching WTO non-discrimination laws. Critics also warn of a potential diversion of green investments from these regions to the U.S., driven by the Act's preferential subsidies and local content requirements (Woolich, 2023). With this context, we aim to explore how industries impacted by the IRA responded across markets, which will offer insights into potential disparities in market reactions between the U.S., Europe, and Asia.

This thesis analyzes the financial market implications of the Inflation Reduction Act by examining stock market reactions. Specifically, it addresses two key research questions:

1. How did various industries in the U.S. stock market react to the announcement of the Inflation Reduction Act?
2. How do the stock market reactions of U.S. industries, targeted by the Inflation Reduction Act, compare to those of similar industries in Europe and Asia?

To answer these questions, we employ an event study methodology. This approach enables us to measure abnormal stock reactions by comparing actual returns to expected returns in the days surrounding the event. Expected returns are estimated using the Fama-French five-factor model supplemented with a momentum factor, accounting for both market-wide and firm-specific characteristics. Based on these estimates, we calculate abnormal returns (AR) and cumulative abnormal returns (CAR). The analysis spans multiple event windows surrounding the announcement made on July 27, 2022, after stock markets had closed. Therefore, July 28, 2022, is the first trading day. Finally, we test the significance of our results by assessing whether the cumulative abnormal returns are significantly different from zero, indicating whether they reflect abnormal effects or merely normal fluctuations.

Our analysis encompasses both predefined sectors and custom-constructed industries. For U.S. markets, we analyze sectors classified under the Global Industry Classification Standard (GICS), containing companies listed on the S&P 500. To capture the impact of the IRA more specifically, we construct additional industry groupings that focus on industries directly or indirectly targeted by the IRA's provisions, such as Renewable Energy and Electric Vehicles. To facilitate meaningful comparisons across regions, we apply these custom industry classifications as consistently as possible when constructing comparable industries in Europe and Asia.

1.1 Contribution to research

This thesis contributes to the literature by providing a deeper understanding of how the Inflation Reduction Act affected financial markets. Building on the research of Bauer et al. (2023), we extend their analysis by looking into S&P 500 GICS indices and dissecting industries at a more detailed level. This approach allows us to isolate the IRA's effect on industries specifically targeted by its provisions. Furthermore, we expand the scope by analyzing reactions across Europe and Asia. The IRA's protectionist elements and its potential to disadvantage companies outside the U.S. have been the subject of extensive debate. Hence, by examining financial market responses within key industries, our study provides insights into how these dynamics unfold across regions, enhancing the understanding of the IRA's broader implications.

The thesis is structured systematically. It begins with a background section, providing the context and foundation for the study. This is followed by a review of relevant literature to position the research within existing work. Next, the data section outlines the selection and preparation of data, while the methodology section details the analytical approach used. In the following sections, the results and discussions are presented, offering insights into the findings and their implications. Subsequently, the limitations of the study are discussed, and the constraints and boundaries of the research are acknowledged. Finally, the thesis concludes by summarizing key findings and final remarks.

2 Background

2.1 Historical context

The Inflation Reduction Act (IRA) emerged from a convergence of economic, political, and environmental pressures that defined the early 2020s. The global COVID-19 pandemic had triggered widespread economic disruptions, leading to significant inflationary pressures that challenged economies around the world, including the United States. Supply chain constraints, rising consumer prices, and geopolitical tensions reinforced these conditions, strengthening the need for a legislative response to stabilize the economy, while also addressing the ever-pressing matter of global warming.

The ambitious Build Back Better plan proposed by the Biden administration in September 2021 sought to enforce radical reforms regarding carbon emission, healthcare, and infrastructure investments. However, the bill faced political opposition within the U.S. Congress, not only from Republican lawmakers but also from moderate Democrats, deeming the bill as too expansive and costly. Given the marginal control of the Democrats in the Senate, they would need a unanimous vote to ensure a simple majority for the bill to pass (Bauer et al., 2023). Nevertheless, Senator Joe Manchin, with many ties to the oil and gas industry, expressed that he would not support the bill (Tankersley et al., 2022), leaving the Biden administration in a seemingly state of defeat.

However, surprisingly, on July 27, 2022, Manchin agreed to the bill's revised and considerably constrained version (Friedman & Plumer, 2022), later known as the Inflation Reduction Act. Despite its reduced scope, the central core was preserved. On August 16, President Biden signed the act into law, marking it a significant victory in the Democratic Party's climate agenda.

What makes the IRA stand out is not only its scale but its strategic intent. Unlike previous climate-focused legislation, the IRA includes measures to strengthen U.S. manufacturing and reduce reliance on foreign supply chains. The IRA is seen as a clear shift toward a more protectionist and self-sufficient economic policy, especially regarding clean energy.

Internationally, the IRA has been met with a mix of support and criticism. While environmental organizations celebrated the bill as a significant step in tackling climate change, other countries, particularly in Europe and Asia, have raised serious concerns regarding global competition. The act's feature of offering tax credits contingent on local content was criticized for potentially discriminating against non-U.S. producers. Both Chinese and EU officials have made the argument that the IRA's use of uncapped subsidies is a breach of WTO non-discriminatory rules (Rappeport et al., 2022), setting the stage for complex international trade discussions. On March 26, 2024, China officially filed a World Trade Organization complaint against the U.S. over what it says are discriminatory requirements for EV subsidies (Reuters, 2024).

Understanding this historical backdrop helps explain why the IRA is such a crucial piece of legislation. It is not just about tackling inflation or global warming but about reshaping the domestic and international competitive landscape. It is essential to consider this context when interpreting how the markets reacted to the act and why different industries responded the way they did.

2.2 Objectives of the Inflation Reduction Act

The Inflation Reduction Act was created to face several major challenges at once. The act's goals were ambitious and aimed at both immediate and long-term issues facing the U.S. economy.

The IRA's first objective, as implied by its name, is to bring down inflation. Given the immediate threat of inflation getting out of control, signing the IRA into law was a clear signal to businesses and the general public that the government is committed to bringing down inflation. Investing in energy production and renewable resources means that energy costs will drop over time, which could help bring down overall prices.

The second objective is its commitment to clean energy. The act includes more than $369 billion in funding to support renewable energy projects and reduce carbon emissions. The goal is to cut U.S. greenhouse gas emissions by 40% below 2005 levels by 2030. This would be a significant step in speeding the transition away from fossil fuels and showing global leadership in green initiatives.

Thirdly, the IRA aims to boost U.S. production and secure job opportunities for American workers. By incentivizing domestic production of things like batteries, solar panels, and wind turbines, the U.S. will reduce its dependency on imports, support its economy, and create more stable jobs in the renewable energy industry.

Aside from its three main objectives, as mentioned, the IRA also touches on other important topics. For example, it includes measures to lower healthcare costs, such as allowing Medicare to negotiate drug prices. This could make a big difference for Americans struggling with high prescription costs. Furthermore, the Act implements a 15% minimum tax for large corporations that will generate revenue to help fund the various initiatives in the bill.

2.3 Main provisions of the IRA

The Inflation Reduction Act contains multiple provisions to address its multifaceted objectives. Here is a quick summary of the IRA's main provisions, collected from Shao (2022).

2.3.1 Tax credits for zero-carbon power plants

A big part of the IRA's budget is set aside for long-term tax credits that last over 10 years to support companies developing new zero-emission energy sources. The provision includes projects like solar panels, wind turbines, battery storage, nuclear reactors, and geothermal plants. This is an extension of existing tax credits for wind and solar that normally expire after a year or two. By offering a longer timeframe, the IRA provides greater certainty for companies that qualify for these credits, encouraging sustained investment in clean energy. Additionally, the act broadens eligibility to include any zero-carbon technology company.

Furthermore, the IRA expands tax credits for oil and gas companies that capture carbon, a technology rarely used due to high costs. The act also expands tax breaks to prevent existing nuclear reactors from closing down.

2.3.2 Incentives for electric vehicles

The IRA also includes direct consumer benefits, offering tax credits for purchasing electric vehicles (EVs). Buyers of used EVs can receive up to $4,000 in tax credits, while those purchasing new EVs are eligible for credits of up to $7,500.

2.3.3 Investments in domestic manufacturing

The IRA allocates $60 billion to boost clean energy manufacturing within the U.S. This includes $30 billion in production tax credits for solar panels, wind turbines, batteries, and critical minerals processing. Additionally, $10 billion is set aside for investment tax credits to build manufacturing facilities that produce electric vehicles and renewable energy technologies.

These provisions are designed to halt and reverse the trend of clean-energy manufacturing moving overseas, particularly to countries like China. Furthermore, the IRA allocates $500 million through the Defense Production Act to support the production of heat pumps and the processing of critical minerals.

Another $27 billion was allocated to a “green bank” aimed at supporting clean energy projects, with a special focus on initiatives in disadvantaged communities.

2.3.4 Lowering healthcare costs

The IRA seeks to reduce healthcare costs by lowering the prescription drug costs. It aims to achieve this by allowing Medicare to negotiate prices with drug companies, put an inflation cap on drug prices, and lowering out-of-pocket (OOP) expenses for Medicare recipients by imposing an OOP-cap at $2,000 annually (Palosky, 2022). Furthermore, it extends the Affordable Care Act (ACA) subsidies for three years (Badlam et al., 2022).

2.3.5 Help people to lower energy cost

To help lower energy costs, the IRA invests $9 billion in rebates for Americans who buy energy-efficient and electric appliances for their homes. It also includes consumer tax credits that last for 10 years, making items like heat pumps, rooftop solar panels, water heaters, and electric HVAC systems (heating, ventilation, and air conditioning) more affordable.

2.3.6 Investments in low-income communities

The act also allocates $60 billion to support low-income communities and communities of color that are disproportionately affected by the environmental and public health impacts of climate change. This includes grants for zero-emissions technologies and vehicles, as well as funding to help reduce the negative effects of highways, bus depots, and other transportation facilities, along with construction projects near disadvantaged neighborhoods.

2.3.7 Cracking down on methane

The act also addresses methane emissions by imposing fees on excess methane leaks from oil and gas wells, pipelines, and other infrastructure. Methane is a powerful greenhouse gas that traps heat much more effectively than carbon dioxide, even though it breaks down faster. Under the IRA, companies that exceed federal methane limits would face penalties starting at $900 per metric ton in 2024, rising to $1,500 per metric ton by 2026.

2.3.8 Agriculture and forests

Lastly, the IRA sets aside $20 billion for programs aimed at reducing emissions from livestock, such as cows, and from agricultural practices like soil management and rice production. Agriculture accounts for about 11 percent of greenhouse gas emissions in the U.S., according to government data. The act also includes funding for grants to support forest conservation, the development of fire-resilient forests, increased urban tree planting, and the conservation and restoration of coastal habitats.

3 Literature Review

Over the past decade, the literature on climate policy has expanded significantly, highlighting the complex ways these policies impact the environment and the economy. Researchers have focused more on how policies interact with markets and global trade as countries push to meet their climate targets. This literature overview will begin to look at the environmental impact of climate policy. Then, we review the results of a previous event study of the Inflation Reduction Act. Lastly, we will review studies that discuss the IRA's effect on global trade and the competitive landscape.

Bistline et al. (2023) examine the potential emissions and energy impacts of the IRA provisions. Through a set of independent models, they expect that greenhouse gas emissions will be reduced by between 43% and 48% of 2005 levels by 2035.

Jenkins et al. (2022) study the effect of different policy scenarios through macro-energy system modeling. These scenarios include the IRA, the Build Back Better Act (BBBA), and the Infrastructure Investment and Jobs Act (IIJA), which was signed by President Biden on November 15, 2021. The study also includes two benchmark scenarios that they call Frozen Policies, which illustrates the policy state prior to Biden's inauguration in January 2021, and the net zero path, which symbolizes the cost-optimized path to reach the Paris Agreement, i.e., reducing greenhouse gas emissions 50% below 2005 levels by 2030 and net zero by 2050. Jenkins et al. (2022) predict the IRA will close the remaining greenhouse gas emissions gap between prior policy and 2030 target levels by roughly two-thirds. This implies an emission level of approximately 3.6 billion tons in 2030, a 42% reduction from 2005 levels. In comparison, the estimated reduction is 26%, 27% and 46% for Frozen Policies, IIJA, and BBBA respectively.

Bauer et al. (2023) investigate equity price reactions to the IRA. The study highlights how significant policy statements can act as realizations of climate policy risk, leading to substantial changes in market valuations. They conduct an event study where they analyze two pivotal events prior to the signing of the IRA. The first significant event happened on July 14, 2022, when Senator Manchin said he would not support the bill. Bauer et al. (2023) refer to this as a "brown" event, marking a major decrease in the likelihood of the bill's passage and resolving much of the prior uncertainty. The second event happened on July 27, 2022, when news broke that Senator Manchin and Democratic leaders surprisingly had reached an agreement. The study refers to this moment as a green event, where the likelihood of the bill's passage had totally shifted. They find that green stocks benefit significantly as a response to the green event, while brown stocks depreciate. Conversely, they find that brown stocks outperform green stocks during the brown event.

However, there are also reasons for concern if we are to believe the literature regarding the global politics surrounding this piece of legislation. A major point in recent research is the IRA's use of protectionist policies that aim to boost U.S. industries. This applies to several of the provisions of the IRA, but not all. Most highlighted are the U.S. green subsidies conditional on local-content requirements (LCRs), a policy prohibited under World Trade Organization rules (Kleimann et al., 2023). This has been viewed as a significant shift from previous climate legislation, which traditionally did not include such explicit trade barriers.

Kleimann et al. (2023) compare IRA policies with preexisting EU green industrial policies. They find that the expected level of IRA green subsidies is about similar in scale to EU policy, with the exception of renewable energy production, where EU subsidies are higher. Nonetheless, there are considerable qualitative differences. While the IRA is designed to provide straightforward subsidies to drive quick deployment of clean energy, the EU's policies have traditionally focused more on innovation and new technologies and tend to be less discriminatory and more fragmented.

Although there is a real fear in the EU that clean-tech manufacturers and adopters will move their production to the U.S. as a result of the IRA, the full magnitude of the provisions is uncertain, and remains to be seen. Kleimann et al. (2023) suggests that an alternative outcome may be that the EU will gain competitive advantage relative to China, due to IRA's aim to shift supply chains away from Chinese manufacturers. This would be beneficial for European industry and growth.

Matthes et al. (2024) analyze the effects of the U.S. Inflation Reduction Act (IRA) on German exports. They find limited negative impacts despite its protectionist elements. The concern about site relocations of German firms has not yet materialized, as broader structural and demand-side factors dominate relocation decisions. They note that high trade and transport costs limit production shifts to the U.S., while low U.S. prices for green hydrogen, solar modules, and EV batteries could aid local energy transition. Notably, German exports of machinery and electrical equipment grew significantly in 2023. Furthermore, a leasing loophole allows EU-exported electric vehicles to qualify for IRA consumer subsidies. In the middle of 2023, about two-thirds of electric cars exported from the EU were leased (Bown, 2023).

4 Data

This chapter presents the data used in our analysis, including its collection, selection process, and industry indices construction. It also outlines key methodological choices, such as the use of logarithmic returns and the collection of Fama-French factors.

4.1 Obtaining Data

The data used in this thesis were collected from Bloomberg. The data has been collected in two ways. First, we obtained the 11 S&P 500 GICS level 1 sectors' daily close prices from Bloomberg. Secondly, we constructed a set of targeted industries likely to be affected by the IRA provisions. This was done for our three regions of interest: the USA, Europe, and Asia. To ensure consistency across all regions, as well as accurate representations of our selected industries, we used Bloomberg's Equity Screener (EQS) and Bloomberg's classification browser.

4.2 Sector selection and rationale

As alluded to, we gathered the S&P 500 GICS level 1 indices directly from Bloomberg. GICS stands for the Global Industry Classification Standard and is a four-tier hierarchical industry classification system (MSCI, 2024). These are mutually exclusive and collectively exhaustive, meaning each company is assigned to only one category, and all 500 S&P-companies are accounted for. This provides a comprehensive representation of sectors, aimed to capture how the IRA influenced market dynamics in the U.S.

Furthermore, we constructed our own industry indices to better isolate the impact of the IRA on its targeted industries. The industries analyzed were selected for their relevance to the IRA and their exposure to its provisions, as identified in reports by Badlam et al. (2022) and Kleimann et al. (2023), which highlight the industries that receive the most substantial funding.

The energy sector is analyzed in further detail by looking into the oil and gas- and renewable energy industry. We delve deeper into the latter, dissecting the performance of equipment manufacturers and project developers, as well as individual subindustries such as wind, solar, and hydrogen. Electric utilities are included for their role in the clean energy transition, while the EV supply chain, along with automobiles and auto parts, is analyzed to capture the impact of tax credits and domestic production requirements. Furthermore, pharmaceuticals, chemicals, and mining are also included due to their roles in drug pricing reforms and the supply of critical minerals for clean technologies. Another key factor in selecting these industries is their relevance for cross-market analysis to assess the influence of the IRA's protectionist elements on foreign markets and global competition.

4.3 Constructing the indices

After selecting the relevant industries, we had to construct and refine them for our analysis. As alluded to earlier, we primarily used the equity screener (EQS) at the Bloomberg Terminal to filter equities by industry and region. We filtered the industries based on Bloomberg's Index Classification System (BICS), which allowed for detailed categorization. For instance, the energy sector was divided into oil and gas and renewable energy, with renewable energy further broken down into subcategories such as equipment manufacturers and project developers. To ensure that all relevant companies were included, we cross-referenced with Bloomberg's Classification Browser and industry indices available on the platform. The Classification browser enabled the classification into highly specific subcategories, such as solar and wind, within renewable energy equipment manufacturers and renewable energy project developers. This method was consistently applied across all industries.

Consequently, a qualitative screening process was applied to the list of companies within the industries based on three criteria. Firstly, the company had to be involved in activities that could be directly or indirectly affected by the provisions of the IRA. For example, in the mining industry, companies engaged in the extraction of materials unrelated to the IRA or green energy, such as diamonds, were excluded. This approach aimed to focus on different parts of the green energy value chain and assess whether these were affected differently across markets. Secondly, the company's primary business activity belonged to the designated industry. Thirdly, the company needed to operate in the specified region. Additionally, as the analysis investigates daily abnormal returns, it is limited to publicly listed companies, thus excluding private firms and other non-listed entities that might play key roles in the industries we are analyzing.

4.3.1 Overview over the constructed indices

Table 4.1 is an overview over our constructed industry indices. Section A.6 in the appendix gives an overview of all companies involved in each industry.

Industry	Description
Oil and gas	Companies with a primary focus on oil and gas.
Automobiles	Automobiles manufacturers.
Auto Parts	Auto parts manufacturers.
Renewable energy: equipment manufacturers	Companies producing equipment for renewable energy projects, ie., wind turbines, solar panels, etc.
Renewable energy: project developers	Companies developing renewable energy projects, such as wind farms, solar plants, etc.
Solar	Companies specializing in the production or development of solar panels, solar farms, or associated technology.
Wind	Companies involved in wind turbine manufacturing, wind farm development and operation, or related components.
Hydrogen	Companies developing hydrogen production, storage, or transportation technologies, including green hydrogen projects and fuel cells.
Electric Vehicles	Companies involved in the production of electric vehicles or related components, including batteries, battery materials and charging infrastructure.
Pharmaceuticals	Companies producing pharmaceuticals.
Minerals Mining	Companies extracting critical minerals such as lithium and rare earth metals for clean energy technologies.
Metals Mining	Companies extracting base metals such as cobalt, nickel and copper necessary for clean energy technologies. Includes extractors of uranium.
Basic Chemicals	Companies that produce fundamental chemical compounds for industrial processes and clean technologies.
Specialty Chemicals	Companies that develop chemical solutions with specific functionalities, supporting high-tech and clean energy applications.
Electric Utilities	Companies involved in energy generation and distribution.

Table 4.1: Overview of constructed industry indices

4.4 Equal Weight

In constructing the industry indices, we opted for an equal-weighting methodology. This decision was made to address challenges inherent in alternative market weighting methods. A market value-weighted approach led to certain industries being dominated by one or a few companies, occasionally exceeding 90% of the total weight. This created an overreliance on individual companies, complicating the interpretation of industry-level results. In contrast, equal weighting assigns each company the same weight, regardless of size. This may overrepresent smaller firms with limited market impact, leading to a less accurate reflection of overall market dynamics. However, it offers a more balanced and broader representation of industry performance, aligning with the goals of our study.

To construct the industry returns, we computed each company's logarithmic returns based on their daily closing price and weighed these equally. We decided to use logarithmic returns due to their additive properties and compounding effects, which simplify the analysis of cumulative returns and ensure consistency in measuring performance changes over time. Furthermore, logarithmic returns provide a more normalized measure of volatility and align better with the normality assumption (Campbell et al., 1997), thus increasing the robustness of the analysis. The daily logarithmic return is computed accordingly:

$$\text{Daily Return} = ln\frac{P_t}{P_{t-1}} \tag{4.1}$$

4.5 Fama French

The data used for the Fama-French five-factor models was obtained from Kenneth R. French data library (2024). We collected the daily values for each of the five factors, in addition to the momentum factor, for each of the indices we analyzed. For Europe and the U.S., we used their respective Fama-French factors, while for Asia, we used the Asia Pacific ex. Japan daily factors. This choice was based on the availability of data, as the Fama-French database provides separate factors for Asia Pacific ex. Japan and Japanese factors, rather than a combined Asia Pacific set. We concluded that the Asia Pacific ex. Japan factors were the best fit for our analysis.

5 Methodology

In this chapter, we present the methodology used to assess the market reactions following the Inflation Reduction Act. We start by explaining the event study framework, which is a common approach for assessing how specific events affect financial markets. Additionally, we provide an overview of the statistical tests and diagnostic tools used to assess the reliability of our results. By establishing a clear methodological foundation, this chapter aims to ensure transparency in the analysis that follows.

5.1 Event study

Event studies are widely used in economics and finance to measure the impact of a specific event on the stock prices of companies. The main idea behind this method is that if markets are efficient, new information will be quickly reflected in stock prices, allowing researchers to estimate the event's economic effect through price changes observed over a short period of time (MacKinlay, 1997). The event study methodology also relies on the assumption that the event is unexpected and has not yet been factored into the stock price and that no other events occur during the event window that could influence the stock price change (Brown & Warner, 1980).

In the following, we will give a brief explanation of the efficient market hypothesis, before we explain the necessary steps for an event study.

5.1.1 Efficient Market Hypothesis

The efficient market hypothesis is a fundamental theory in financial economics that describes how information is incorporated into market prices. First developed by Fama (1965), the hypothesis suggests that in an efficient market, all available information is fully reflected in stock prices. Thus, it should be impossible to achieve consistently superior returns without assuming additional risk. When new information is presented, market participants act on it immediately, causing prices to adjust to a fair level that reflects the new information.

The efficiency of a market is determined by how quickly stock prices absorb new information

(Fama et al., 1969). Fama (1970) presented three forms of market efficiency: weak, semi-strong, and strong. The weak form of efficiency suggests that stock prices only reflect widely available data, such as historical prices. Further, the semi-strong form extends this by stating that all publicly available information, such as financial reports and news, is reflected in current prices. This implies that it is not possible for investors to earn abnormal returns based on public data. Finally, the strong form states that all information, public and private, is reflected in stock prices, implying that even insiders cannot consistently outperform the market. It is generally understood that stock markets operate with a level of efficiency close to the semi-strong form, in which publicly available information is quickly incorporated into prices (Fama, 1991).

Market efficiency is closely associated with the concept of unpredictability of stock prices, often described as a "random walk". This theory suggests that price changes are random and driven by the arrival of new information, which is naturally unpredictable. The concept of random walk in stock price movements was first identified through early time-series analyses of market data conducted by Kendall and Hill (1953). Their research aimed to identify patterns that could predict future stock prices but found no consistent behavior, concluding that price changes are random. This does not imply irrationality; rather, it reflects how investors compete to quickly act on new information, causing stock prices to adjust efficiently as this information becomes available (Bodie et al., 2024).

The concept of market efficiency is particularly relevant in event studies, which aim to measure the impact of new information or events on stock prices. According to Fama (1991), the clearest evidence of market efficiency comes from event studies, particularly those focused on daily returns. These studies provide a clear insight into how quickly and accurately prices adjust to new information, thus offering a measure of the market's responsiveness.

5.1.2 Event window

The first step in an event study is to define the event of interest, such as a policy announcement or major news affecting companies. The event window, which includes the days immediately before or after the event, is chosen to capture any immediate market reaction or information leakage (MacKinlay, 1997). This window helps isolate the event's impact on stock prices. The duration of this window can have a significant impact on the results. While a too short event window may risk excluding relevant price reactions, a too long window increases the chances of concomitant treatments. An important assumption of the event study methodology is that there are no other significant events during the event window that could affect the stock prices and confound the results (Binder, 1998; McWilliams et al., 1999).

The event we chose for our analysis took place on July 27, 2022, when Senator Manchin and Democratic majority leader Chuck Schumer unexpectedly reached a deal (Friedman & Plumer, 2022). As this deal was made public after the stock market had closed, the first trading day was July 28, 2022. This event is the same "green" event analyzed by Bauer et al. (2023) in their event study. The surprising nature of this agreement makes it an ideal candidate for an event study, as it allows us to capture the market's reaction to the sudden realization of policy transition risk.

We have chosen to highlight four event windows in our study. The first two windows contain the days before the announcement. The first event window is the two trading days prior to the event, July 26 and 27, which will be referred to as -2:-1. The second is the four trading days prior to the event and will be referred to as -4:-1. The rationale for including these event windows is to investigate any abnormal returns prior to the event due to potential information leakage. The third event window, 1:2, contains the two trading days after the event. This will capture the immediate reactions after the deal was made public, which is when we expect the most significant results to occur. The last event window, 1:4, adds two trading days to the previous window. This is meant to capture any delayed market reactions and/or corrections, which is useful to discuss.

5.1.3 Estimation window

Before we can model the expected return, we must define an estimation window from which the regression parameters are estimated (MacKinlay, 1997). The estimation window establishes a baseline for normal stock performance by examining returns before the event. While there are no strict rules for determining the length of the estimation window, it is important that it does not overlap with the event to avoid contamination from the event itself on normal performance (MacKinlay, 1997).

The length of the estimation window can vary. Armitage (1995) suggests that for estimation windows exceeding 100 days, variation in the length of windows has a minimal impact on results. However, the estimation window should strike a balance between length and relevance. Extending the window too far back may risk incorporating outdated market conditions that no longer reflect the current foundation of expected returns (Strong, 1992). At the same time, it should be long enough to provide sufficient data for accurate estimation (Krivin et al., 2003). In our analysis, we selected an estimation window of 100 trading days. Our estimation window ends 10 trading days before the announcement date, July 13, to prevent overlap with the event. Additionally, since July 14 is identified as a brown event by Bauer et al. (2023), we avoid including it in the estimation window.

5.1.4 Expected return model

Now that we have defined an estimation window, we can estimate the expected return for the event window, given that no event takes place. There are several models that can be used to compute expected returns. MacKinlay (1997) divides these models into statistical and economic models. The former category includes models that take statistical assumptions on the behavior of asset returns and do not take any economic arguments into account. Economic models, on the other hand, follow from economic theory but must also be in line with statistical assumptions. Hence, some economic models are cast as restrictions on the statistical models (MacKinlay, 1997).

A commonly used statistical model is the market model, which relates the return of any given asset to the return of the market portfolio (MacKinlay, 1997). The market model takes the form

$$R_{it} = \alpha_i + \beta R_{mt} + \epsilon_{it} \tag{5.1}$$

where R_{it} and R_{mt} are the asset excess return and market excess return on time t. The error term is expressed as ϵ_{it} and has expectation $E(\epsilon_{it}) = 0$ and variance $Var(\epsilon_{it}) = \sigma^2_{\epsilon_i}$. α_i and β_i are parameters and are estimated by the model.

In our event study, we have used the statistical model, the Fama-French factor model by Eugene Fame and Kenneth French, as it has been shown to have better explanatory power (Hussain et al., 2002). Specifically, we use the extended Five Factor model. We have also included a momentum factor, leading to a total of six factors: Market Return, Small Minus Big (SMB), High Minus Low (HML), Robust Minus Weak (RMW), Conservative Minus Aggressive (CMA), Up Minus Down (UMD). The econometric model takes the form

$$R_{it} = \alpha_i + \beta_{i1} R_{Mt} + \beta_{i2} SMB_t + \beta_{i3} HML_t + \beta_{i4} RMW_t + \beta_{i5} CMA_t + \beta_{i6} UMD_t + \epsilon_{it} \quad (5.2)$$

Thus, we can express the normal or expected return as

$$E(R_{it}) = \hat{\alpha}_i + \hat{\beta}_{i1} R_{Mt} + \hat{\beta}_{i2} SMB_t + \hat{\beta}_{i3} HML_t + \hat{\beta}_{i4} RMW_t + \hat{\beta}_{i5} CMA_t + \hat{\beta}_{i6} UMD_t \quad (5.3)$$

To estimate the factor loadings or betas for the linear model we use the ordinary least squares (OLS) method. Later in this chapter, we will discuss the assumptions that must hold for the OLS-method to be applicable.

5.1.5 Computing abnormal return

Now that we have estimated the predicted return values, we can compute the abnormal return, which is defined as the actual return less the predicted expected return:

$$\hat{AR}_{it} = R_{it} - E(R_i t) \quad (5.4)$$

During normal circumstances, actual returns and expected returns should naturally be quite similar, resulting in negligible abnormal returns. However, under the circumstance of a significant event, such as the IRA in this case, we can measure the size of abnormal returns. Furthermore, to analyze the accumulated effect during the event window, we can compute the cumulative abnormal return as

$$C\hat{A}R_{i,(t_1,t_2)} = \sum_{t=t_1}^{t_2} \hat{AR}_{it} \quad (5.5)$$

where t_1 and t_2 are the start and end of the event window.

5.2 Assumptions for the Time Series Regression

In this section, we will give an overview of the time series regression assumptions TS.1-6. It is important to understand these assumptions and the consequences in case any of them fail. Initially, assumptions TS.1-3 are needed to show that the ordinary least squares (OLS) estimators are unbiased (Wooldridge, 2020). This essentially means that the estimators are centered around the true population parameters. However, this does not mean that there are no other unbiased estimators with lower variance. When adding TS.4 and TS.5, we can say that the OLS estimator is the best linear unbiased estimator (BLUE), with "best" indicating that the estimator has the smallest variance among unbiased linear estimators. Assumptions TS.1 through TS.5 are known as the Gauss-Markov Theorem (Wooldridge, 2020), and when satisfied we can confidently say something about the expected value and variance of the estimator. However, we know essentially nothing about the sampling distribution of the estimator. Thus, we cannot trust statistical inference. When also adding assumption TS.6, this problem is mitigated. Having established the relevance of the various TS assumptions, we will now provide an overview of their contents.

Before we describe the time series regression assumptions, it is useful to define some notations. x_{tk} is the independent variable k in time t. $\boldsymbol{x_t}$ refers to all independent variables at time t, and $\boldsymbol{X}$ refers to all independent variables for all time periods.

Assumption TS.1 is "Linearity in Parameters". This means that the model can be written as

$$y_t = \beta_0 + \beta_1 x_{t1} + ... + \beta_k x_{tk} + \upsilon_t \tag{5.6}$$

The main feature is that the model is linear in its parameters. The dependent variable and the independent variables can however be arbitrary functions the variable of interest, such as squares and natural logarithms (Wooldridge, 2020). The linearity assumption is essentially the same as for cross-sectional data, except that it includes a time dimension.

Assumption TS.2 is "No Perfect Collinearity". This assumption states that none of the independent variables can have an exact linear relationship to one another. This does not mean that there can be no correlation between the independent variables, but they cannot be perfectly correlated (Wooldridge, 2020).

Assumption TS.3 is "Zero Conditional Mean" and is, according to Wooldridge (2020), the most important assumption needed for unbiasedness of estimators. It indicates that the error term at time t, u_t, is uncorrelated with all explanatory variables across all time periods. Mathematically, we describe it

$$E(u_t|\boldsymbol{X}) = 0, t = 1, 2, ..., n. \tag{5.7}$$

A common reason that this assumption is violated is by omitting significant variables in the model that correlate with one or more of the independent variables. The effect of this omitted variable will then be captured by the error term. This is known as omitted variable bias.

Assumption TS. 4 is "Homoskedasticity". This means that the variance of the error term given all different observations for all different points in time has to be constant. Mathematically,

$$Var(X) = Var(\upsilon_t) = \sigma^2, t = 1, 2, ..., n. \tag{5.8}$$

When this assumption is violated, we say that the errors are heteroskedastic (Wooldridge, 2020).

Assumption TS.5 is "No Serial Correlation". This means that, conditional of X, the errors in two different time periods must be uncorrelated. Mathematically,

$$Corr(\upsilon_t, \upsilon_s|\mathbf{X}) = 0 \tag{5.9}$$

for all $t \neq s$. When this assumption is violated, we say that there is autocorrelation in our errors.

The last assumption, TS.6, is "Normality". It states that the error term υ_t must be independent of all the explanatory variables for all time periods, normally distributed with zero mean and constant variance. According to Wooldridge (2020), this assumption is much stronger than any of the previous assumptions in the sense that it implies TS.3 through TS.5, and includes the independence and normality assumption. As mentioned, by adding the normality assumption to the Gauss-Markov assumptions, we can perform statistical inference, as we will come back to later in this chapter.

5.3 Test of Time Series Regression Assumptions

In this section, we assess whether the time series regression assumptions are satisfied through diagnostic analyses and statistical tests. These evaluations are critical for ensuring the validity and reliability of our regression results. For simplicity, we focus our discussion on four selected industries: *Renewable Equipment*, *Renewable Energy*, *Electric Vehicles*, and *Pharmaceuticals*. The diagnostic results for the remaining industries are available in the appendix. See A.5.

5.3.1 Assumption TS.1, TS.2, and TS.4

5.3.1.1 Residual Plot

The residual plot is a useful tool to assess several of the time series regression assumptions. It is a scatterplot that shows the difference between the observed and the fitted values on the y-axis and the fitted values on the x-axis.

When assessing the linearity assumption, we are looking to see if there are any patterns in the residual plot. If yes, this might indicate a violation of the linearity assumption. In other words, this means that the linear regression model is not a good model for the true population.

When assessing the zero conditional mean assumption, we are checking whether the residuals are centered around zero for any given level of the fitted values. If this is not the case, this might indicate there are omitted variables that bring systematic bias to the model.

When assessing the homoscedasticity assumption, we are looking to see if the residuals are increasing (or decreasing) in size with higher levels of the fitted values. To get a picture of how this could look like we can think of a “megaphone”. If the residual plot shows this shape in either direction, the assumption of homoscedasticity is violated.

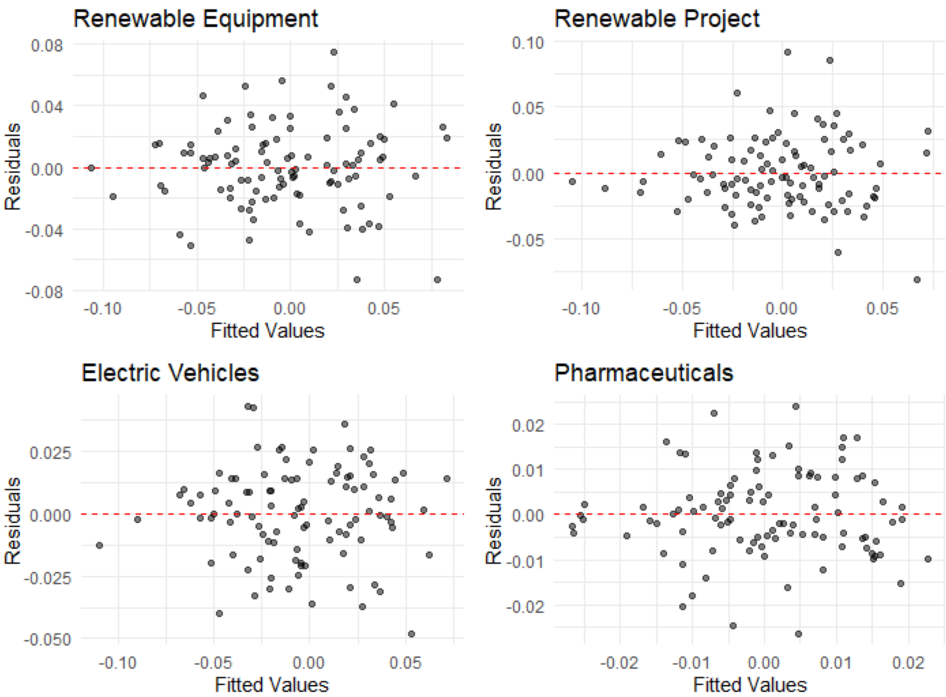


Figure 5.1: Residual plots for selected U.S. industries

In figure 5.1, the residuals appear to be randomly scattered with no noticeable pattern for all selected models, indicating that the linearity assumption is maintained. Furthermore, we see that the residuals seem to be centered around zero and that the spread for all models seems consistent across different levels of fitted values. Thus, the zero conditional mean and homoscedasticity assumptions are maintained as well.

5.3.2 Assumption TS.2 No Perfect Collinearity

5.3.2.1 Correlation Matrix

The correlation matrix shows the pairwise correlation matrix between the explanatory variables, in our case, the Fama-French factors. We use this tool to check for the no perfect collinearity assumption. The correlation coefficient ranges from -1 to 1, where -1 indicates perfect negative correlation, 0 indicates no correlation, and 1 indicates perfect positive correlation.

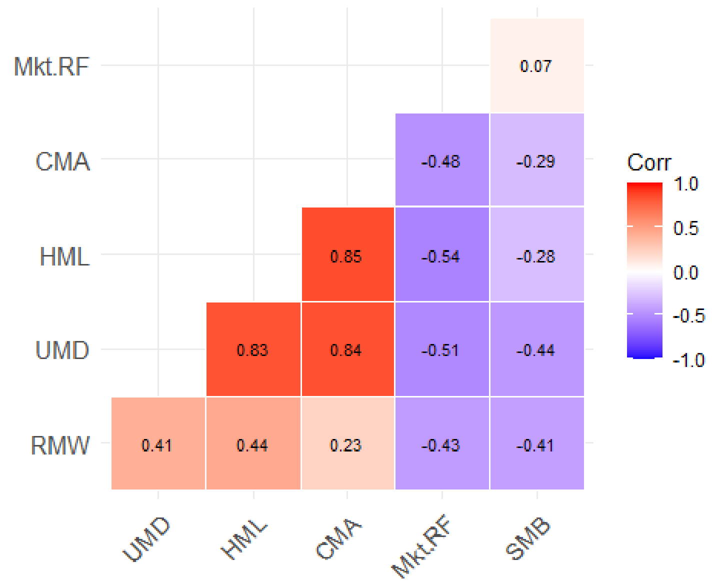


Figure 5.2: Correlation matrix

From the correlation matrix in figure 5.2, we can see that there is a strong positive correlation between HML, CMA, and UMD. We will therefore investigate these explanatory variables further by conducting a variance inflation factor analysis (VIF).

5.3.2.2 VIF-analysis

The VIF-analysis quantifies how much of the variance of a regression coefficient that is inflated due to collinearity with other predictors. There is no clear cutoff value, but VIF-values above 10 can indicate that multicollinearity can be a problem (Wooldridge, 2020).

From our analysis, we find the VIF-values 5.39, 5.60, and 4.93 for HML, CMA, and UMD, respectively. See table A.14. Thus, there is no evident reason to believe that we have a problem with collinearity between our explanatory variables.

5.3.3 Assumption TS.5 No Serial Correlation

5.3.3.1 ACF PLot

An ACF plot (Autocorrelation Function) is a graphical representation of the autocorrelation for a time series, with lags on the x-axis and correlation on the y-axis. The lags represent the time steps by which the time series is shifted to compute the correlation. The first value is the lag 0 and will always take the value of 1. This should be obvious as any observation has a perfect correlation with itself. Thus, we are interested in the ACF values starting from lag 1. If the bar on the plot crosses the red line in any direction, this indicates that autocorrelation is a problem.

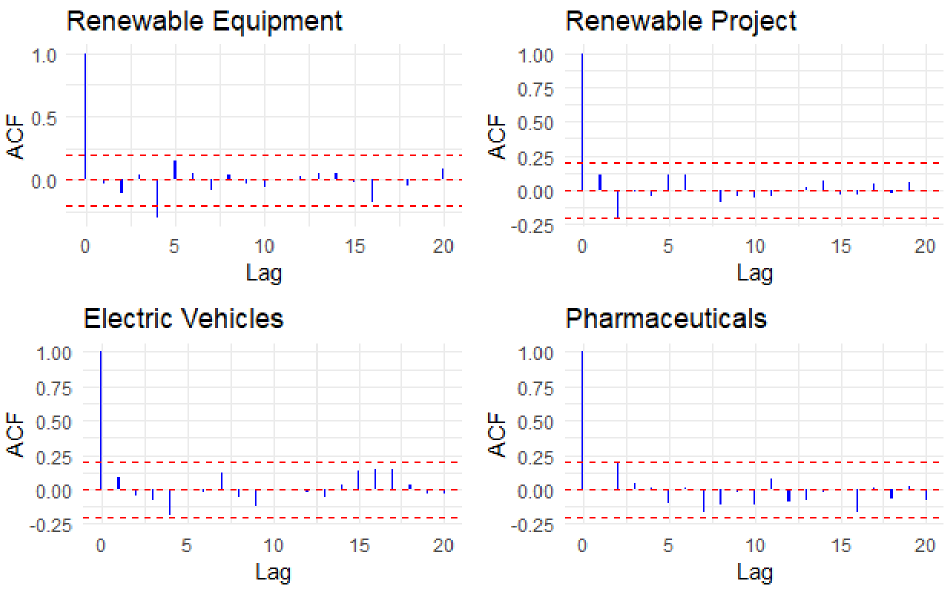


Figure 5.3: ACF plots for selected U.S. industries

From the ACF plots in figure 5.3, we see that autocorrelation might be a problem for the renewable equipment industry, where lag 4 slightly dips below the horizontal red line. This means that residuals separated 4 trading days tend to move in opposite directions, i.e., if one residual is positive, the one 4 lags away tends to be negative, and vice versa.

5.3.4 Assumption TS.6 Normality

5.3.4.1 QQ plot

When assessing the normality assumption, the QQ plot is a particularly useful diagnostic tool. It is a scatterplot that compares the quantiles of the observed data to the quantiles of a theoretical normal distribution. If the normality assumption holds, the data points will closely align with the diagonal reference line. However, significant deviations, especially in the tails, may indicate a violation of the normality assumption, which should be investigated more thoroughly.

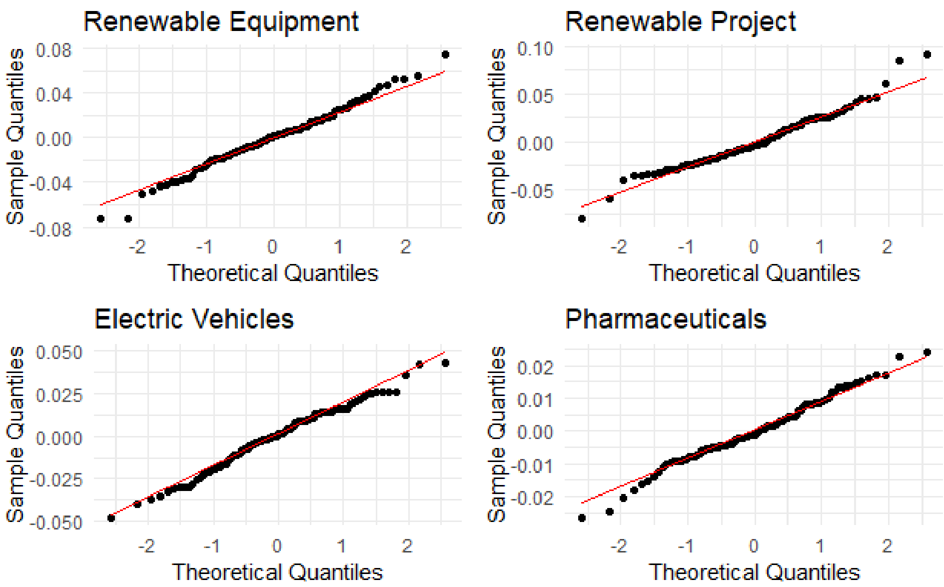


Figure 5.4: QQ plots for selected U.S. industries

For all four plots, the majority of the data points closely align with the red line, indicating that the residuals are approximately normally distributed. However, we do observe slight deviations in the tails for all industries, that indicate minor departures from the normal distribution. This can be due to extreme values as a result of significant events during the estimation period.

5.4 Statistical inference

The event study methodology aims to determine whether abnormal returns on the event day or during the event window are significantly different from what we typically would expect. To investigate this, a hypothesis test is conducted, where the null hypothesis suggests that the expected abnormal return is zero (MacKinlay, 1997). If the null hypothesis is rejected, then the opposite must be true, that the abnormal return is significantly different from zero, and that there is a relationship between the event and the abnormal return. Generally, we can describe it

$$\begin{aligned} H_0 &: E(AR) = 0 \\ H_A &: E(AR) \neq 0 \end{aligned} \tag{5.10}$$

The corresponding t-statistic can be calculated as

$$t = \frac{AR_{it}}{S_{AR_i}} \tag{5.11}$$

where S_{AR} denotes the sample standard deviation of the abnormal returns during the estimation window. The sample variance is given as

$$S^2_{AR_i} = \frac{1}{M_i - K} \sum_{t=T_0}^{T_1} AR^2_{it} \tag{5.12}$$

where M_i is the number of non-missing returns in the estimation window and, K is the degree of freedom in the regression model. In our model, $K = 7$, given by the six independent variables plus the intercept constant. Furthermore, T_0 and T_1 are the beginning and end of the estimation window.

Since we are also interested in the cumulated abnormal returns during the event window, we test

$$\begin{aligned} H_0 &: E(CAR) = 0 \\ H_A &: E(CAR) \neq 0 \end{aligned} \tag{5.13}$$

The corresponding t-statistic is calculated as

$$S^2_{CAR_i} = L_2 S^2_{AR_i} \tag{5.14}$$

Here, L_2 is denoted as the length (number of days) of the event window.

After calculating the t-statistic, we can find the corresponding p-value, which is the probability that the chosen test statistic would have been at least as extreme as its observed value, given that the null hypothesis is true. If the p-value is equal to or lower than 5% (commonly used significance level), we reject the null hypothesis.

6 Results

In this chapter, we present findings from our event study. The results are structured to address the two research questions in our thesis.

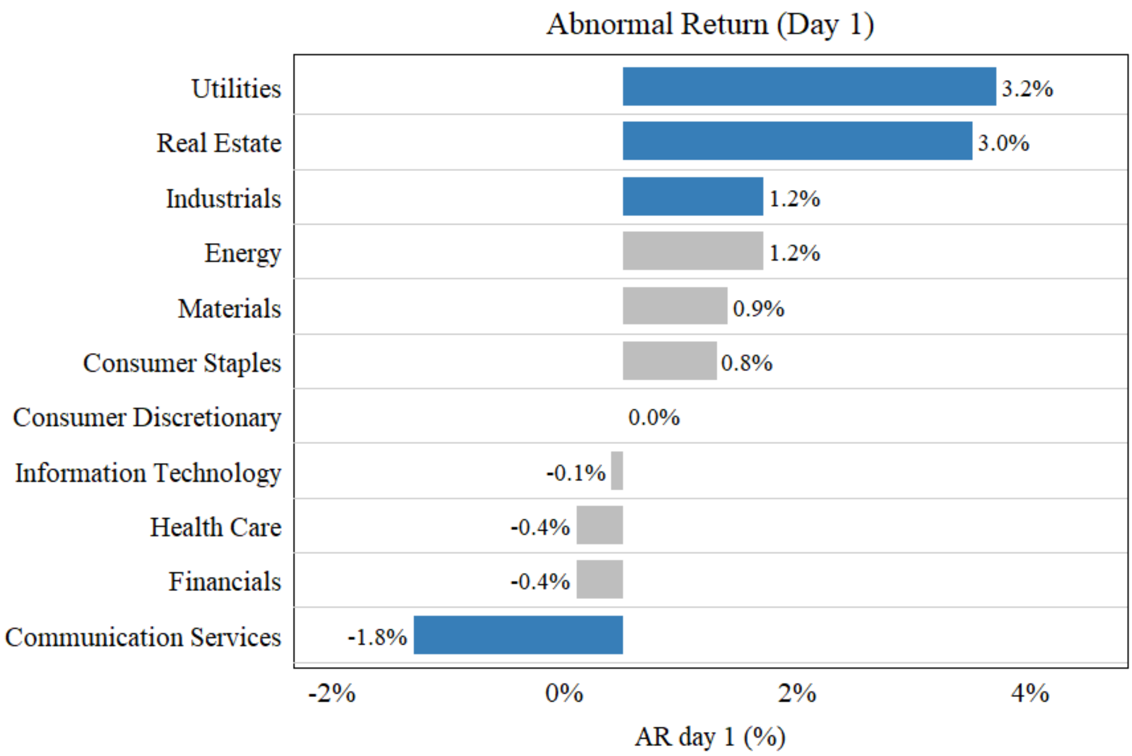
To begin with, we present the results for the broad GICS sectors within the U.S. market. This provides an overview of how the U.S. stock market responded to the IRA announcement. Following this, we narrow our focus to our custom-constructed industries that are likely to be affected by the IRA provisions. These industries are analyzed for the three regions: the U.S., Europe, and Asia. Finally, we perform a comparative analysis of the most significant industries across regions, highlighting the similarities and differences in how markets responded to the IRA.

6.1 Results for GICS U.S. sectors

In the following, we will present the results of the event study conducted on the S&P 500 indices, classified according to the GICS standard. These indices are value-weighted and provide a reference point for understanding how broader market dynamics and sectoral performances were impacted by the Inflation Reduction Act.

6.1.1 Initial abnormal returns

In figure 6.1, we observe the abnormal returns (AR) from the GICS level 1 sectors on the first trading day after the IRA was announced.



P-value < 5% = Dark blue. P-value < 10% = Light blue. P-value > 10% = Grey

Figure 6.1: Abnormal Return Trading Day 1

As seen from figure 6.1, of the eleven GICS sectors, *Utilities*, *Real Estate*, *Industrials*, and *Communication Services* exhibit significant abnormal returns on the first trading day. Of these, *Utilities* shows the strongest reaction with an abnormal return of 3.2%. *Real Estate* follows closely with an AR of 3.0%, while *Industrials* has an abnormal return of 1.2%. Conversely, *Communication Services* exhibits a significant negative abnormal return of -1.8%. The rest of the sectors do not show any significant abnormal returns.

6.1.2 Post-event windows

Table 6.1 shows the cumulative abnormal returns of the post-event windows. Significant CAR-values are highlighted and colored dependent on positive or negative CARs.

GICS	**1 : 2**		**1 : 4**	
Sector	**CAR**	**P-value**	**CAR**	**P-value**
Health Care	**-2 %**	**5 %**	-2 %	14 %
Information Technology	0 %	98 %	0 %	78 %
Financials	**-2 %**	**0 %**	-2 %	8 %
Energy	**6 %**	**0 %**	3 %	15 %
Utilities	**4 %**	**1 %**	**4 %**	**2 %**
Industrials	**2 %**	**0 %**	**2 %**	**0 %**
Consumer Discretionary	**2 %**	**4 %**	3 %	6 %
Consumer Staples	-1 %	59 %	2 %	30 %
Communication Services	**-3 %**	**0 %**	**-4 %**	**0 %**
Real Estate	3 %	6 %	1 %	59 %
Materials	1 %	47 %	0 %	81 %

Table 6.1: GICS CAR Post-Event Windows

The results reveal considerable variation in CARs across the S&P 500 GICS sectors, highlighting how different industries reacted to the IRA. Notably, *Health Care*, *Financials*, *Energy*, *Utilities*, *Industrials*, *Consumer Discretionary* and *Communication Services* display significant CARs in one or more post-event windows.

Not surprisingly, we observe similar patterns to the abnormal returns seen on trading day 1. *Utilities* maintains a strong positive performance throughout, with CAR values of 4% in both windows and corresponding p-values of 1% and 2%, respectively. The most notable abnormal returns occur within the first event window, reflecting an immediate reaction to the IRA announcement.

Similarly, the energy sector, comprising companies involved in oil, gas, consumable fuels, and energy equipment, demonstrates a strong immediate reaction to the IRA. It records a CAR of 6% in the first event window (1:2), supported by a highly significant p-value of 0%. However, as the window extends, the sector's performance weakens, with CAR decreasing to 3% and insignificant in the subsequent event window. *Real Estate* shows a similar pattern, with a CAR of 3%, significant at the 10%-level in the 2-day window and insignificant in the 4-day window.

The industrial sector exhibits significant positive CARs of 2% across both event windows with corresponding p-values of 0%. *Consumer Discretionary* has a significant CAR of 2% at the 5% level in the first window and a CAR of 3%, significant at the 10% level in the subsequent window.

Conversely, the financial, health care, and communication services sectors exhibit significant negative CARs in the post-event windows. The financial sector has CAR values of 2% in the two windows, significant at the 5% and 10% levels, respectively. Moreover, *Health Care* has a significant CAR of -2% at the 5% level in the 2-day window. While the CAR value remains unchanged across event windows, its statistical significance diminishes over time. *Communication Services* experiences a more sustained negative reaction, showing significant negative CARs of -3% and -4% with corresponding p-values of 0%.

Lastly, sectors like *Consumer Staples*, *Information Technology*, and *Materials* show minor and statistically insignificant CARs across both windows.

6.1.3 Pre-event windows

Table 6.2 shows the cumulative abnormal returns of the GICS sectors during the pre-event windows.

GICS	**-2 : -1**		**-4 : -1**	
Sector	**CAR**	**P-value**	**CAR**	**P-value**
Health Care	0 %	96 %	0 %	75 %
Information Technology	1 %	15 %	0 %	70 %
Financials	-1 %	10 %	-1 %	28 %
Energy	1 %	66 %	2 %	29 %
Utilities	0 %	84 %	1 %	71 %
Industrials	0 %	53 %	-1 %	52 %
Consumer Discretionary	-1 %	22 %	0 %	81 %
Consumer Staples	-1 %	35 %	-2 %	27 %
Communication Services	**2 %**	**1 %**	1 %	68 %
Real Estate	0 %	77 %	1 %	79 %
Materials	-1 %	33 %	-2 %	19 %

Table 6.2: GICS CAR Pre Event Windows

As seen from table 6.2, the pre-event windows show limited marked responses across all sectors, with only *Communication Services* showing a positive significant CAR of 2% at the 5% level in the 2-day window. *Financials* exhibit significant CARs at the 10% level in the -1:-2 event window. As these are the only observations significant at the 10% level, it suggests that the market did not anticipate or price in the Inflation Reduction Act prior to its announcement.

6.1.4 Discussion of GICS sector reactions

In this section, we will briefly discuss the results of the GICS sector reactions as we will go into more depth about the reactions of our selected U.S. industry indices. First, we will discuss the results of sectors that exhibited positive abnormal returns. Subsequently, we will discuss the sectors exhibiting negative results. Before each discussion, we present graphs with the relevant sectors to illustrate the development of cumulative abnormal returns during the period before and after the event.

6.1.5 Positive abnormal returns

Figure 6.2 shows the sectors exhibiting significant positive returns in one or more event windows.

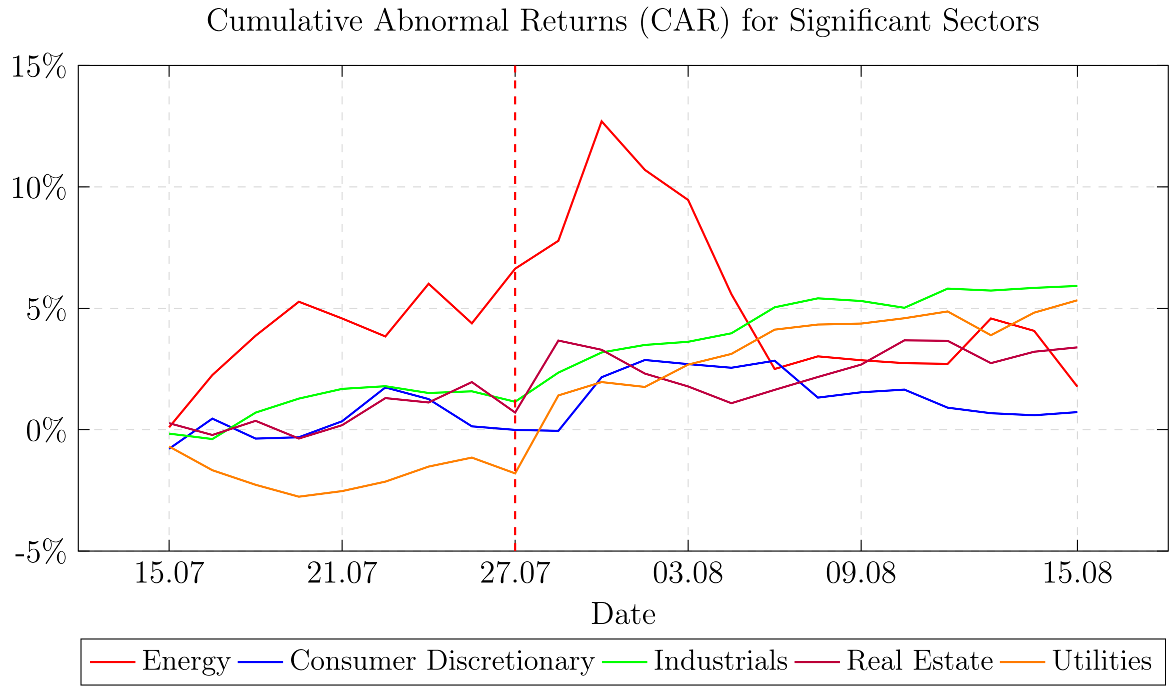


Figure 6.2: Chart with sectors experiencing positive returns

6.1.5.1 Energy

The energy sector showed a significant positive CAR of 6% in the 1:2 window but lacked significance on day 1 and in the 1:4 window, indicating mixed investor confidence. The S&P 500 GICS energy sector is primarily comprised of companies involved in activities related to oil and gas. Given the act's strong focus on decarbonization and clean energy development, it would be reasonable to anticipate negative market reactions. However, the positive reaction observed could be attributed to market optimism about transitional opportunities, as these companies are diversifying into areas like natural gas, carbon capture and storage, etc (Segal, 2021). It is worth noting that the sector begins to increase the day before and experiences a substantial correction following the initial positive reaction, as observed in figure 6.2. Whether this defined spike is driven by pure speculation or new information is not clear. We will delve deeper into the oil and gas sector later in this chapter.

6.1.5.2 Utilities

As previously mentioned, the utilities sector exhibited significant positive results across all post-event windows. As an important enabler of the clean energy transition, the sector stands to benefit from increased electricity demand driven by the act, as well as subsidies and tax credits for renewable energy infrastructure, biogas, and natural gas services. These results align with the results of Bauer et al. (2023), who identified utilities as major beneficiaries of the IRA due to the aforementioned increased electricity demand and provisions. As seen in figure 6.2, the sustained positive reaction reflects investor confidence in the sector's ability to leverage these incentives and capitalize on the resulting opportunities.

6.1.5.3 Industrials

The industrial sector recorded significant AR and CARs in all post-event windows, reflecting investor optimism on the act's implications for the sector. Key subsectors such as machinery and equipment, electrical equipment, construction, and transportation are impacted by the act's focus on clean energy, infrastructure development, and energy efficiency. Particularly, the $9 billion in rebates for energy-efficient and electric appliances, along with 10-year consumer tax credits for items such as heat pumps, electric HVAC systems, and solar panels, are likely to drive demand for industrial manufacturers. This increased demand for producing and installing these technologies likely drove the sector's positive returns. This is consistent with the results of Bauer et al. (2023), who saw construction, transportation, and machinery and equipment all exhibiting positive abnormal returns.

6.1.5.4 Consumer Discretionary

The consumer discretionary sector showed significant positive CARs at the 5%- and 10% levels in the 2- and 4-day post-event window, respectively. The sector comprises a wide range of industries, including automobile manufacturers, retailers, restaurants, and entertainment and travel companies. The positive reaction likely reflects optimism about IRA provisions, such as electric vehicle tax credits, benefiting manufacturers and retailers within the sector. The sector's reliance on consumer affordability may also suggest investor confidence in increased discretionary spending. However, the lack of abnormal returns on the first trading day and the significant positive CAR before the event warrants caution, as it is harder to directly attribute the results to the IRA.

6.1.5.5 Real Estate

Real Estate exhibits positive a positive reaction following the IRA, but loses statistical significance during the multi-day event windows. Therefore, the results should be interpreted with caution. However, the significant abnormal return could reflect a positive reaction to the IRA's targeted incentives for energy efficiency and clean energy development. These support energy-efficient upgrades in commercial and residential properties, reducing costs and boosting property value (Millett & Adams, 2022).

6.1.6 Negative abnormal returns

Figure 6.3 shows the sectors that exhibited significant negative CARs during one or more event windows.

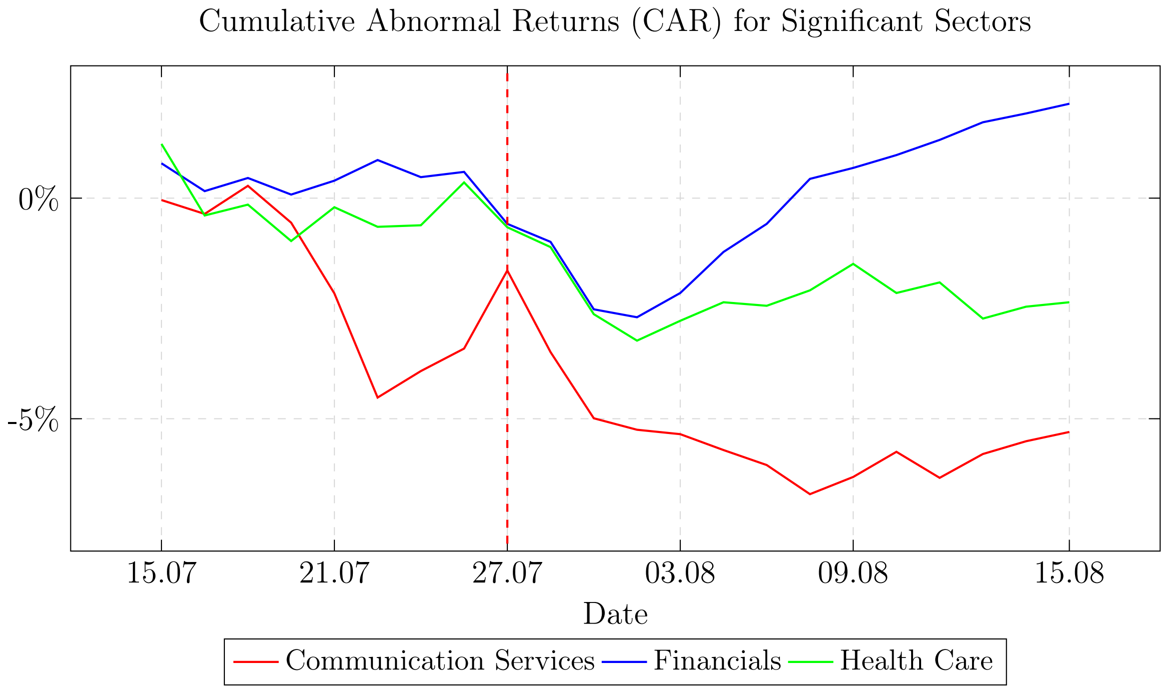


Figure 6.3: Chart with sectors experiencing negative returns

6.1.6.1 Health Care

The health care sector showed a significant negative reaction in the 1:2 window. However, it did not exhibit significant results on trading day 1 or in the 4-day window, reducing the robustness of the results. The sector includes the subsectors pharmaceuticals, biotechnology, health care providers and medical equipment manufacturers. The sector's negative reaction is likely driven by the IRA's provisions, such as Medicare's ability to negotiate drug prices and impose inflation caps, which reduces the pricing power of drug companies (Drozdowski & Kachinsky, 2023). However, as is evident from 6.3, the sector began to decline a day earlier. This could indicate potential information leakage or suggest that the sector is responding to external factors.

6.1.6.2 Financials

The financial sector exhibited a negative reaction in the 2-day post-event window. However, it is worth noting that the significance decreases to 8% p-value in the 4-day window, while showing an insignificant abnormal return on the first trading day. Further, the negative reaction starts the day before the announcement, as seen in figure 6.3. The negative CARs align with findings from Bauer et al. (2023), which attributed similar negative reactions to the IRA's introduction of a 15% minimum corporate tax on large corporations. This provision is particularly impactful for large banks and insurance companies, many of which have historically paid little or no federal taxes (Koronowski, 2022).

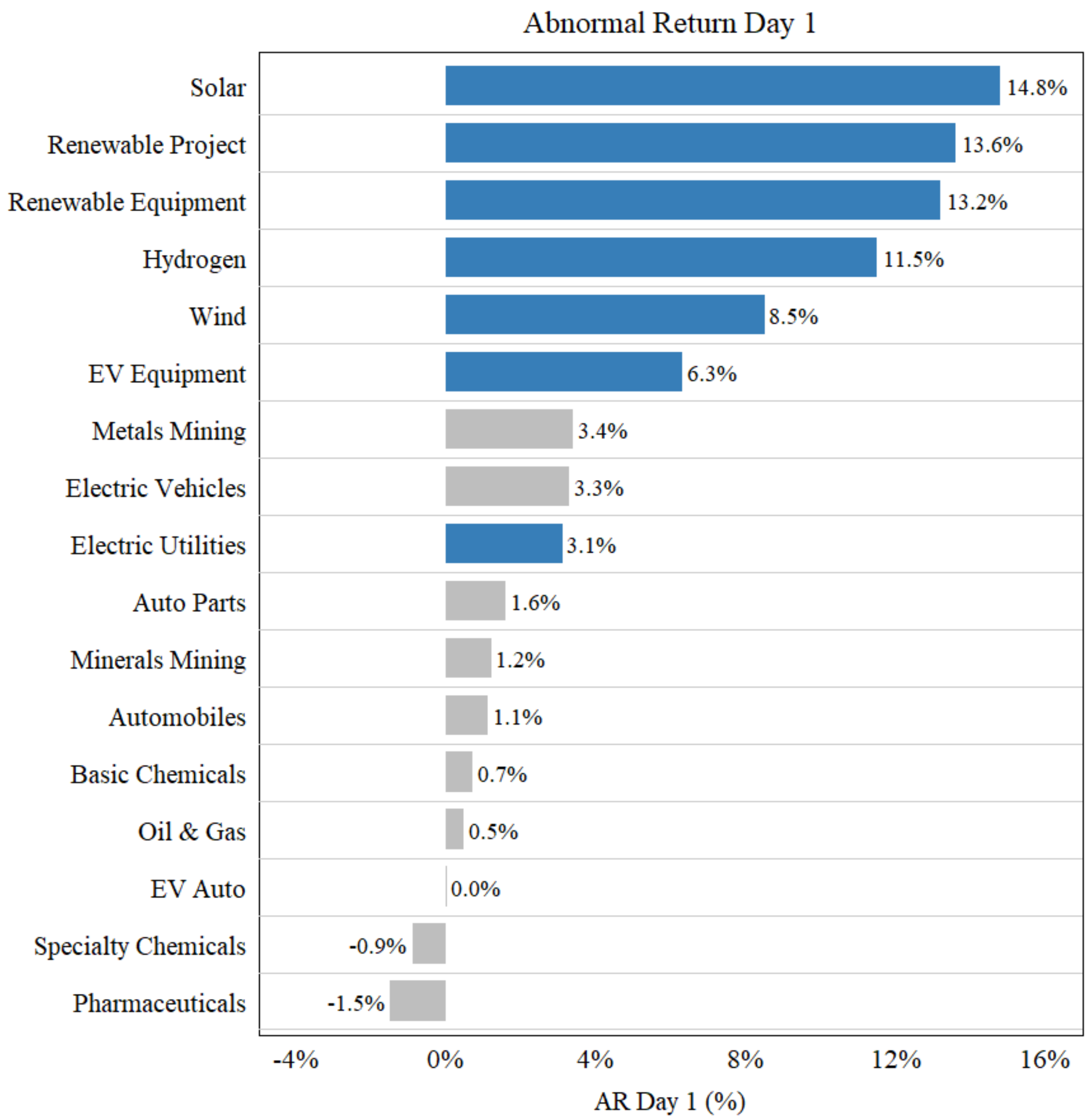
6.1.6.3 Communication Services

The communication services sector shows a significant positive CAR in the 2-day pre-event window but experiences a marked shift upon the IRA's announcement. This includes an initial significant negative abnormal return on day one, followed by continued negative CARs in subsequent windows. The sector appears to receive limited direct benefits from the IRA's provisions, and the introduction of the 15% corporate minimum tax may have contributed to the sector's negative returns.

6.2 Results from selected U.S. industry indices

6.2.1 Immediate abnormal returns

In figure 6.4, we observe the abnormal returns (AR) from selected industries on day 1, indicating the first trading day after IRA was announced.



P-value $<$ 5% = Dark blue. P-value $<$ 10% = Light blue. P-value $>$ 10% = Grey

Figure 6.4: Abnormal Return Trading Day 1

As we can see from figure 6.4, abnormal returns vary significantly across industries. Notably, the renewable energy industry exhibits the strongest abnormal returns. Of these, *Solar* shows the strongest reaction, with an AR of 14.8%. Next, *Renewable Project* and *Renewable Equipment* follow closely, with AR values of 13,6% and 13,2% respectively. *Hydrogen* and *Wind* also demonstrate substantial positive reactions with abnormal returns of 11.5% and 8.5%, respectively.

The electric vehicles industry, including companies throughout the supply chain, shows moderate abnormal returns of 3.3%. Interestingly, after dissecting the industry into electric vehicle manufacturers (*EV Auto*) and the remaining part of the supply chain (*EV Equipment*), we observe differing reactions. *EV Equipment* exhibits a strong positive abnormal return of 6,3%, while *EV Auto* shows no reaction.

Unsurprisingly, *Electric Utilities*, as a part of the GICS level 1 Utilities sector, follows the same trajectory as *Utilities* and sees a positive AR of 3.2%. The rest of the industries exhibit insignificant AR values.

6.2.2 Post-event windows

Table 6.3 highlights the cumulated returns during the event windows, along with their corresponding p-values.

U.S.	**1 : 2**		**1 : 4**	
Industry	**CAR**	**P-value**	**CAR**	**P-value**
Oil & Gas	**4 %**	**1 %**	1 %	74 %
Automobiles	4 %	15 %	5 %	20 %
Auto Parts	-1 %	47 %	-1 %	51 %
Renewable Equipment	**19 %**	**0 %**	**18 %**	**0 %**
Renewable Project	**20 %**	**0 %**	**17 %**	**0 %**
Solar	**21 %**	**0 %**	**16 %**	**1 %**
Wind	**13 %**	**0 %**	**11 %**	**0 %**
Hydrogen	**10 %**	**0 %**	**12 %**	**2 %**
Electric Vehicles	**6 %**	**1 %**	**10 %**	**1 %**
EV Auto	0 %	89 %	1 %	83 %
EV Equipment	**11 %**	**0 %**	**15 %**	**0 %**
Pharmaceuticals	**-3 %**	**4 %**	**-4 %**	**3 %**
Minerals Mining	3 %	27 %	4 %	32 %
Metals Mining	**8 %**	**1 %**	4 %	40 %
Basic Chemicals	-1 %	56 %	-1 %	59 %
Special Chemicals	-2 %	11 %	-2 %	42 %
Electric Utilities	**4 %**	**1 %**	**4 %**	**2 %**

Table 6.3: CAR of U.S targeted industries - Post-Event Windows

The renewable energy industry exhibits strong, significant positive CARs during both post-event windows for both project developers and equipment manufacturers. Both industries peak during the 2-day window, followed by a relatively small correction in the subsequent two trading days. When scoping in on the renewable subindustries, we see similar patterns for *Solar* and *Wind* peaking at 21% and 13% before correcting to 16% and 11%, respectively. *Hydrogen* also exhibits strong positive significant CARs during the post-event windows.

The electric vehicle industry shows mixed reactions from manufacturers and equipment suppliers, as also seen on day 1. While *EV Equipment* exhibits strong positive significant CAR in the 2-day and 4-day post-event window, *EV Auto* shows no significant CAR. Interestingly, we see a significant increase in CAR from the 2-day window to the 4-day window, indicating lingering reactions. Overall, *Electric Vehicles* have a strong positive significant CAR during both post-event windows.

Pharmaceuticals experienced negative significant CAR for both post-event windows. *Electric Utilities*, on the other hand, showed positive significant CARs following the event.

The oil & gas industry exhibits a modest, yet significant CAR during the 2-day post-event window. In the 4-day window, however, most of the gains are lost and the CAR is insignificant. The same pattern can be shown for *Metals Mining*. The rest of the custom-constructed industries show no significant CARs during any of the event windows.

6.2.3 Pre-event windows

Table 6.4 shows the cumulative abnormal returns for the U.S. targeted industries during the pre-event windows.

U.S. targeted	**-2 : -1**		**-4 : -1**	
Industry	**CAR**	**P-value**	**CAR**	**P-value**
Oil & Gas	1 %	40 %	3 %	16 %
Automobiles	0 %	97 %	3 %	45 %
Auto Parts	-1 %	41 %	-2 %	44 %
Renewable Equipment	3 %	42 %	6 %	29 %
Renewable Project	4 %	33 %	7 %	17 %
Solar	3 %	40 %	11 %	7 %
Wind	1 %	54 %	2 %	43 %
Hydrogen	0 %	93 %	6 %	25 %
Electric Vehicles	0 %	86 %	3 %	35 %
EV Auto	-1 %	72 %	1 %	80 %
EV Equipment	-1 %	76 %	3 %	52 %
Pharmaceuticals	1 %	67 %	1 %	62 %
Minerals Mining	-1 %	78 %	7 %	7 %
Metals Mining	2 %	46 %	**8 %**	**5 %**
Basic Chemicals	0 %	97 %	0 %	90 %
Special Chemicals	-2 %	28 %	-1 %	56 %
Electric Utilities	0 %	97 %	1 %	66 %

Table 6.4: U.S. targeted industries - Pre Event Windows

From table 6.4, we see that *Metals Mining* exhibits a significant positive return in the 4-day window. Also, *Minerals Mining* and *Solar* have positive CAR values, significant at the 10% level. None of these industries, however, show significant reactions during the 2-day window. Apart from this, there are no significant cumulated abnormal returns during the pre-event windows. This does not rule out the possibility of information leakage prior to the event, but we cannot, based on our findings, conclude that this has taken place. These findings support the claim that the announcement came as a surprise to the public, strengthening the application of the event study method in our thesis.

For the results of longer event windows both for pre-and post-event windows, see table A.11. In the longer windows, we observe that on a general note, the significance of the results decreases.

6.2.4 Discussion of targeted industry reactions

6.2.4.1 Renewables

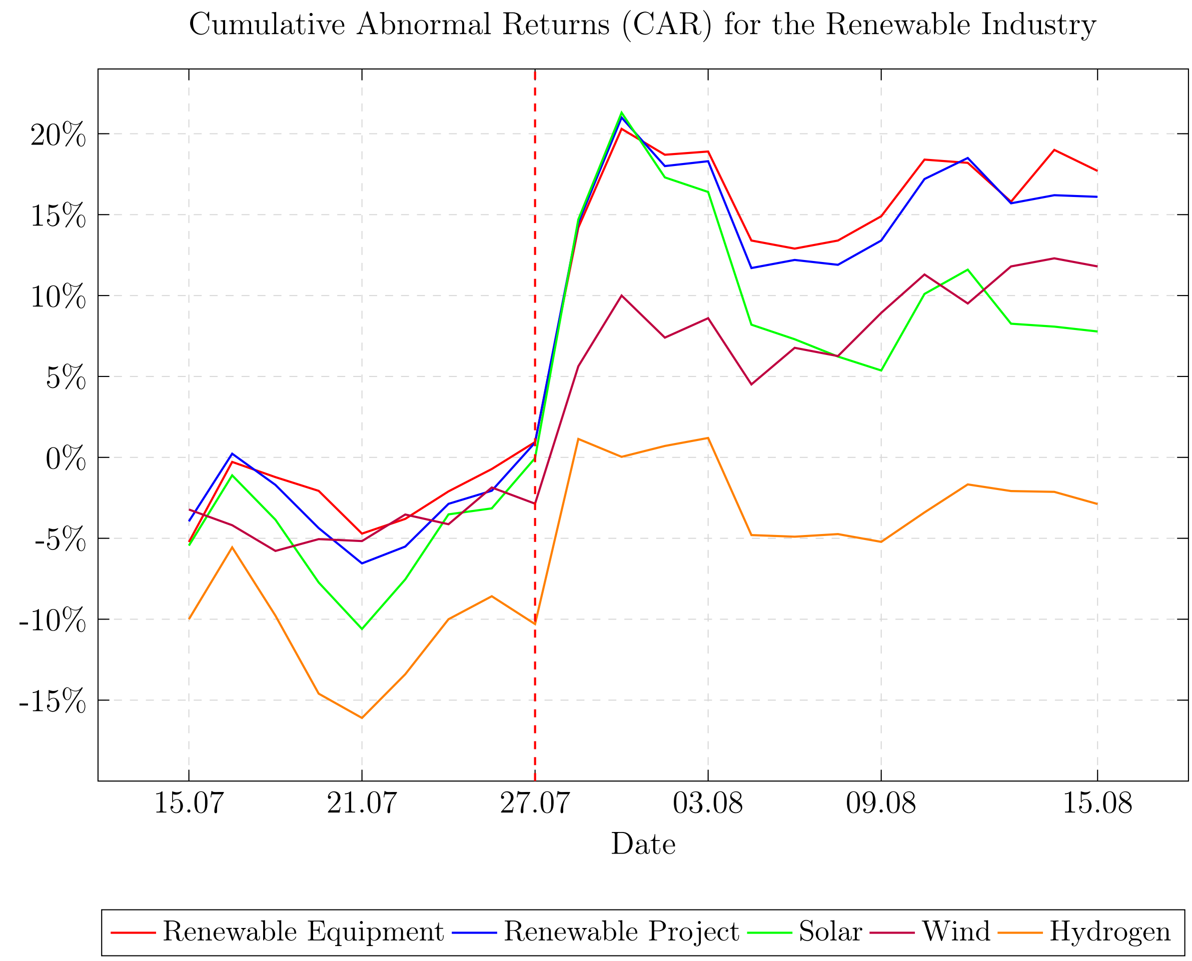


Figure 6.5: Cumulative Abnormal Returns (CAR) for the Renewable Energy Industry

The significant positive reactions observed for the renewable industry, as seen in figure 6.5, align closely with the objectives and provisions of the Inflation Reduction Act. As highlighted in the background chapter, the IRA sets aside substantial funding and long-term tax credits to support zero-emission sources. These are supply-side subsidies that increase expected future profits by lowering production costs. As mentioned, the provisions also include consumer tax credits that positively impact the demand side of energy-efficient appliances, leading to higher predicted streams of revenue for green firms. Although these provisions were introduced with the announcement of the IRA, it is reasonable to assume that policies favoring renewable companies were already a significant part of company valuations. However, there will always be uncertainty regarding the timing, magnitude, and design of green policies. Thus, changes in policy expectations might result in significant shifts in the valuation of companies, especially those sensitive to green legislation. Once the deal between Manchin and Schumer was announced to the public, the uncertainty was mitigated. This is what Bauer et al. (2023) refer to as the realization of policy transition risk, in which they attribute the significant positive reactions for green stocks to the green event in their study.

6.2.4.2 Automobile industry

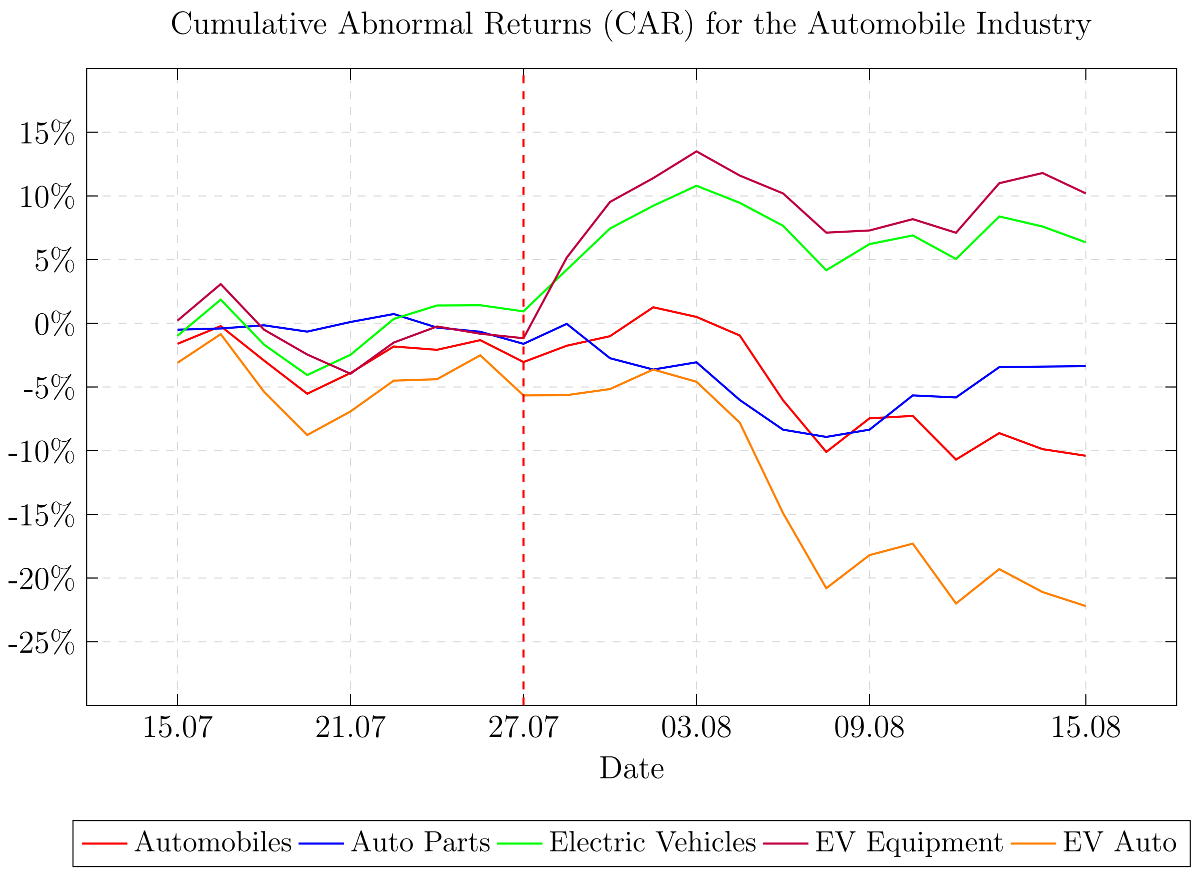


Figure 6.6: Cumulative Abnormal Returns (CAR) for Automobile-Related Industries

The reactions in the automobile industry were mixed, as seen in figure 6.6. When viewing the industry as a whole, we found no market reactions following the event. However, when only looking at the electric vehicle industry, we found significant positive reactions. This could be consistent with the IRA's generous consumer tax credits for EV purchases.

However, when examining the various segments of the supply chain, it becomes evident that the positive market reaction within the EV industry is driven exclusively by equipment manufacturers. This category includes companies specializing in battery production, battery components, and the development of charging infrastructure. A strong positive reaction among EV equipment manufacturers is consistent with IRA's aim to reduce its dependency on battery manufacturers from China especially. As explained in the background chapter, this is achieved through production tax credits as well as local-content requirements on consumer tax credits for EVs. By favoring domestic production, EV equipment manufacturers in the U.S. gain a significant competitive advantage that is reflected in stock returns following the IRA announcement.

EV auto manufacturers, on the other hand, show no sign of market response to the provision despite the consumer subsidies for American-made EVs. This is harder to explain, but a possible reason is that while the credits, as mentioned, are available for sedans up to $55,000, the average retail price for an EV in the U.S. in 2022 was more than $60,000 (Ewing & Penn, 2022). This means that many of the electric vehicles sold in the U.S. do not qualify for the tax credit. Furthermore, it is worth noting that the equally-weighted indices do not represent the market appropriately. This will be further investigated in the robustness analysis.

6.2.4.3 Pharmaceuticals

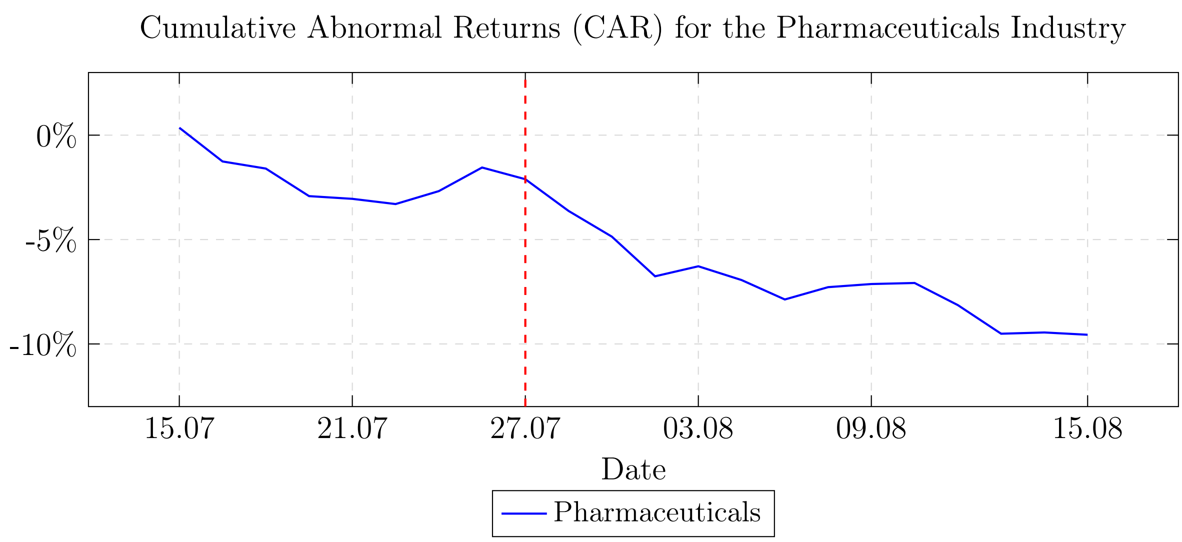


Figure 6.7: Cumulative Abnormal Returns (CAR) for the Pharmaceuticals Industry

The pharmaceutical industry experienced significant negative CARs following the IRA's announcement. This aligns with the results of Bauer et al. (2023) and their expectations that the drug industry would be adversely impacted by the act. We do, however, see that CAR starts dropping prior to the event (see 6.7). This could indicate information leakage, or that the industry is reacting to other events.

As previously noted, the IRA enables Medicare to negotiate prices for certain high-cost drugs and introduces inflation-linked caps on price increases. While these measures are designed to lower prescription drug costs and overall healthcare expenditures, they directly challenge the revenue streams of pharmaceutical companies. By restricting the industry's pricing power, these provisions threaten gross margins and profitability (Drozdowski & Kachinsky, 2023). This could have prompted a reassessment of future earnings, as reflected in the industry's negative reaction.

6.2.4.4 Metals and Minerals

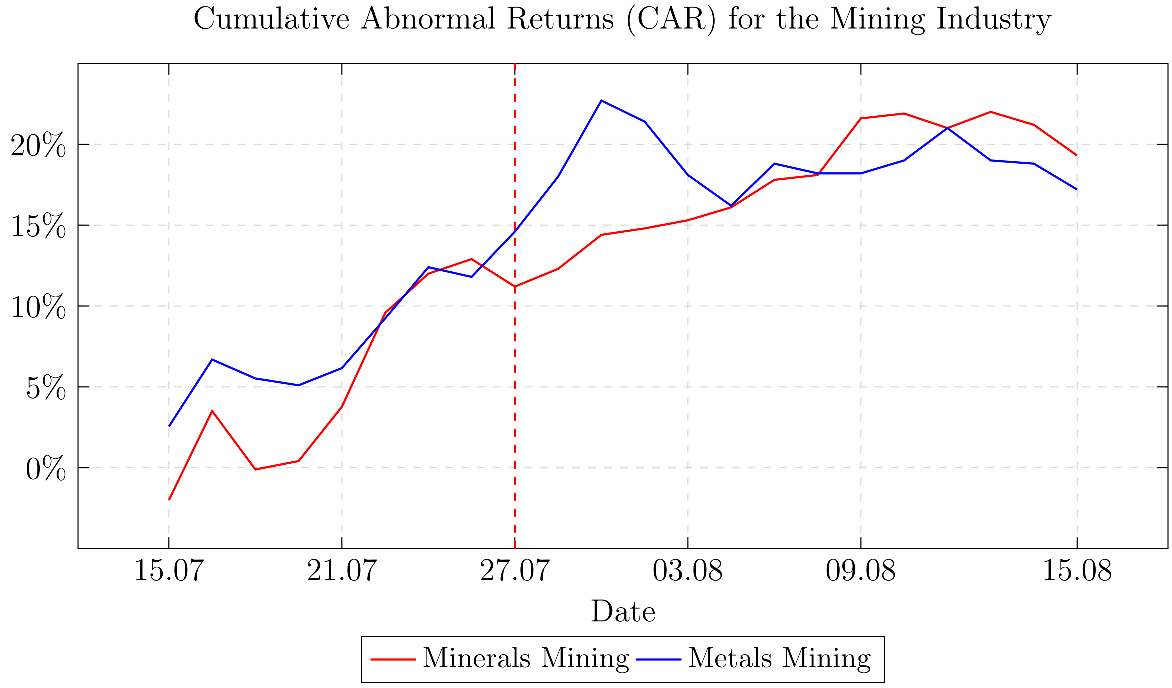


Figure 6.8: Cumulative Abnormal Returns (CAR) for the Mining Industry

Bauer et al. (2023) found that the mining industry reacted negatively to the IRA and states that it stands to lose substantially from the act and the intended decarbonization of the U.S. economy. That is due to the mining industry being tied to the extraction of fossil fuels and other resources associated with carbon-intensive activities. However, a closer examination of the industry reveals a more nuanced story. In our analysis, *Metals Mining* includes companies involved in the mining of uranium, copper, nickel, and cobalt, while *Minerals Mining* includes companies engaged in lithium and rare earth elements. These are all essential for advancing the green transition, particularly in battery production for electric vehicles, renewable energy technologies, and other clean energy applications.

Metals mining exhibited a significant positive CAR of 8% in the 2-day event window and a positive insignificant CAR of 4% in the 4-day window, while minerals mining exhibited modest insignificant CARs of 3% and 4%.

The strong response in metals mining during the 2-day window likely reflects investor confidence in the industry's alignment with the goals of the IRA. However, as seen from figure 6.8, the CAR starts increasing prior to the event, potentially indicating information leakage or concomitant events. In terms of provisions, section 45x of the IRA offers a 10% tax credit on production costs for companies extracting or processing specified critical minerals within the United States (Farmer, 2022). This includes lithium, cobalt, nickel, rare earth elements, and several others. Additionally, domestic content requirements and consumer tax credits for electric vehicles, contingent on sourcing thresholds for critical minerals, further incentivize these industries. A study by S&P Global (2023) states that post-IRA, U.S. energy transition demand for lithium will be 15% higher by 2035 than projected pre-IRA, 14% higher for nickel, 13% for cobalt, and 12% for copper. Combining these, one should expect a significant boost to the metals- and minerals mining industry. Interestingly, the strong immediate response to metals mining reduces with time, while minerals mining sees insignificant positive reactions. This may reflect several factors. One of these might be that the size of the firms constructing the industry indices is, in general, quite small, which might limit their capacity to scale operations quickly and fully capitalize on the IRA's incentives.

6.2.4.5 Electric Utilities

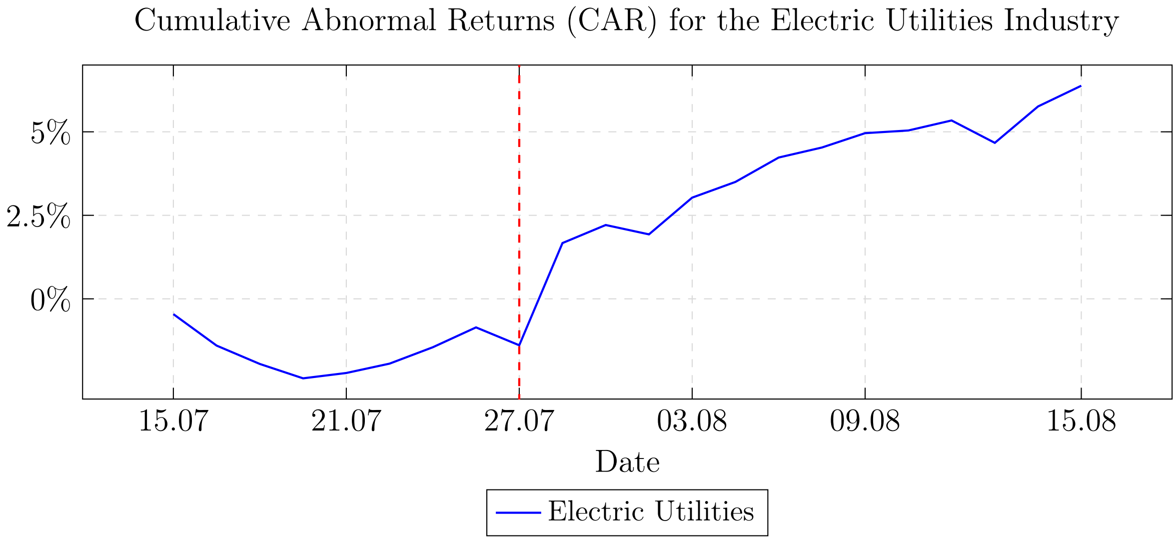


Figure 6.9: Cumulative Abnormal Returns (CAR) for the Electric Utilities Industry

The electric utilities sector showed significant positive CARs of 4% in both the 2-day and 4-day window, reflecting the industry's alignment with the IRA's objectives. These findings closely align with the previously observed reactions of the broader GICS utility sector, of which electric utilities is a subsector, as well as the results reported by Bauer et al. (2023), all of which demonstrated significant positive reactions. This consistency substantiates the role of electric utilities in the clean energy transition, as it stands to gain from the additional demand for electricity driven by the IRA. Furthermore, some electric utility companies stand to benefit from the IRA's incentives and tax credits for renewable natural gas and renewable energy development, which could have further contributed to the positive market response.

6.2.4.6 Oil and Gas

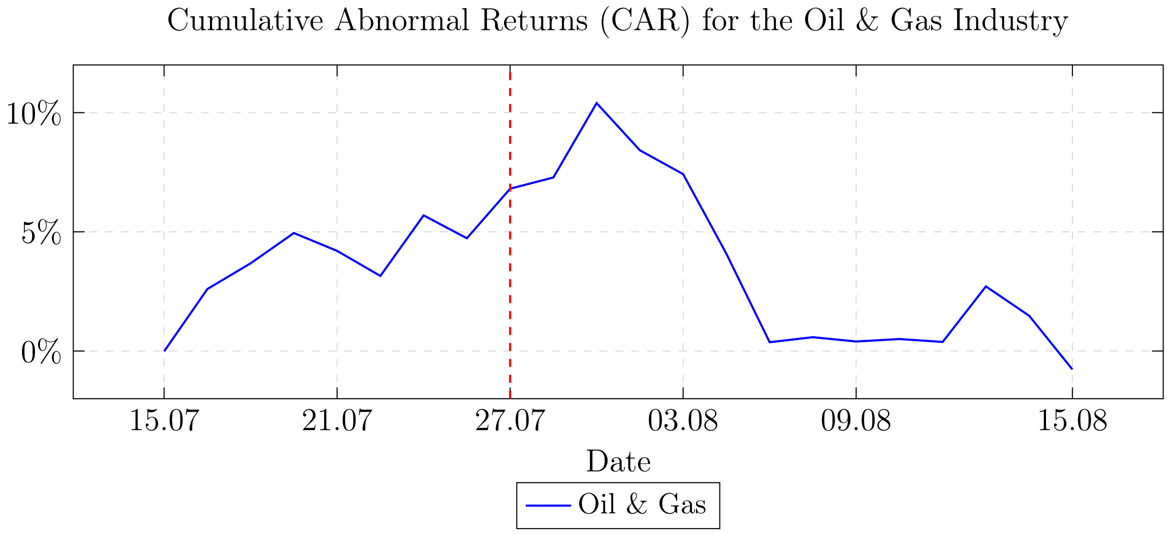


Figure 6.10: Cumulative Abnormal Returns (CAR) for the Oil & Gas Industry

The results from the oil and gas industry are somewhat ambiguous and challenging to interpret. While the abnormal return on day 1 is insignificant, we observe a significant positive CAR for the 2-day event window. In other words, this means that the industry exhibited significant positive abnormal returns on day 2, as seen in figure 6.10. This delayed and unexpected reaction makes it difficult to directly link the results to the Inflation Reduction Act. Moreover, the positive reaction seems counterintuitive, as one might have expected negative reactions for carbon-intensive industries such as oil and gas following the announcement of climate legislation.

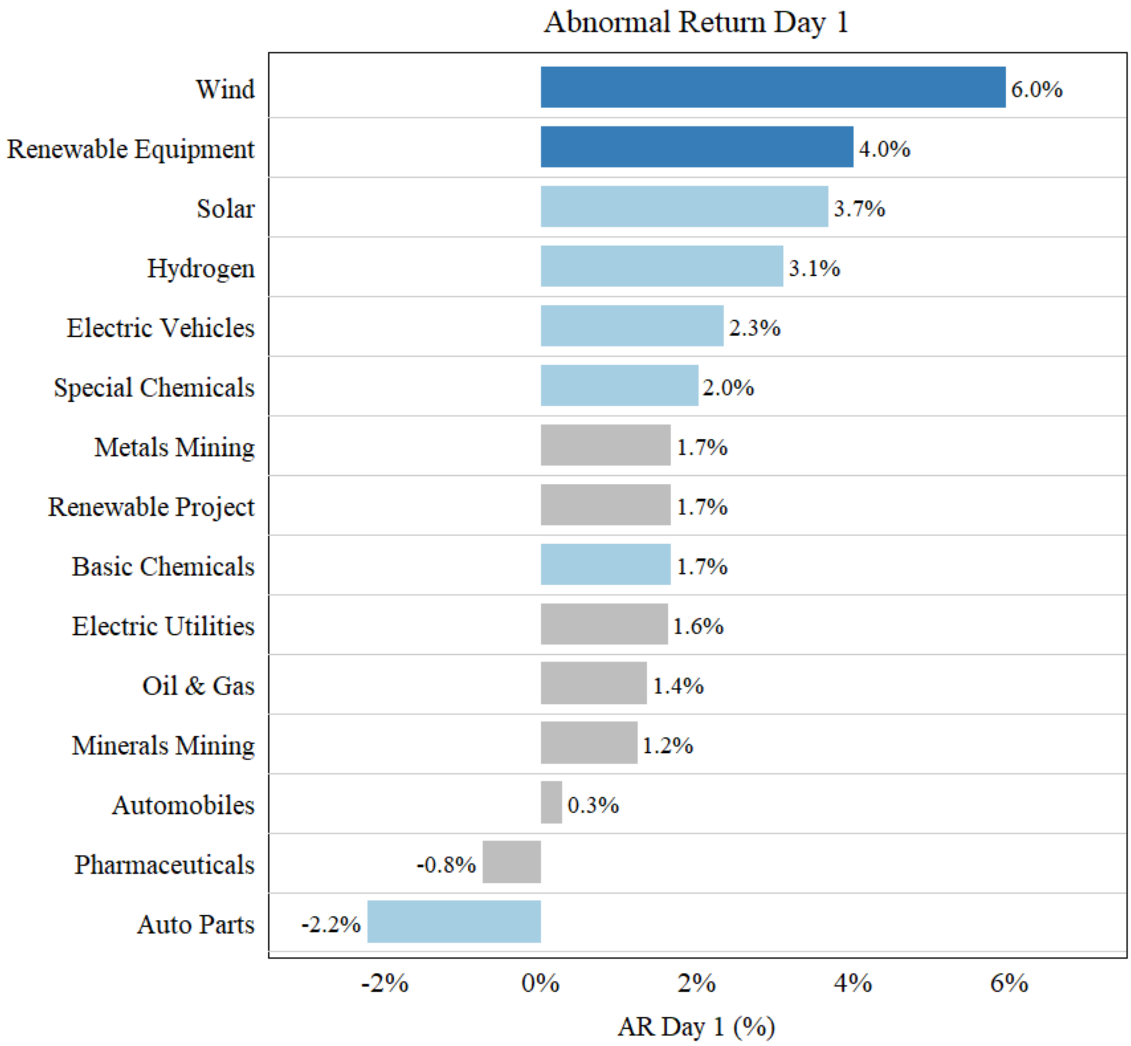
One possible explanation for the lack of negative reactions is the unconventional design of the IRA compared to other climate policies, such as the Paris Agreement. Although the provisions include fees on methane spillage from oil and gas wells, the IRA does not include measures like higher carbon taxes. Instead, it focuses on providing subsidies to green energy companies, which might not harm carbon-heavy companies in the same way a tax-focused policy would.

When comparing our results to those of Bauer et al. (2023), we observe many similarities, although our findings show generally more positive results. This discrepancy could be due to differences in industry composition and the choice of model. While we used the Fama-French Factor Model, Bauer et al. (2023) used the simpler market model, which might lead to differences in abnormal returns.

6.3 Results for comparable European and Asian industries

6.3.1 Europe

In figure 6.11, we observe the abnormal returns on the first trading day.



P-value < 5% = Dark blue. P-value < 10% = Light blue. P-value > 10% = Grey

Figure 6.11: European AR Trading Day 1

Figure 6.11 highlights the abnormal returns on the first trading day following the IRA announcement. We can observe that *Wind* and *Renewable Equipment* exhibit positive significant AR at 6% and 4%, respectively. Furthermore, we see positive AR for *Solar*, *Hydrogen*, *Electric Vehicles*, *Special Chemicals*, and *Basic Chemicals* with significance at the 10% level. In the other end, we can observe negative 2,2% AR for *Auto Parts* with significance at the 10% level.

Europe	**1 : 2**		**1 : 4**	
Industry	**CAR**	**P-value**	**CAR**	**P-value**
Oil & Gas	**5 %**	**1 %**	2 %	56 %
Automobiles	-2 %	22 %	2 %	34 %
Auto Parts	**-5 %**	**1 %**	-3 %	27 %
Renewable Equipment	5 %	7 %	4 %	26 %
Renewable Project	1 %	50 %	1 %	70 %
Solar	**6 %**	**2 %**	3 %	49 %
Wind	**6 %**	**0 %**	**5 %**	**5 %**
Hydrogen	3 %	17 %	3 %	35 %
Electric Vehicles	**4 %**	**4 %**	**5 %**	**3 %**
Pharmaceuticals	-1 %	53 %	-1 %	45 %
Minerals Mining	3 %	23 %	5 %	10 %
Metals Mining	4 %	7 %	2 %	57 %
Basic Chemicals	0 %	98 %	2 %	19 %
Specialty Chemicals	2 %	12 %	**4 %**	**5 %**
Electric Utilities	3 %	16 %	3 %	30 %

Table 6.5: Europe CAR Post-Event Windows

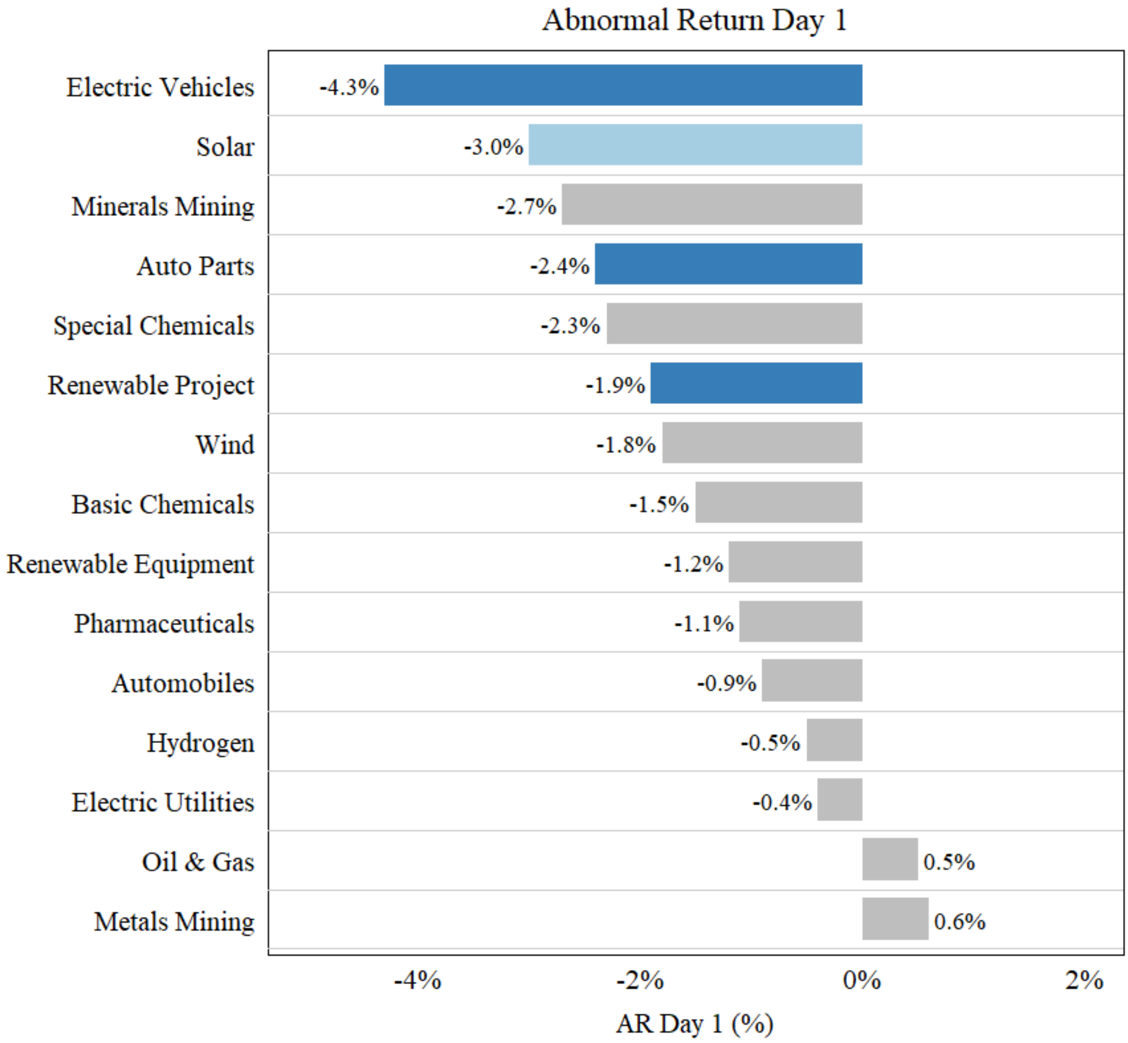
In table 6.5, we see the results for the European industries during the multi-day event windows following the IRA announcement. *Renewable Equipment* shows positive CAR in the 1:2 event window with significance at the 10% level. This is, however, not the case for project developers, exhibiting non-significant CARs for both post-event windows. Narrowing down, we observe positive significant CARs for *Solar* and *Wind* during the 2-day post-event window. While the wind industry maintains a positive significant CAR at the 4-day window, the reaction for *Solar* is insignificant.

The oil and gas industry exhibits a similar reaction compared to the U.S., with positive significant CAR in the 2-day post-event window, followed by non-significant Car during the 4-day window.

The auto parts industry, interestingly, exhibits negative significant CAR during the 2-day post-event window. The negative reaction is, however, non-significant during the 4-day window.

The European pre-event windows display no significant cumulative abnormal returns. The results can be found in table A.1 in the appendix.

6.3.2 Asia



P-value $<$ 5% = Dark blue. P-value $<$ 10% = Light blue. P-value $>$ 10% = Grey

Figure 6.12: Asia AR Trading Day 1

Figure 6.12 shows abnormal returns for the Asian industries on the first trading day following the event. We see that *Electric Vehicles*, *Auto Parts* and *Renewable Project* exhibit negative significant AR. The solar industry also shows negative AR, significant at the 10% level.

Asia	**1 : 2**		**1 : 4**	
Industry	**CAR**	**P-value**	**CAR**	**P-value**
Oil & Gas	1 %	66 %	2 %	59 %
Automobiles	-2 %	25 %	0 %	96 %
Auto Parts	-2 %	12 %	-1 %	74 %
Renewable Equipment	-2 %	50 %	-2 %	64 %
Renewable Project	0 %	74 %	-3 %	13 %
Solar	-2 %	50 %	-4 %	26 %
Wind	1 %	68 %	4 %	20 %
Hydrogen	4 %	17 %	4 %	26 %
Electric Vehicles	**-7 %**	**2 %**	-4 %	30 %
Pharmaceuticals	-3 %	7 %	**-5 %**	**1 %**
Minerals Mining	-5 %	17 %	-7 %	15 %
Metals Mining	1 %	51 %	4 %	16 %
Basic Chemicals	-1 %	51 %	1 %	60 %
Special Chemicals	-3 %	26 %	0 %	93 %
Electric Utilities	-1 %	57 %	1 %	71 %

Table 6.6: Asia CAR Post-Event Windows

As we can see from table 6.6, there is, with a few exceptions, very little sign of significant market reactions in the Asian industries when studying the multi-day event windows. The electric vehicle industry exhibits a negative significant CAR during the two days following the IRA announcement. When looking at the 4-day post-event window, however, the reaction is insignificant. The pharmaceuticals industry shows negative CAR during the two-day and 4-day post-event window, with significance at the 10% and 5% level, respectively.

The Asian pre-event windows display no significant CARs in either window. For results, see table A.2 in the appendix.

6.4 Cross-regional comparison and discussion

In the previous section, we presented the results for various industries and identified those that had the most significant reactions to the IRA. In this section, we focus on comparing these key industries across the three regions, USA, Asia and Europe. Thus, we will present various charts that illustrate the regional differences for a selection of industries, to better understand the competitive implications of the IRA.

6.4.1 Renewable project developer and equipment manufacturer

Figure 6.13 shows the development of CARs for *Renewable Project* and *Renewable Equipment* across the U.S., Europe and Asia.

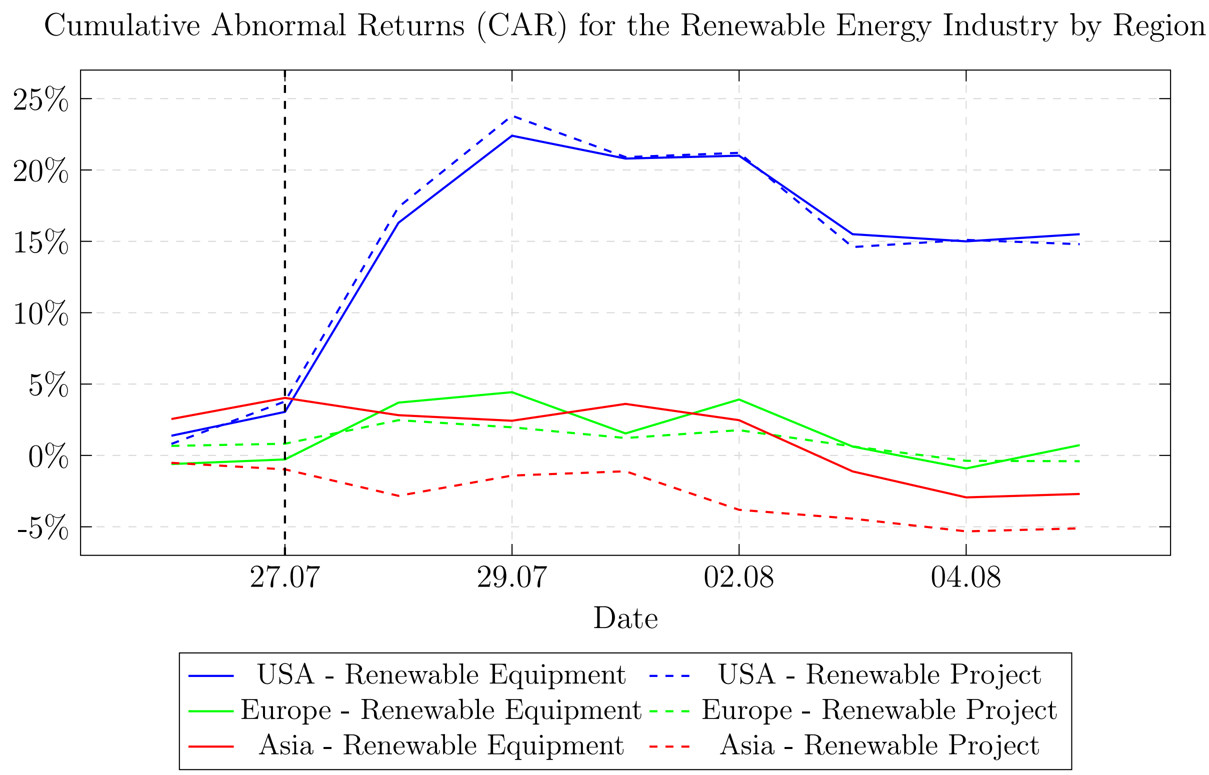


Figure 6.13: CAR for Renewables across USA, Europe, and Asia

When examining renewable equipment manufacturers across regions, we observe some noteworthy differences. In Europe, the IRA surprisingly triggers moderate but significant positive reactions. This suggests that potential negative effects, such as competitive distortions favoring the U.S., do not appear to concern investors in this industry. Instead, the IRA seems to generate optimism, which could be linked to expectations of increased global demand for renewable technologies. Another explanation might be the opportunities for European companies to relocate parts of their production to the U.S. to benefit from the IRA's subsidies. Additionally, this positive response could be tied to Europe's strengthened competitive position relative to Asia, as suggested by Kleimann et al. (2023).

On the other hand, we observe no significant reaction for renewable equipment manufacturers in Asia. Whether this is because Asian equipment manufacturers are largely unaffected by the IRA or because positive and negative effects within the industry offset each other is unclear based on our analysis.

Next, we discuss the results for renewable project developers across regions. Since electricity markets in these regions are largely separate, companies in Europe and Asia are not in direct competition with their U.S. counterparts. As a result, we would not expect any market disruptions outside the U.S. Nevertheless, although companies across regions may not compete directly with one another, they are all dependent on attracting private capital for growth and operations. Strengthened investment opportunities in the U.S., driven by the IRA's incentives, could therefore come at the expense of non-American companies' ability to secure funding or attract investors. This crowding-out effect was among the concerns raised by the EU as a potential consequence of the IRA (Cheng & Fan, 2024). Furthermore, the IRA could indirectly benefit project developers globally by driving down the costs of key inputs, which would positively affect profitability. Despite these potential effects, we observe very limited reactions, except for a moderate but significant negative response in Asia on Day 1 (see figure 6.12).

6.4.2 Wind, Solar, and Hydrogen

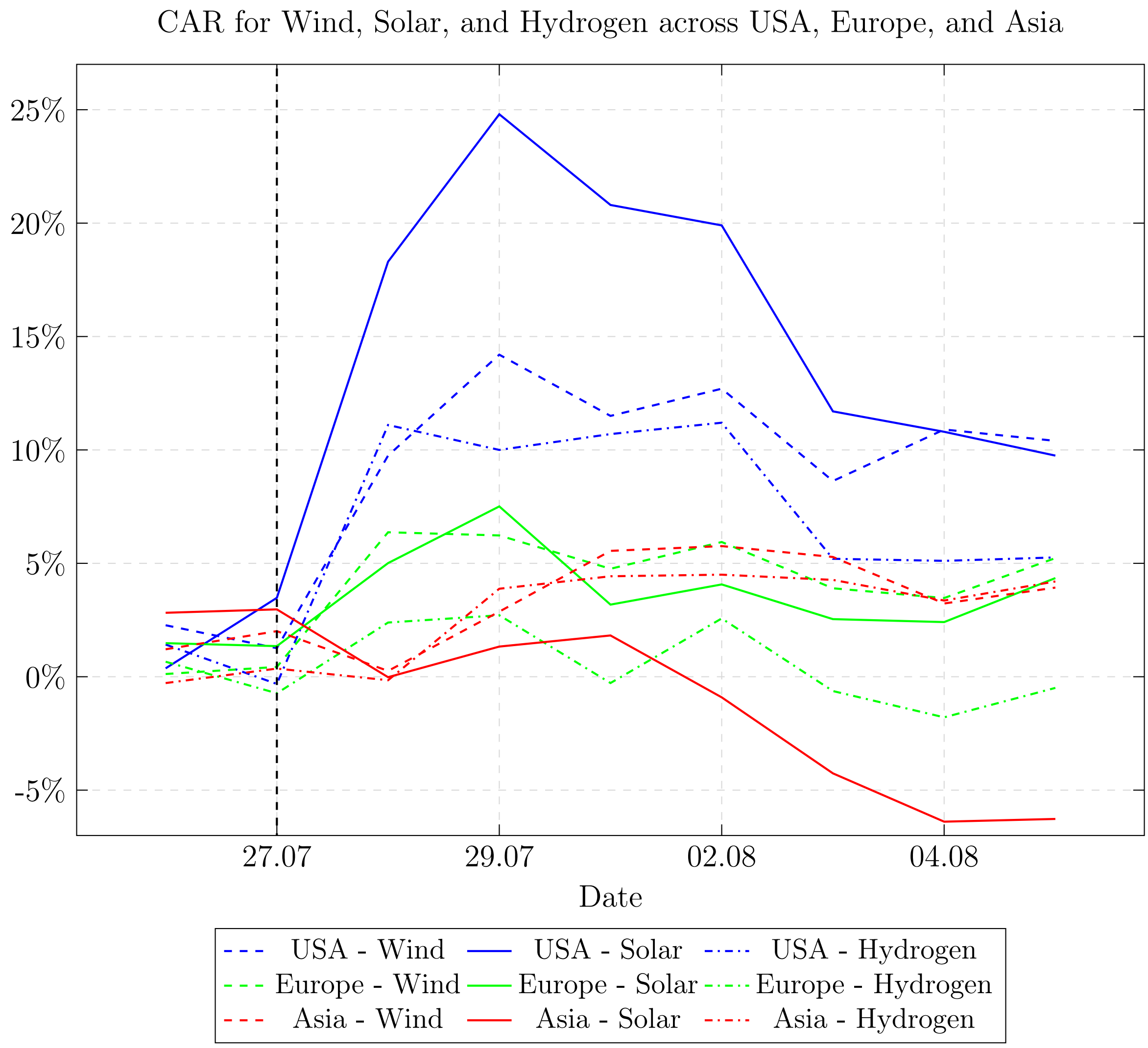


Figure 6.14: CAR for Wind, Solar, and Hydrogen across USA, Europe, and Asia

Now, we turn to the results for the wind industry across the three regions, as seen in figure 6.14. We observe a sustained positive reaction among European wind companies. This is likely driven by the anticipated increase in global demand for renewable technologies following the introduction of the IRA, as suggested by Bistline et al. (2023). However, this effect may be partially offset by the local-content requirements, which favor U.S.-based equipment manufacturers. That said, as the local-content requirement is capped at 55%, there remains a significant share of the market available for non-U.S. equipment manufacturers to capture. Well-established European manufacturers thus seem to benefit from the IRA provisions, as their total market increases relative to the absence of the IRA (Erraia et al., 2023). In Asia, however, we do not see any market reaction for the wind industry. Again, it is not clear whether this is because the industry is unaffected by the IRA or because the negative and positive implications, as discussed, offset each other.

Similar to the wind industry, we observe positive reactions for the solar industry in Europe. This again suggests that positive spillover effects and expectations of reduced input costs outweigh the potential negative impacts of competition distortion. However, the effect appears to be less pronounced than what we observed for the wind industry. In contrast, we see a negative reaction in Asia, which is significant at the 10% level. This may reflect concerns about reduced U.S. dependence on the Asian supply chain as a result of increased domestic production incentivized by the IRA. The reaction is, however, moderate as the results turn to non-significant in the multi-day period.

For the hydrogen industry, we observe minimal reactions from both Europe and Asia, as shown in the figure. This is likely due to high transportation costs, which limit intercontinental trade for hydrogen and thus isolate regional markets. Estimates from Erraia et al. (2023) suggest that the transportation costs between Europe and the U.S. are greater than the difference in production costs between the regions. However, a potential positive impact could stem from technological advancements and cost reductions driven by the IRA. This may explain the moderate yet significant positive reaction observed in Europe on day 1 (see 6.11).

6.4.3 Electric Vehicles

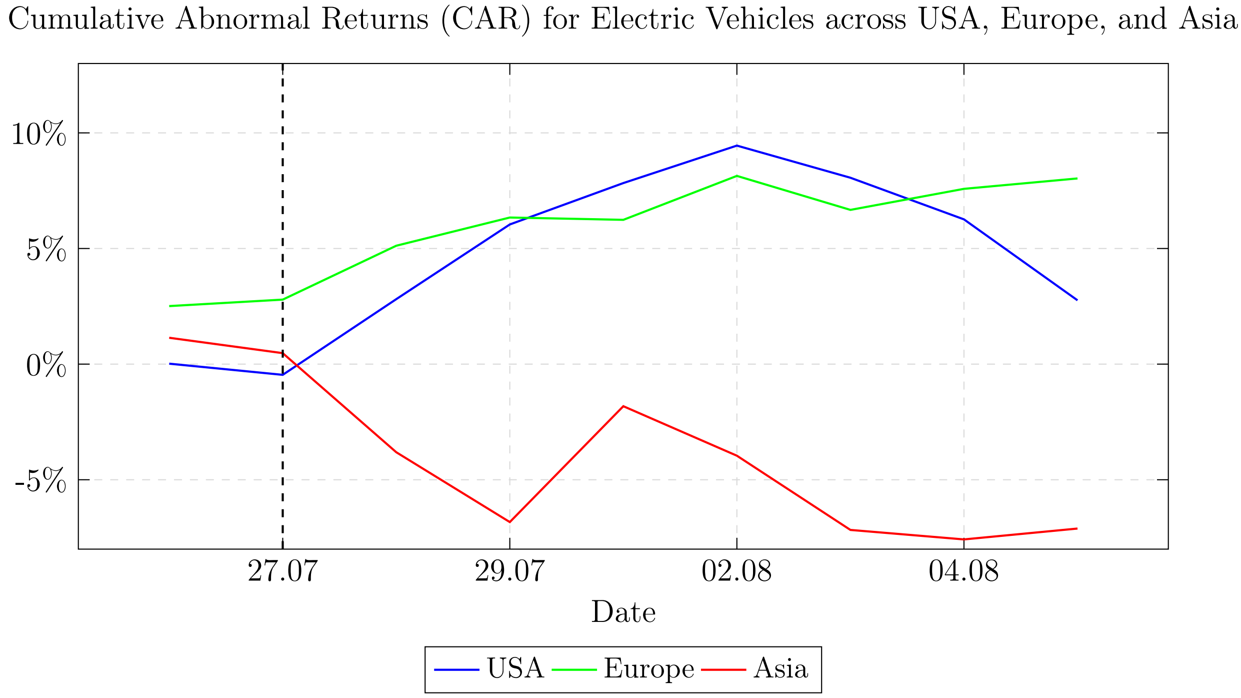


Figure 6.15: CARs for Electric Vehicles across USA, Europe, and Asia

We now turn to discussing the results for the Electric Vehicles (EV) industry across the three regions, as illustrated by figure 6.15. First, we highlight the positive reactions observed for the European EV industry. This is an interesting finding, as it contrasts with the strong negative response the IRA initially received from the EU, particularly regarding the consumer tax credits with local-content requirements, which are seen as discriminatory towards European companies in the EV supply chain. The positive reactions in the European EV industry further support the suggestion that the EU may strengthen its competitive position relative to Asia. Moreover, investor concerns in Europe may have been alleviated due to expectations of regulatory countermeasures from the EU, which have since materialized in the form of the Net Zero Industry Act.

Conversely, we observe clear negative reactions in Asia following the event, suggesting market concerns about the impact of the IRA provisions, such as the local content requirements for the EV tax credit. These restrictions may have been seen as a direct threat to Asian manufacturers, especially those in China, who have been key players in the global EV supply chain. Thus, the IRA's focus on reducing reliance on Chinese imports appears to have been harmful to investor confidence in the region.

6.5 Robustness

This section presents robustness checks to assess whether the results from our analysis hold under different methodological assumptions. Specifically, we will check if the results are robust to changes in the sector weighting methodology and estimation window.

6.5.1 Weighting methodology

Our primary analysis employs an equal-weighting methodology to structure sectors, where each company within a sector contributes equally to the sector's performance. However, this approach may not accurately reflect the economic significance of larger companies within a sector. To test the robustness of our results, we restructured the sectors using market capitalization as the weighting criteria, where the influence of each company is proportional to its market value. The market value of each company is sourced from the Refinitiv database and calculated as the average market capitalization over the period from June 2021 to June 2022.

The results for the U.S. targeted industries, as seen in table A.3 and figure A.1, remain largely consistent when applying the market weight methodology, with the same industries showing significant abnormal returns. However, the electric vehicle industry is no longer significantly positive in the post-event windows. This is primarily because Tesla, which dominates 90% of the industry, did not exhibit significant reactions. This reduces the robustness of the industry's reactions but further substantiates that the market expects equipment manufacturers to benefit more than vehicle manufacturers. *Renewable Equipment* and *Solar* show significant CARs in the -4 : -1 window. This could reflect that they are reacting to something different in the pre-event windows, or there could be signs of information leakage.

For Europe, the results presented in table A.4 and figure A.2 are relatively similar to the ones observed using equal-weight. Interestingly, *Renewable Equipment* and *Wind* exhibit notably higher abnormal returns on the first trading day, with returns of 12% and 9.6%, respectively. This trend follows in subsequent windows. Furthermore, *Hydrogen* and *Solar* show significant positive abnormal returns at the 5% level on the first trading day, compared to 10% using equal-weight. Overall, the renewable industries, apart from

Renewable Projects, display stronger and more sustained positive reactions to the IRA under market weighting. This finding could suggest that the market expects larger firms to better capitalize on the IRA's subsidies. This is not surprising, as larger, well-established firms are more likely to already have operations in the U.S. or be better positioned to move some of their operations to the U.S. to take advantage of the provisions.

The results for the Asian industries, as displayed in table A.5 and figure A.3, are also relatively similar. *Electric Vehicles* and *Pharmaceuticals* show significant negative CARs in the post-event windows, similar to equal-weight. *Renewable Project*, however, exhibits a significant negative CAR in the 1:4 window. On the first trading day, *Automobiles* and *Renewable Project* show negative abnormal returns at the 5%- and 10% level, respectively. The negative reaction to *Automobiles* could indicate that the market expects larger car manufacturers in Asia to be negatively affected by the LCRs and decrease their EV market shares in the U.S. However, the significance decreases in subsequent windows. Further, *Solar* and *Auto Parts* are no longer significant on the first trading day, decreasing their robustness.

Overall, the robustness checks confirm that the key findings remain consistent regardless of the weighting methodology, further substantiating their validity. At the same time, the observed differences offer insight into how the market perceives larger firms relative to smaller firms and their impact on industry performance.

6.5.2 Estimation Window

Our primary analysis uses a 100-day estimation window. To check our results for robustness to the choice of estimation window, we extend it to 200 days. Extending the window can improve accuracy and reduce the impact of other events occurring during the estimation window (Benninga, 2008).

In the U.S., results remain unchanged, as seen in table A.6 and figure A.4 for the U.S. GICS sectors and in table A.7 and figure A.5 for U.S. targeted industries. In Asia, *Electric Vehicles* and *Solar* lose significance on trading day 1, while other results are stable. The results can be found in table A.9 and figure A.7. In Europe, the results show more deviations, as seen in table A.8 and figure A.6. *Solar*, *Special Chemicals* and *Basic Chemicals* gain significance on trading day 1. Conversely, *Electric Vehicles* loses significance across all post-event windows, reducing the robustness of the industry's results. However, in general, the results confirm the reliability of our key findings.

7 Limitations

While our study aims to provide valuable insights into the market reactions to the Inflation Reduction Act, it is important to acknowledge several limitations that could potentially influence the validity of our results.

As stated, a fundamental assumption in our methodology is that no other significant events overlap with our event of interest, as this could distort our findings. A notable limitation in our study is that the CHIPS and Science Act was passed in the U.S. Senate on July 27, 2022, the same day as the IRA was announced. Although the CHIPS Act was largely anticipated by the market and was passed by an almost 2 to 1 margin, we cannot completely rule out the possibility that it influenced the stock market reactions during our event window.

Another limitation concerns the selection of companies for the various custom-constructed sectors. While we carefully selected companies based on their relevance to specific sectors, many of these companies have diversified product portfolios. This means that their stock prices are influenced by operations that fall outside the scope of the analyzed sector. For instance, some oil and gas companies also invest significantly in renewable energy. This diversification introduces noise to the data.

The weighting method used for the sectors is another source of potential bias. While the GICS sectors in our analysis are market-cap weighted, our custom-constructed sectors use equal weighting. This implies that the return data used to compute abnormal returns do not fully reflect the actual trading volume or market impact during the event windows. For example, Lucid Group, one of three EV companies in the U.S. EV Auto industry, was assigned a weight of one-third despite its market share being less than 4%. This mismatch could lead to biased estimates of industry-wide abnormal returns. However, this was accounted for in our robustness analysis.

Another limitation in the regional comparison is the structural differences in industry composition across regions. For example, in the electric vehicle industry, battery manufacturers represent a much larger share of the value chain in Asia, particularly in China, compared to Europe. Such structural differences make it challenging to compare sectors directly, as they are not always perfectly equivalent across regions. Furthermore, the amount of companies in each industry differs across industries and markets. This could also make the comparisons less precise.

Lastly, our analysis is restricted to publicly listed companies. This introduces a selection bias, as the sample does not fully represent the broader population of companies in the relevant industries.

8 Conclusion

The Inflation Reduction Act (IRA) is a transformative piece of U.S. legislation with significant implications for the financial markets, particularly in industries directly targeted by its provisions. Through our event study analysis, we examined how various industries reacted to the announcement of the IRA. To explore this, we have addressed the following research questions: How did various industries in the U.S. stock market react to the announcement of the Inflation Reduction Act? Moreover, how do the stock market reactions of U.S. industries targeted by the Inflation Reduction Act compare to those of similar industries in Europe and Asia? The findings shed light on the financial market's interpretation of the IRA's objectives and its broader impact on global competitiveness.

First, we looked at the reactions of broad U.S. GICS sector indices. Here, we observed that *Utilities* and *Industrials* exhibited significant positive CARs. These reactions were sustained, suggesting that these sectors were positively impacted by the act. The *Energy* sector, comprising mainly oil and gas companies, had a short-lived positive reaction. Conversely, *Health Care*, *Communication Services*, and *Financials* saw negative market reactions following the announcement. This could be attributed to the 15% minimum corporate tax introduced by the act.

The results from the U.S. market show strong positive reactions for renewable industries, such as solar, wind, and hydrogen, consistent with the IRA's focus on supporting clean technologies through substantial tax credits and incentives. Notably, renewable project developers and equipment manufacturers exhibited significant positive cumulative abnormal returns, reflecting investor confidence in the IRA's ability to lower production costs and drive future revenue growth. Similarly, electric utilities experienced positive CARs, further underscoring their central role in the clean energy transition, particularly as demand for electricity increases alongside renewable energy development.

The Automobile industry presented a more nuanced picture. While the broader industry did not show a significant reaction, the electric vehicle segment, specifically component manufacturers such as battery and charging infrastructure companies, displayed strong positive reactions. This aligns with the IRA's focus on incentivizing domestic production and reducing reliance on Asian imports. Conversely, EV automakers did not show a significant response, possibly reflecting limitations in the consumer tax credit provisions, such as price caps and income thresholds, which exclude many vehicles from eligibility.

The oil and gas industry's reaction was unexpected. While no immediate significant reaction was observed, the industry displayed a significant positive CAR over the two-day window, driven by a strong reaction on the second trading day following the event. The delayed and counterintuitive response may reflect the IRA's design, which avoids punitive measures like carbon taxes and instead focuses on subsidizing green industries.

Some intriguing observations emerge when examining the market reactions across the different regions. Despite the Act's protectionist traits and concerns about its implications for international trade, our results reveal remarkably minimal reactions in Asian markets. With the exception of the Electric Vehicle industry, which exhibited significant negative CARs, we observe very little evidence of adverse reactions in Asia. This contrasts the narrative of heightened trade tensions and suggests that investors may not have perceived the IRA as a substantial threat to most Asian industries in the short term. Interestingly, we find evidence of positive reactions in European renewable industries, such as renewable equipment manufacturers and wind companies, suggesting potential spillover benefits from the IRA. These positive reactions may reflect optimism about increased global demand for renewable technologies or a perceived competitive gain for Europe relative to Asia, particularly China. This positive reaction increases when using the market weight methodology, potentially suggesting market optimism toward larger European companies to benefit from the IRA.

Although the event study methodology employed in this analysis is not suited to assess the long-term implications of the IRA on international trade, it does provide valuable insights into how financial markets adapt to this type of regulation. By capturing the immediate market reactions, our findings contribute to the growing body of literature that seeks to understand the relationship between ambitious climate policies and financial markets. These results underscore the role of capital markets in shaping the green transition and highlight the importance of designing policies that balance domestic priorities with global trade dynamics.

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Statement on the use of AI tools in the work on this master's thesis

Name (and version) of the AI tool: ChatGPT-4o The purpose of the use of the tool: Used to organize data, idea generation, and language enhancement.

We are aware that we are responsible for all content of this master's thesis, including the parts where AI tools are used. We are responsible for ensuring that the thesis complies with ethical rules for privacy and publication.

Appendices

A Appendix

A.1 Europe and Asia Pre-Event Windows

Europe	-2 : -1		-4 : -1	
Industry	**CAR**	**P-value**	**CAR**	**P-value**
Oil & Gas	-1 %	77 %	0 %	91 %
Automobiles	0 %	78 %	1 %	65 %
Auto Parts	1 %	63 %	1 %	58 %
Renewable Equipment	0 %	92 %	-1 %	71 %
Renewable Project	1 %	62 %	0 %	92 %
Solar	1 %	62 %	3 %	41 %
Wind	0 %	82 %	2 %	44 %
Hydrogen	-1 %	77 %	-1 %	80 %
Electric Vehicles	3 %	10 %	1 %	66 %
Pharmaceuticals	-1 %	23 %	-1 %	27 %
Minerals Mining	1 %	57 %	3 %	36 %
Metals Mining	0 %	85 %	-1 %	79 %
Basic Chemicals	-2 %	22 %	-1 %	45 %
Specialty Chemicals	-1 %	57 %	-3 %	20 %
Electric Utilities	1 %	73 %	1 %	84 %

Table A.1: Europe CAR Pre Event Windows

Asia	**-2 : -1**		**-4 : -1**	
Industry	**CAR**	**P-value**	**CAR**	**P-value**
Oil & Gas	2 %	40 %	0 %	95 %
Automobiles	-1 %	68 %	-1 %	62 %
Auto Parts	0 %	81 %	1 %	81 %
Renewable Equipment	4 %	9 %	2 %	46 %
Renewable Project	-1 %	46 %	-2 %	35 %
Solar	3 %	22 %	1 %	88 %
Wind	2 %	33 %	-1 %	65 %
Hydrogen	0 %	89 %	1 %	76 %
Electric Vehicles	0 %	88 %	0 %	93 %
Pharmaceuticals	0 %	74 %	0 %	88 %
Minerals Mining	2 %	58 %	0 %	96 %
Metals Mining	0 %	99 %	0 %	94 %
Basic Chemicals	0 %	88 %	1 %	76 %
Specialty Chemicals	-1 %	62 %	-1 %	88 %
Electric Utilities	0 %	96 %	-1 %	43 %

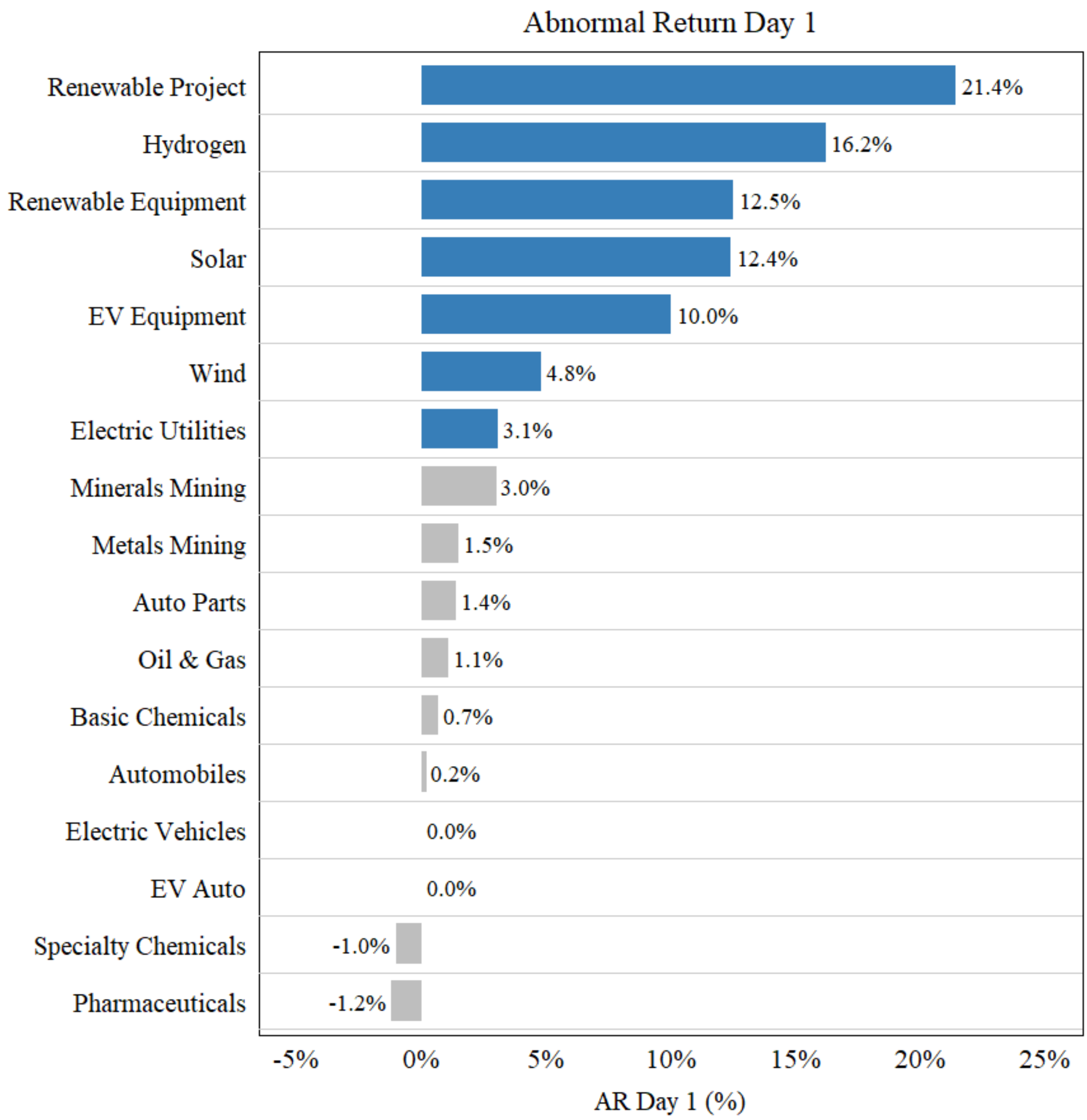
Table A.2: Asia CAR Pre-Event Windows

A.2 Robustness: Market Weight Methodology

A.2.1 U.S.

U.S.	**-2 : -1**		**-4 : -1**		**1 : 2**		**1 : 4**	
Industry	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**
Oil & Gas	1 %	46 %	2 %	19 %	**6 %**	**0 %**	2 %	19 %
Automobiles	0 %	95 %	4 %	42 %	3 %	33 %	3 %	46 %
Auto Parts	-2 %	30 %	-3 %	25 %	0 %	89 %	0 %	86 %
Renewable Equipment	5 %	21 %	**11 %**	**4 %**	**17 %**	**0 %**	**14 %**	**1 %**
Renewable Project	1 %	77 %	8 %	21 %	**29 %**	**0 %**	**21 %**	**0 %**
Solar	7 %	12 %	**14 %**	**2 %**	**19 %**	**0 %**	**13 %**	**2 %**
Wind	-2 %	49 %	1 %	70 %	**5 %**	**2 %**	**6 %**	**5 %**
Hydrogen	-2 %	66 %	5 %	35 %	**14 %**	**0 %**	**17 %**	**0 %**
Electric Vehicles	0 %	95 %	4 %	39 %	3 %	36 %	3 %	56 %
EV Auto	0 %	94 %	4 %	39 %	3 %	38 %	3 %	57 %
EV Equipment	-3 %	44 %	-1 %	90 %	**13 %**	**0 %**	**10 %**	**5 %**
Pharmaceuticals	0 %	74 %	-1 %	67 %	**-3 %**	**1 %**	**-4 %**	**3 %**
Minerals Mining	-1 %	77 %	7 %	19 %	3 %	34 %	4 %	43 %
Metals Mining	2 %	42 %	1 %	81 %	**6 %**	**3 %**	0 %	99 %
Basic Chemicals	-1 %	58 %	-1 %	50 %	0 %	93 %	0 %	96 %
Special Chemicals	-1 %	77 %	1 %	77 %	-2 %	44 %	-1 %	67 %
Electric Utilities	0 %	84 %	1 %	69 %	**4 %**	**1 %**	**4 %**	**2 %**

Table A.3: U.S. CAR market weight



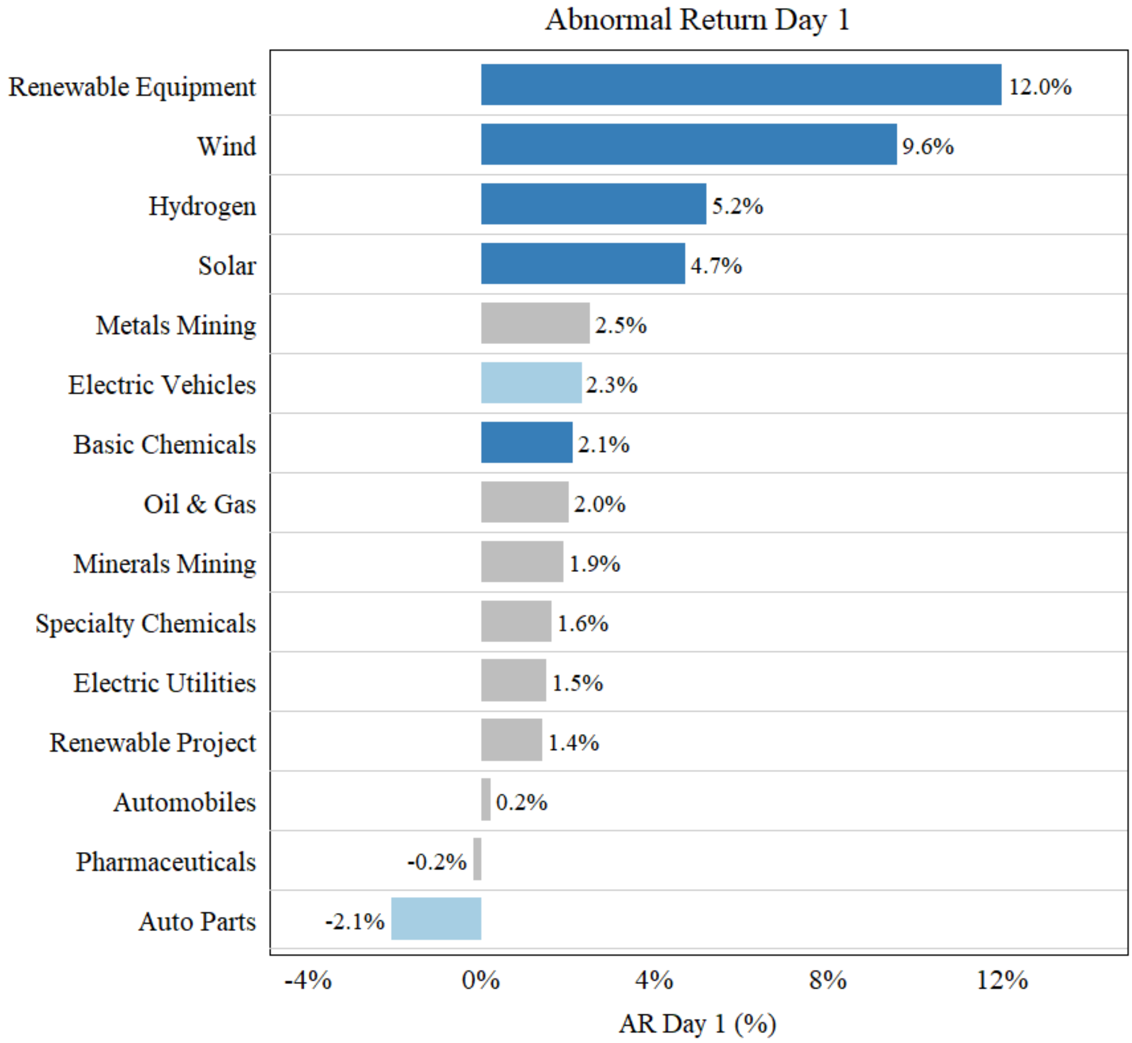
P-value < 5% = Dark blue. P-value < 10% = Light blue. P-value > 10% = Grey

Figure A.1: AR U.S. market weight

A.2.2 Europe

Europe	**-2 : -1**		**-4 : -1**		**1 : 2**		**1 : 4**	
Industry	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**
Oil & Gas	1 %	46 %	0 %	89 %	**6 %**	**0 %**	3 %	32 %
Automobiles	1 %	53 %	1 %	74 %	-2 %	18 %	2 %	40 %
Auto Parts	-1 %	43 %	-1 %	71 %	**-4 %**	**2 %**	-3 %	22 %
Renewable Equipment	-4 %	33 %	-4 %	51 %	**14 %**	**0 %**	**13 %**	**2 %**
Renewable Project	2 %	28 %	4 %	24 %	2 %	30 %	2 %	57 %
Solar	0 %	91 %	3 %	44 %	**8 %**	**2 %**	3 %	47 %
Wind	-2 %	54 %	-1 %	84 %	**11 %**	**0 %**	10 %	6 %
Hydrogen	0 %	96 %	-2 %	63 %	5 %	12 %	5 %	30 %
Electric Vehicles	3 %	10 %	1 %	66 %	**4 %**	**4 %**	**5 %**	**3 %**
Pharmaceuticals	-1 %	39 %	-1 %	47 %	-1 %	51 %	-2 %	29 %
Minerals Mining	1 %	72 %	3 %	26 %	4 %	10 %	**6 %**	**5 %**
Metals Mining	1 %	85 %	1 %	90 %	5 %	7 %	2 %	68 %
Basic Chemicals	-1 %	66 %	-1 %	45 %	1 %	26 %	3 %	14 %
Specialty Chemicals	-1 %	49 %	-3 %	20 %	3 %	8 %	**5 %**	**5 %**
Electric Utilities	1 %	68 %	2 %	37 %	3 %	11 %	3 %	24 %

Table A.4: Europe CAR market weight



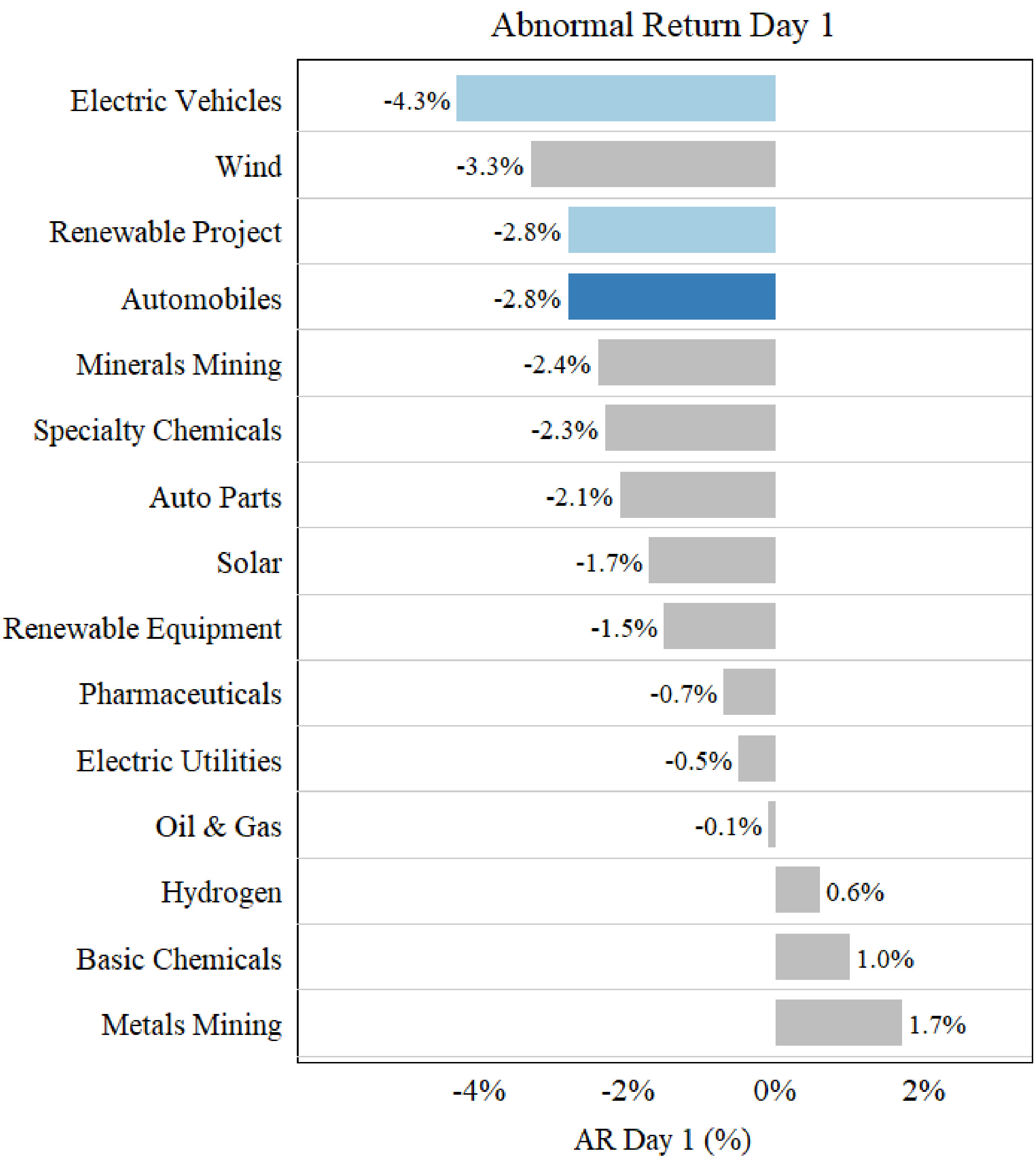
P-value < 5% = Dark blue. P-value < 10% = Light blue. P-value > 10% = Grey

Figure A.2: AR Europe market weight

A.2.3 Asia

Asia	**-2 : -1**		**-4 : -1**		**1 : 2**		**1 : 4**	
Industry	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**
Oil & Gas	1 %	61 %	-2 %	53 %	1 %	62 %	3 %	28 %
Automobiles	-1 %	79 %	-1 %	64 %	-3 %	9 %	0 %	87 %
Auto Parts	0 %	89 %	-1 %	78 %	-4 %	6 %	-3 %	34 %
Renewable Equipment	5 %	15 %	3 %	57 %	-2 %	53 %	-3 %	48 %
Renewable Project	0 %	97 %	-2 %	53 %	-1 %	47 %	**-9 %**	**0 %**
Solar	5 %	15 %	3 %	54 %	-2 %	52 %	-3 %	51 %
Wind	2 %	51 %	-2 %	62 %	-1 %	71 %	-1 %	82 %
Hydrogen	3 %	37 %	6 %	31 %	3 %	42 %	0 %	98 %
Electric Vehicles	-1 %	87 %	0 %	93 %	**-7 %**	**4 %**	-2 %	68 %
Pharmaceuticals	0 %	96 %	-1 %	59 %	-2 %	12 %	**-7 %**	**0 %**
Minerals Mining	3 %	52 %	0 %	98 %	-5 %	21 %	-8 %	17 %
Metals Mining	-1 %	85 %	-1 %	79 %	3 %	27 %	4 %	25 %
Basic Chemicals	0 %	84 %	-1 %	86 %	1 %	58 %	-5 %	12 %
Specialty Chemicals	-1 %	62 %	-1 %	88 %	-3 %	26 %	0 %	93 %
Electric Utilities	0 %	83 %	-2 %	42 %	-1 %	63 %	1 %	56 %

Table A.5: CAR Asia market weight



P-value < 5% = Dark blue. P-value < 10% = Light blue. P-value > 10% = Grey

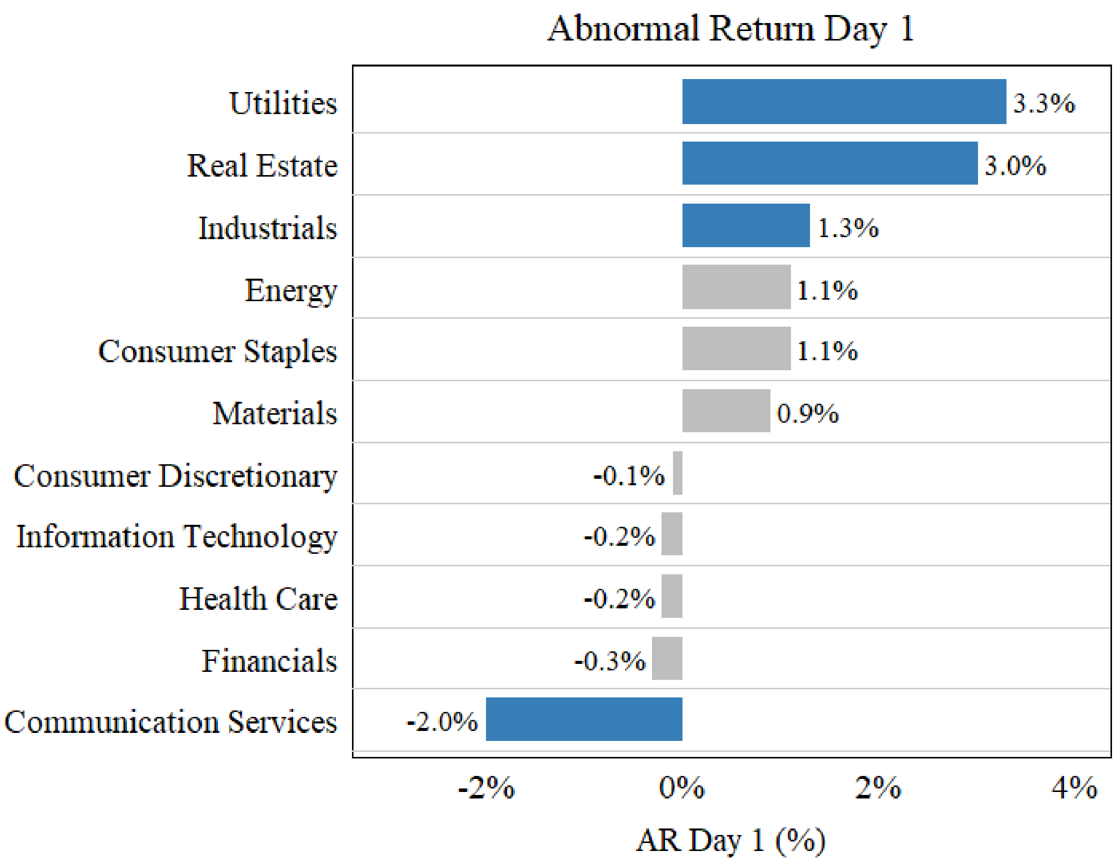
Figure A.3: AR Asia market weight

A.3 Robustness: 200 Days Estimation Window

A.3.1 U.S GICS

GICS	-2 : -1		-4 : -1		1 : 2		1 : 4	
Sector	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**
Health Care	0 %	76 %	0 %	82 %	-2 %	9 %	-2 %	17 %
Information Technology	1 %	15 %	0 %	94 %	0 %	92 %	0 %	72 %
Financials	-1 %	10 %	-1 %	33 %	**-2 %**	**1 %**	-2 %	8 %
Energy	1 %	59 %	2 %	31 %	**6 %**	**0 %**	3 %	11 %
Utilities	0 %	97 %	2 %	37 %	**4 %**	**0 %**	**5 %**	**1 %**
Industrials	0 %	69 %	0 %	71 %	**2 %**	**0 %**	**3 %**	**0 %**
Consumer Discretionary	-1 %	16 %	-1 %	67 %	2 %	6 %	2 %	9 %
Consumer Staples	-1 %	50 %	-1 %	59 %	0 %	69 %	2 %	23 %
Communication Services	**2 %**	**5 %**	0 %	85 %	**-3 %**	**0 %**	**-3 %**	**2 %**
Real Estate	0 %	79 %	1 %	72 %	**3 %**	**3 %**	1 %	46 %
Materials	-1 %	42 %	-1 %	27 %	1 %	33 %	0 %	71 %

Table A.6: CAR GICS 200 Estimation Days



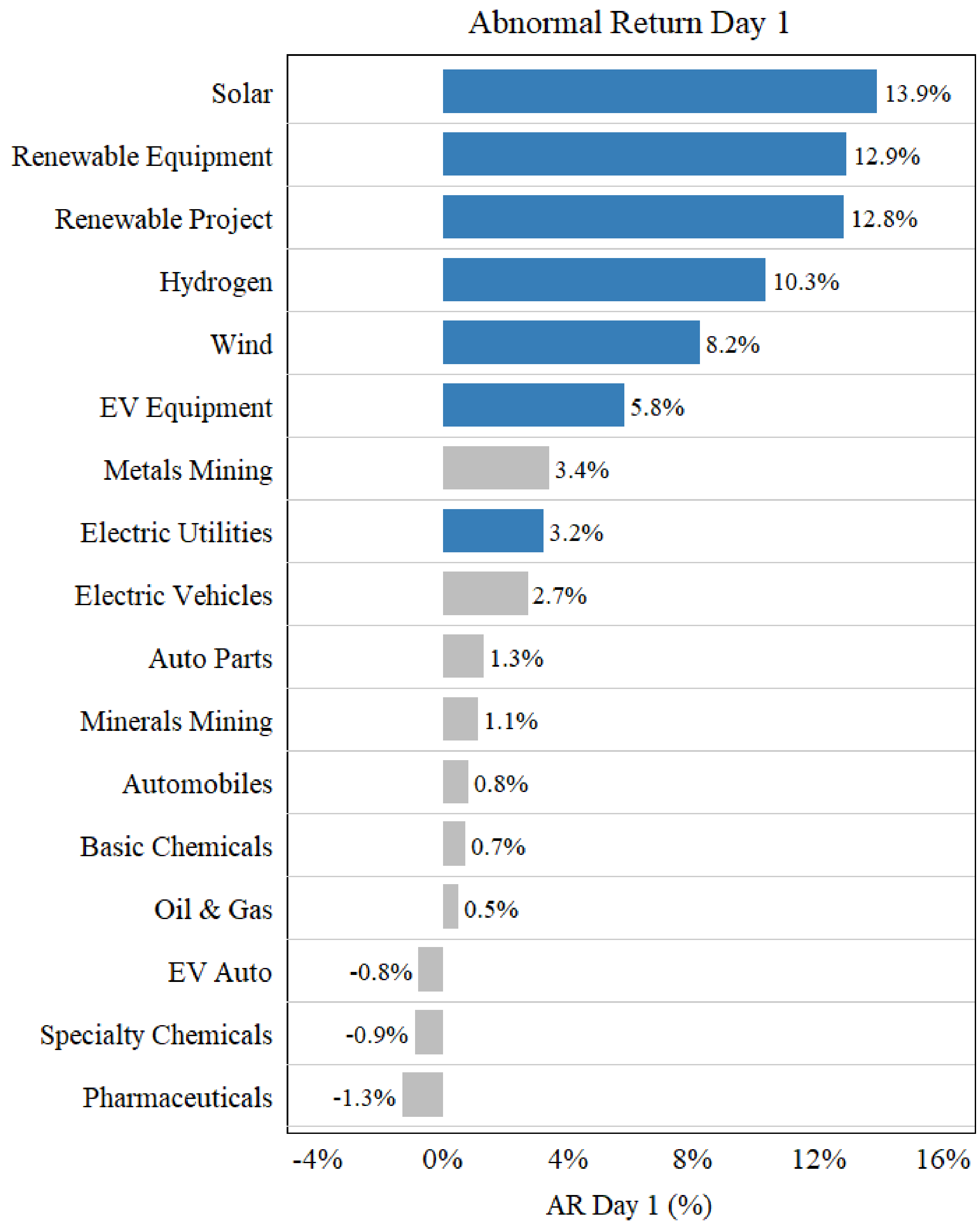
P-value < 5% = Dark blue. P-value < 10% = Light blue. P-value > 10% = Grey

Figure A.4: AR GICS 200 estimation days

A.3.2 U.S. Targeted Industries

U.S.	**-2 : -1**		**-4 : -1**		**1 : 2**		**1 : 4**	
Industry	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**
Oil & Gas	1 %	31 %	2 %	16 %	**3 %**	**1 %**	1 %	73 %
Automobiles	-2 %	52 %	-2 %	65 %	1 %	77 %	3 %	46 %
Auto Parts	-2 %	30 %	-3 %	21 %	-1 %	33 %	-2 %	48 %
Renewable Equipment	3 %	40 %	5 %	31 %	**19 %**	**0 %**	**18 %**	**0 %**
Renewable Project	3 %	32 %	6 %	18 %	**18 %**	**0 %**	**17 %**	**0 %**
Solar	3 %	40 %	9 %	8 %	**19 %**	**0 %**	**16 %**	**0 %**
Wind	1 %	56 %	2 %	45 %	**13 %**	**0 %**	**12 %**	**0 %**
Hydrogen	-2 %	64 %	3 %	63 %	**8 %**	**3 %**	**10 %**	**5 %**
Electric Vehicles	-1 %	72 %	2 %	54 %	**5 %**	**4 %**	**9 %**	**2 %**
EV Auto	-3 %	54 %	-2 %	70 %	-1 %	77 %	0 %	96 %
EV Equipment	-1 %	66 %	2 %	63 %	**10 %**	**0 %**	**14 %**	**0 %**
Pharmaceuticals	1 %	46 %	2 %	34 %	**-3 %**	**4 %**	**-4 %**	**2 %**
Minerals Mining	-1 %	78 %	7 %	8 %	3 %	35 %	3 %	49 %
Metals Mining	2 %	45 %	**8 %**	**5 %**	**7 %**	**2 %**	3 %	53 %
Basic Chemicals	0 %	96 %	0 %	95 %	0 %	66 %	-1 %	62 %
Specialty Chemicals	-1 %	30 %	-1 %	57 %	-2 %	23 %	-1 %	50 %
Electric Utilities	0 %	73 %	2 %	32 %	**4 %**	**0 %**	**5 %**	**1 %**

Table A.7: CAR U.S. 200 Days Estimation Window



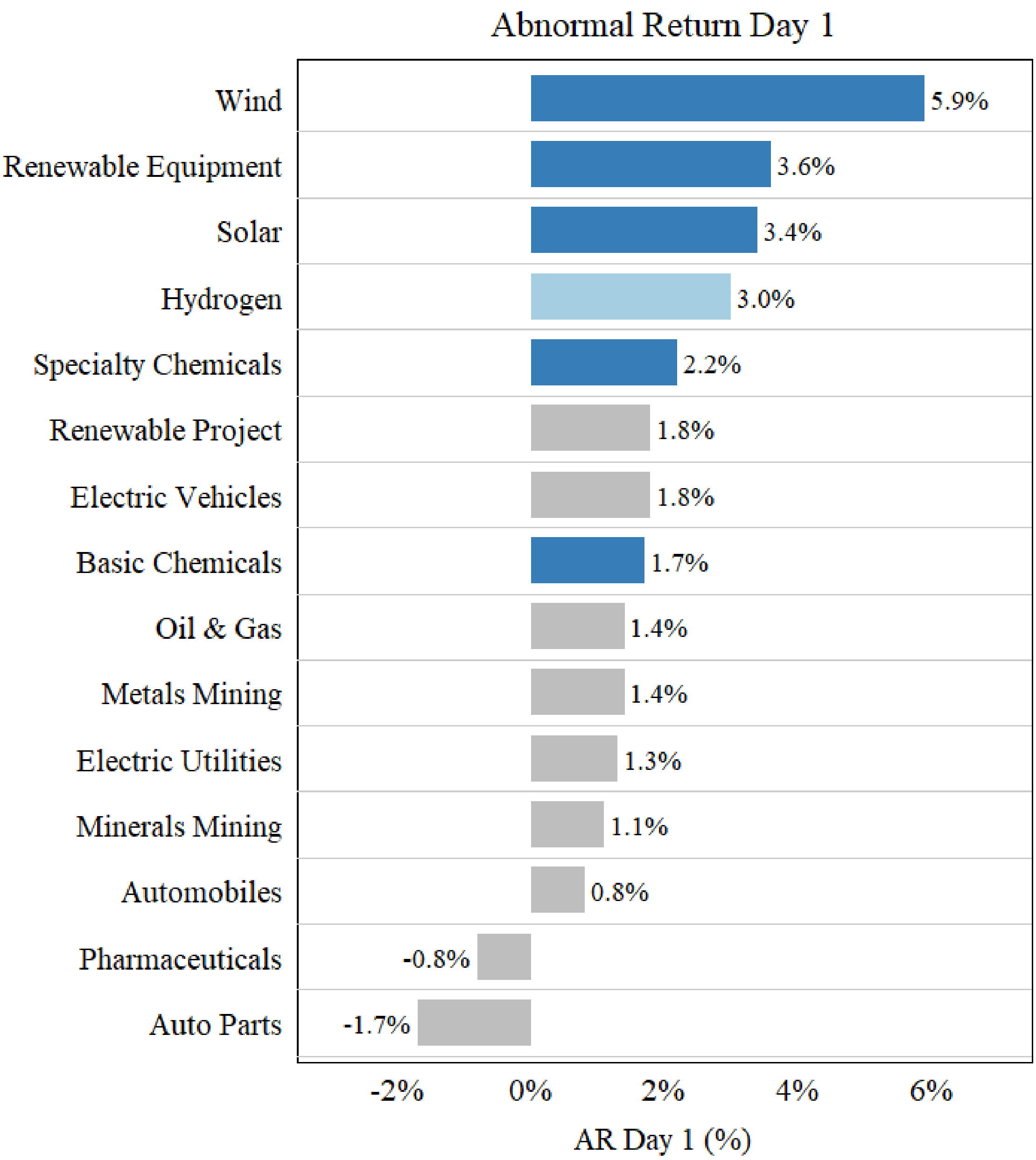
P-value < 5% = Dark blue. P-value < 10% = Light blue. P-value > 10% = Grey

Figure A.5: AR U.S. 200 estimation days

A.3.3 Europe

Europe	**-2 : -1**		**-4 : -1**		**1 : 2**		**1 : 4**	
Industry	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**
Oil & Gas	0 %	80 %	0 %	92 %	**5 %**	**0 %**	2 %	46 %
Automobiles	0 %	95 %	0 %	84 %	-1 %	58 %	3 %	22 %
Auto Parts	0 %	88 %	1 %	73 %	**-3 %**	**4 %**	-2 %	41 %
Renewable Equipment	-1 %	79 %	-2 %	62 %	4 %	6 %	4 %	23 %
Renewable Project	1 %	63 %	1 %	81 %	2 %	26 %	2 %	49 %
Solar	1 %	66 %	3 %	31 %	**6 %**	**1 %**	3 %	40 %
Wind	0 %	97 %	2 %	49 %	**6 %**	**0 %**	**5 %**	**4 %**
Hydrogen	-1 %	66 %	-1 %	75 %	3 %	15 %	3 %	39 %
Electric Vehicles	3 %	16 %	1 %	83 %	2 %	19 %	4 %	10 %
Pharmaceuticals	-1 %	37 %	-1 %	40 %	-1 %	36 %	-1 %	41 %
Minerals Mining	1 %	72 %	2 %	54 %	2 %	40 %	4 %	26 %
Metals Mining	0 %	81 %	-1 %	79 %	3 %	9 %	1 %	72 %
Basic Chemicals	-2 %	12 %	-2 %	29 %	0 %	98 %	2 %	15 %
Specialty Chemicals	-1 %	62 %	-2 %	27 %	**3 %**	**3 %**	**5 %**	**1 %**
Electric Utilities	1 %	71 %	0 %	85 %	2 %	17 %	2 %	30 %

Table A.8: CAR Europe 200 estimation days



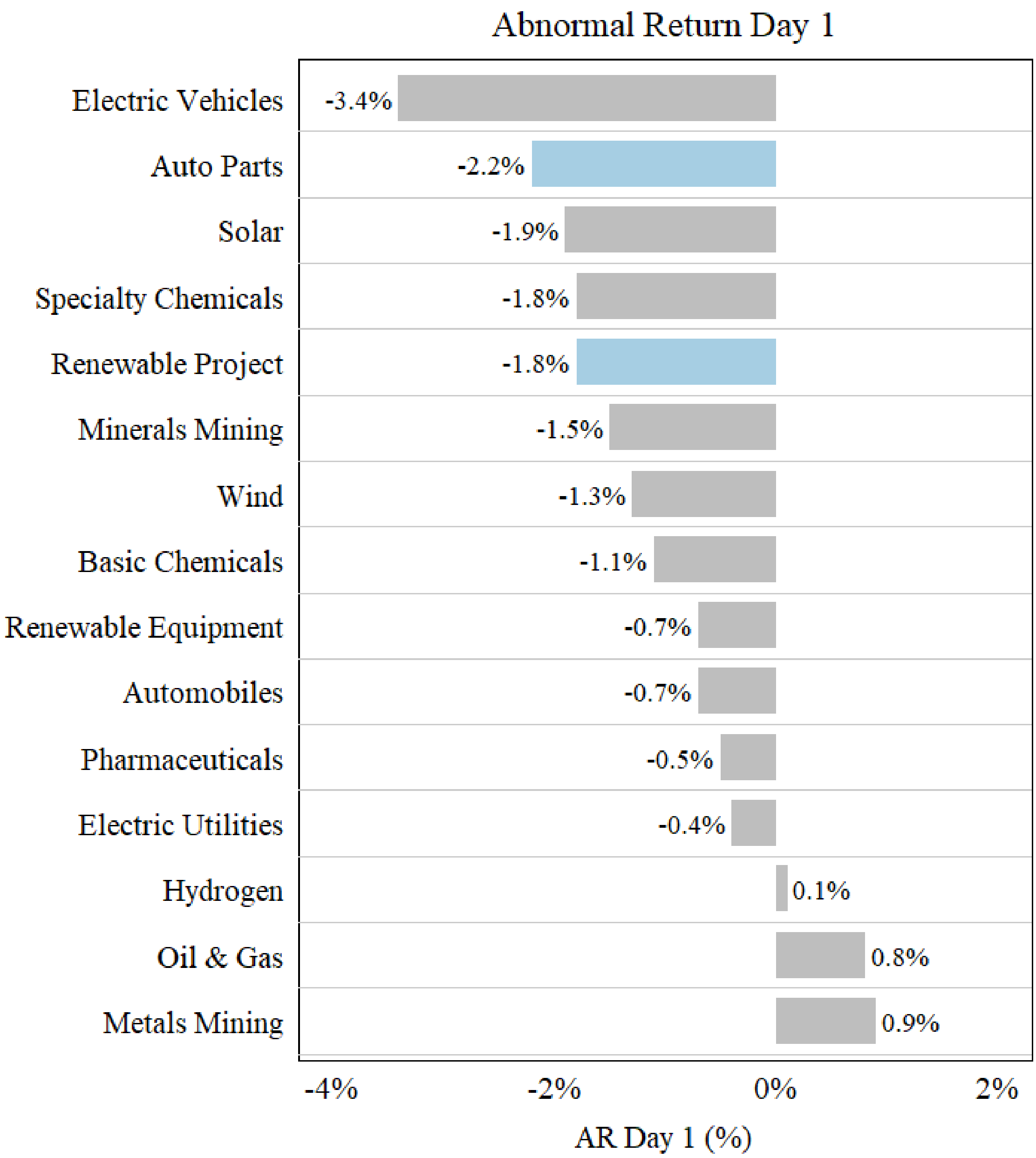
P-value < 5% = Dark blue. P-value < 10% = Light blue. P-value > 10% = Grey

Figure A.6: AR Europe 200 estimation days

A.3.4 Asia

Asia	**-2 : -1**		**-4 : -1**		**1 : 2**		**1 : 4**	
Industry	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**
Oil & Gas	2 %	31 %	0 %	96 %	1 %	50 %	2 %	53 %
Automobiles	-1 %	63 %	-1 %	59 %	-2 %	30 %	0 %	86 %
Auto Parts	0 %	75 %	0 %	85 %	-2 %	19 %	-1 %	82 %
Renewable Equipment	4 %	13 %	3 %	46 %	-1 %	81 %	-1 %	83 %
Renewable Project	-1 %	42 %	-2 %	37 %	0 %	91 %	-2 %	24 %
Solar	3 %	26 %	1 %	83 %	0 %	100 %	-3 %	38 %
Wind	1 %	47 %	-2 %	58 %	2 %	42 %	4 %	20 %
Hydrogen	1 %	80 %	2 %	65 %	4 %	9 %	4 %	25 %
Electric Vehicles	1 %	84 %	1 %	80 %	**-6 %**	**5 %**	-4 %	41 %
Pharmaceuticals	1 %	70 %	1 %	80 %	-2 %	27 %	**-5 %**	**3 %**
Minerals Mining	2 %	56 %	1 %	82 %	-3 %	38 %	-7 %	21 %
Metals Mining	0 %	99 %	1 %	80 %	2 %	35 %	3 %	15 %
Basic Chemicals	0 %	81 %	2 %	57 %	-1 %	71 %	2 %	46 %
Specialty Chemicals	-2 %	52 %	-1 %	83 %	-2 %	40 %	-1 %	81 %
Electric Utilities	0 %	100 %	-1 %	49 %	-1 %	64 %	1 %	60 %

Table A.9: CAR Asia 200 estimation days



P-value $<$ 5% = Dark blue. P-value $<$ 10% = Light blue. P-value $>$ 10% = Grey

Figure A.7: AR Asia 200 estimation days

A.4 Longer Event Windows

A.4.1 US. GICS

GICS	-6 : -1		-10 : -1		1 : 6		1 : 10	
Sector	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**
Health Care	-1 %	77 %	-1 %	57 %	-2 %	31 %	-1 %	58 %
Information Technology	1 %	35 %	2 %	20 %	1 %	58 %	0 %	97 %
Financials	-1 %	35 %	-1 %	36 %	0 %	100 %	2 %	18 %
Energy	3 %	25 %	**7 %**	**3 %**	-4 %	8 %	-4 %	20 %
Utilities	0 %	84 %	-2 %	53 %	**6 %**	**1 %**	**7 %**	**3 %**
Industrials	0 %	66 %	1 %	42 %	**4 %**	**0 %**	**5 %**	**0 %**
Consumer Discretionary	0 %	84 %	0 %	87 %	3 %	11 %	1 %	69 %
Consumer Staples	-1 %	52 %	-3 %	29 %	3 %	15 %	4 %	9 %
Communication Services	-2 %	21 %	-2 %	32 %	**-4 %**	**0 %**	**-5 %**	**2 %**
Real Estate	0 %	89 %	0 %	99 %	1 %	70 %	3 %	34 %
Materials	0 %	76 %	-1 %	55 %	1 %	67 %	2 %	28 %

Table A.10: U.S. GICS Long Event Windows

A.4.2 U.S.

U.S.	**-6 : -1**		**-10 : -1**		**1 : 6**		**1 : 10**	
Industry	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**
Oil & Gas	3 %	17 %	**7 %**	**2 %**	**-6 %**	**0 %**	**-6 %**	**3 %**
Automobiles	0 %	98 %	-1 %	92 %	-3 %	49 %	-8 %	17 %
Auto Parts	-1 %	59 %	-1 %	79 %	**-7 %**	**1 %**	-4 %	23 %
Renewable Equipment	2 %	74 %	2 %	81 %	12 %	7 %	**17 %**	**4 %**
Renewable Project	3 %	70 %	0 %	97 %	11 %	9 %	**18 %**	**4 %**
Solar	4 %	60 %	2 %	82 %	7 %	31 %	12 %	21 %
Wind	3 %	41 %	-2 %	69 %	**10 %**	**1 %**	**12 %**	**1 %**
Hydrogen	-1 %	93 %	-10 %	21 %	5 %	38 %	9 %	27 %
Electric Vehicles	3 %	56 %	3 %	65 %	7 %	14 %	4 %	48 %
EV Auto	0 %	96 %	-2 %	76 %	-9 %	14 %	**-16 %**	**4 %**
EV Equipment	-1 %	90 %	0 %	99 %	**11 %**	**3 %**	8 %	22 %
Pharmaceuticals	-1 %	82 %	-3 %	38 %	**-6 %**	**1 %**	**-6 %**	**4 %**
Minerals Mining	**11 %**	**3 %**	7 %	26 %	7 %	19 %	10 %	13 %
Metals Mining	9 %	8 %	**16 %**	**2 %**	4 %	41 %	6 %	33 %
Basic Chemicals	1 %	76 %	0 %	93 %	0 %	84 %	0 %	92 %
Specialty Chemicals	-1 %	78 %	-1 %	69 %	-1 %	81 %	-1 %	82 %
Electric Utilities	1 %	81 %	-1 %	62 %	**6 %**	**1 %**	**7 %**	**2 %**

Table A.11: CAR U.S. Long windows

A.4.3 Europe

Europe	**-6 : -1**		**-10 : -1**		**1 : 6**		**1 : 10**	
Industry	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**
Oil & Gas	-1 %	88 %	0 %	95 %	1 %	69 %	0 %	99 %
Automobiles	-3 %	30 %	-3 %	50 %	-1 %	69 %	-2 %	50 %
Auto Parts	-1 %	77 %	-2 %	64 %	**-7 %**	**4 %**	-7 %	7 %
Renewable Equipment	-3 %	46 %	-2 %	71 %	-1 %	89 %	0 %	96 %
Renewable Project	-1 %	80 %	-2 %	65 %	-1 %	68 %	-2 %	64 %
Solar	1 %	91 %	-1 %	82 %	1 %	82 %	2 %	71 %
Wind	-1 %	67 %	-4 %	42 %	3 %	37 %	5 %	29 %
Hydrogen	-3 %	50 %	1 %	84 %	-1 %	80 %	0 %	93 %
Electric Vehicles	4 %	15 %	7 %	8 %	5 %	10 %	4 %	31 %
Pharmaceuticals	-2 %	19 %	-2 %	36 %	-2 %	18 %	**-5 %**	**2 %**
Minerals Mining	5 %	19 %	8 %	12 %	4 %	32 %	4 %	38 %
Metals Mining	-1 %	87 %	-2 %	61 %	1 %	81 %	0 %	97 %
Basic Chemicals	-2 %	39 %	0 %	87 %	2 %	46 %	2 %	59 %
Specialty Chemicals	-3 %	22 %	-5 %	18 %	3 %	28 %	2 %	55 %
Electric Utilities	-2 %	48 %	-3 %	47 %	1 %	74 %	3 %	47 %

Table A.12: CAR Europe long windows

A.4.4 Asia

Asia	**-6 : -1**		**-10 : -1**		**1 : 6**		**1 : 10**	
Industry	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**	**CAR**	**P-value**
Oil & Gas	4 %	32 %	7 %	14 %	1 %	88 %	0 %	100 %
Automobiles	-2 %	47 %	0 %	93 %	-2 %	63 %	-2 %	68 %
Auto Parts	1 %	74 %	2 %	62 %	-1 %	84 %	-2 %	65 %
Renewable Equipment	-1 %	79 %	-4 %	47 %	-7 %	9 %	-5 %	31 %
Renewable Project	-3 %	13 %	-2 %	48 %	-4 %	6 %	-4 %	21 %
Solar	-3 %	46 %	-9 %	9 %	**-9 %**	**3 %**	-8 %	15 %
Wind	-1 %	77 %	-1 %	85 %	1 %	74 %	4 %	36 %
Hydrogen	2 %	64 %	3 %	61 %	3 %	49 %	3 %	60 %
Electric Vehicles	-6 %	23 %	-9 %	17 %	-8 %	13 %	-10 %	13 %
Pharmaceuticals	-1 %	69 %	-4 %	24 %	**-6 %**	**2 %**	-4 %	24 %
Minerals Mining	-5 %	43 %	-9 %	28 %	-5 %	41 %	-5 %	57 %
Metals Mining	2 %	53 %	2 %	61 %	2 %	53 %	2 %	66 %
Basic Chemicals	1 %	74 %	3 %	55 %	-2 %	65 %	-2 %	58 %
Specialty Chemicals	-1 %	82 %	0 %	95 %	-1 %	78 %	-3 %	59 %
Electric Utilities	-3 %	16 %	**-5 %**	**5 %**	0 %	95 %	-2 %	48 %

Table A.13: CAR Asia long windows

A.5 OLS Diagnostic Plots

A.5.1 U.S. GICS sectors

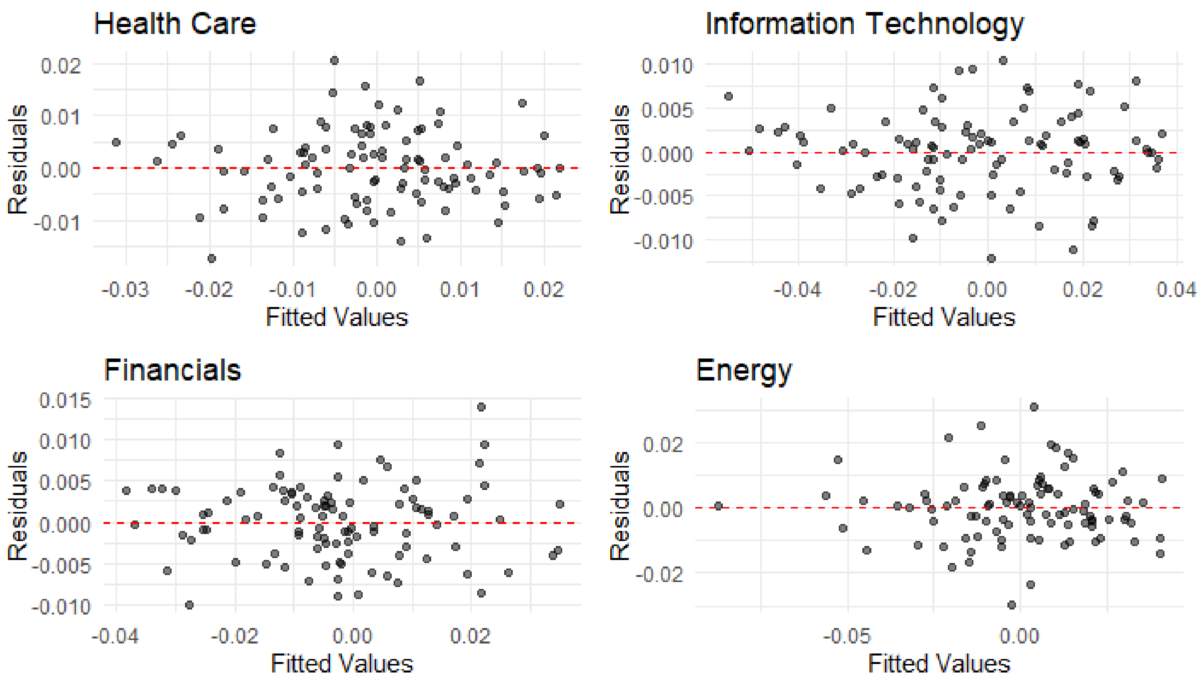


Figure A.8: Residual plots for various GICS sectors

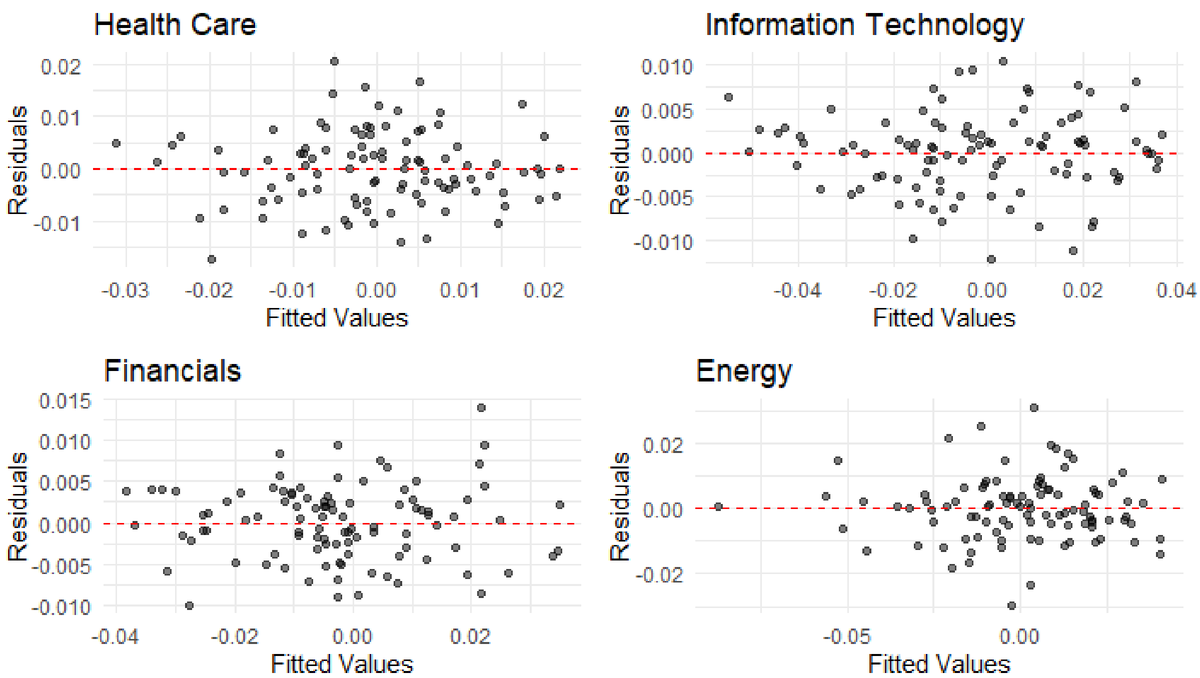


Figure A.9: Residual plots for various GICS sectors

Figure A.10: Residual plots for various GICS sectors

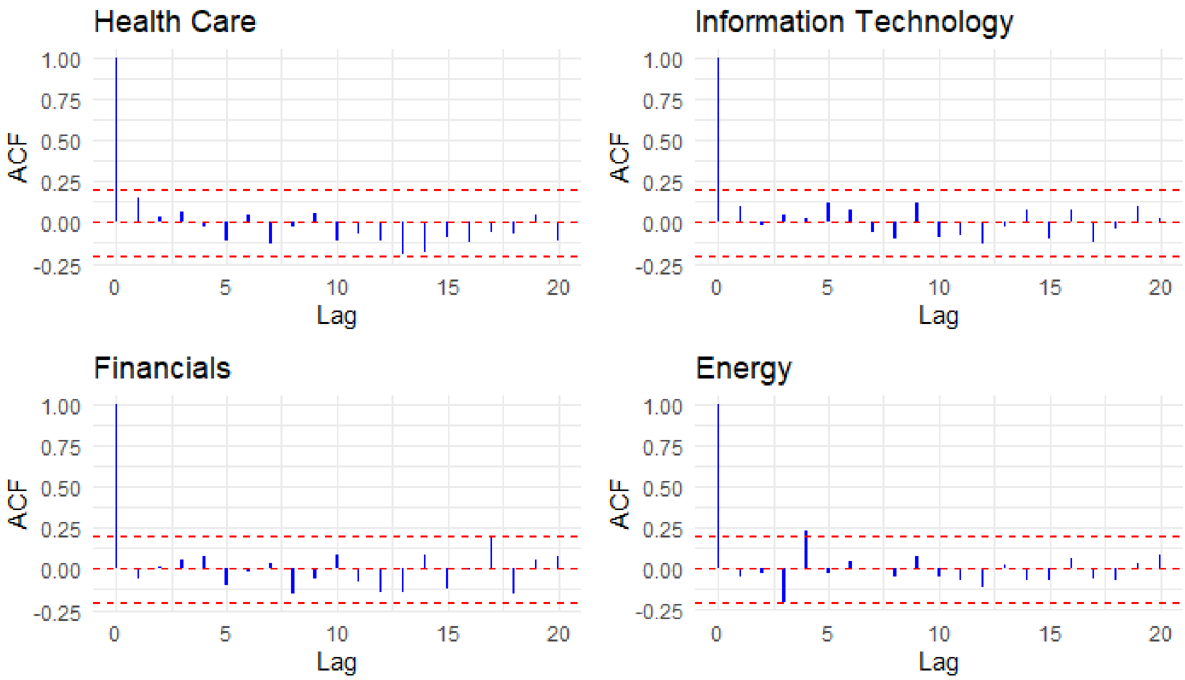


Figure A.11: ACF plots for various GICS sectors

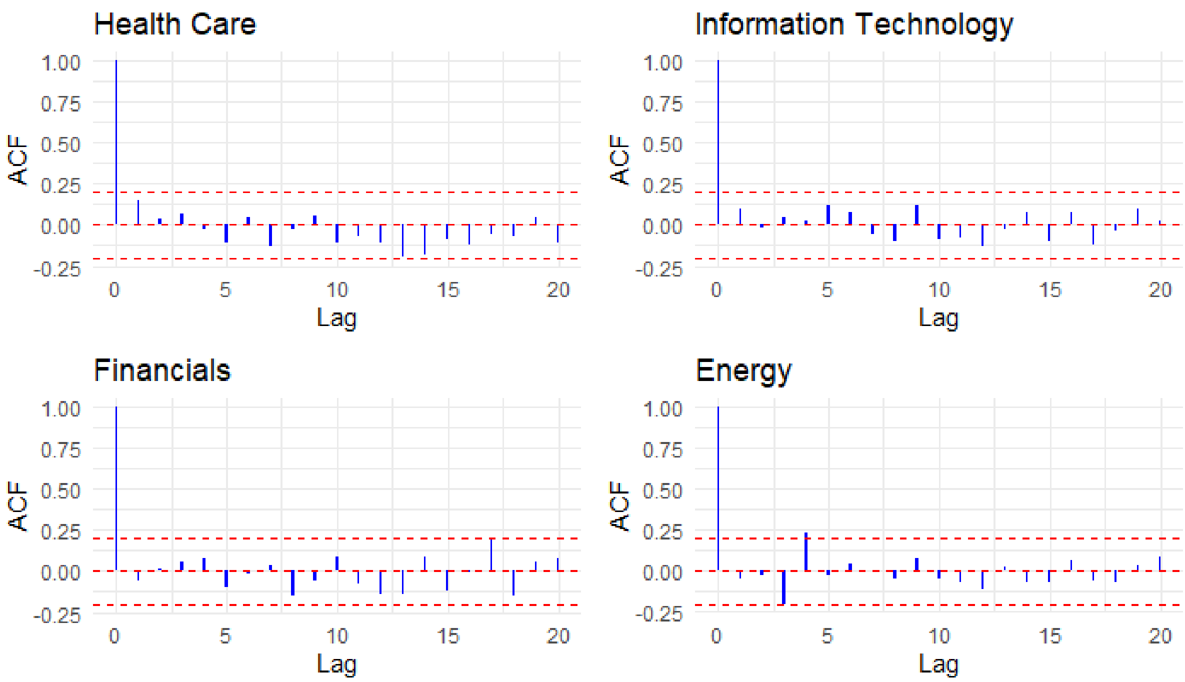


Figure A.12: ACF plots for various GICS sectors

Figure A.13: ACF plots for various GICS sectors

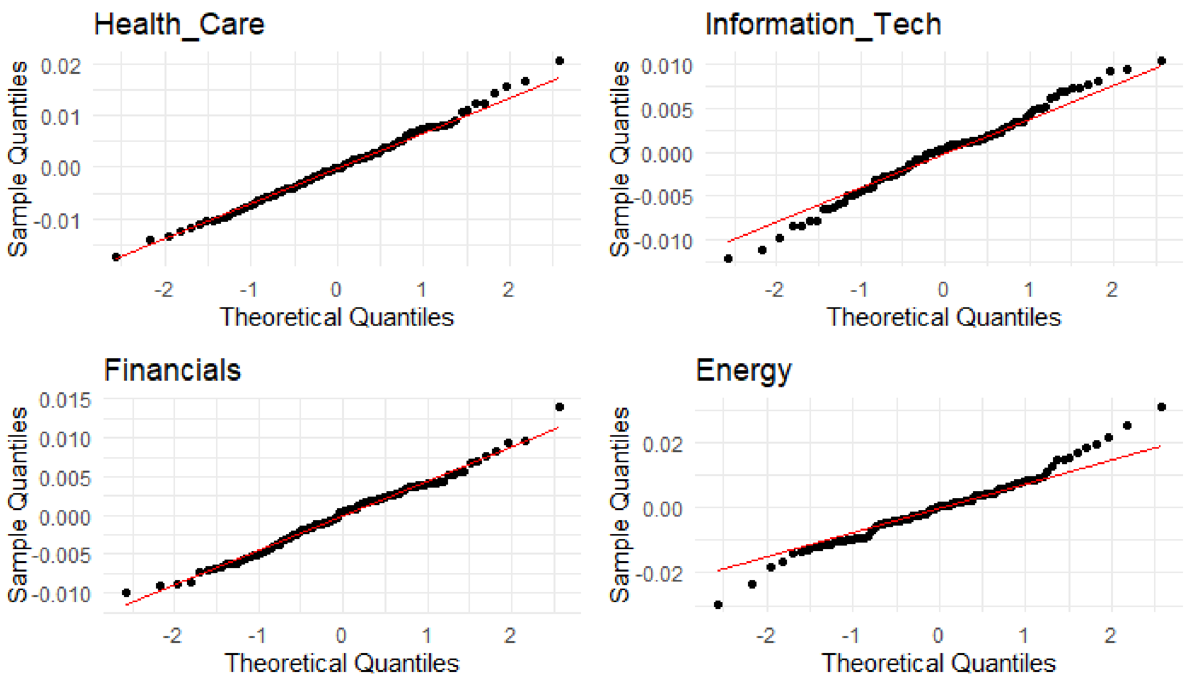


Figure A.14: QQ plots for various GICS sectors

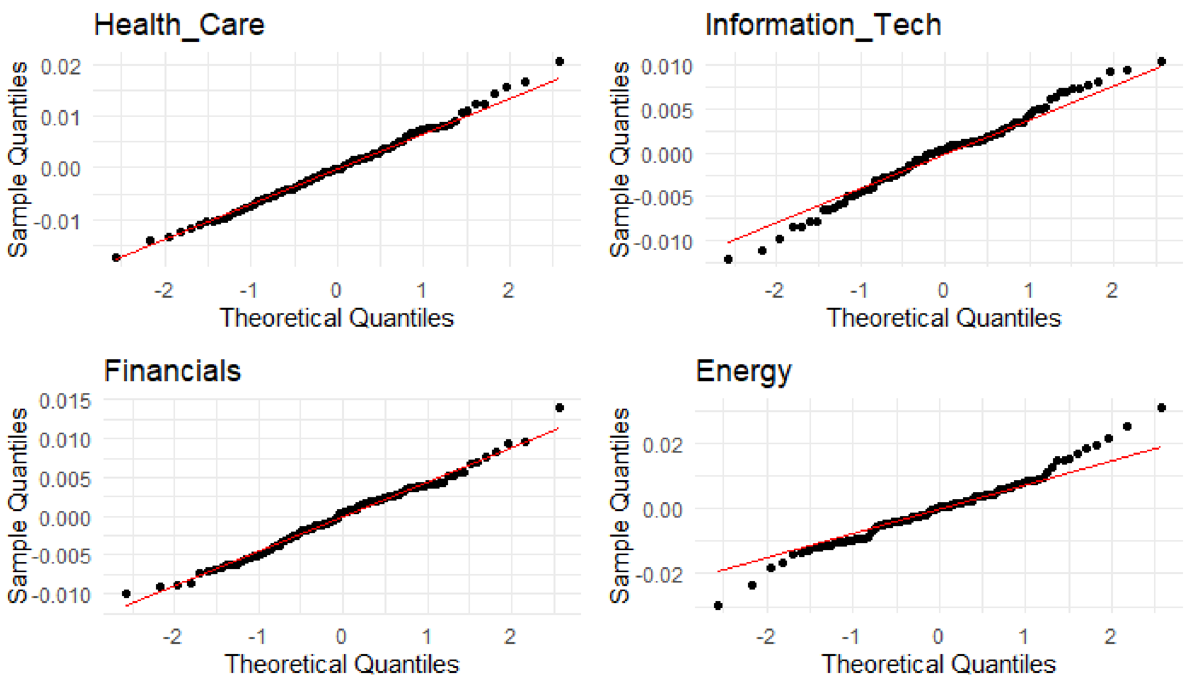


Figure A.15: QQ plots for various GICS sectors

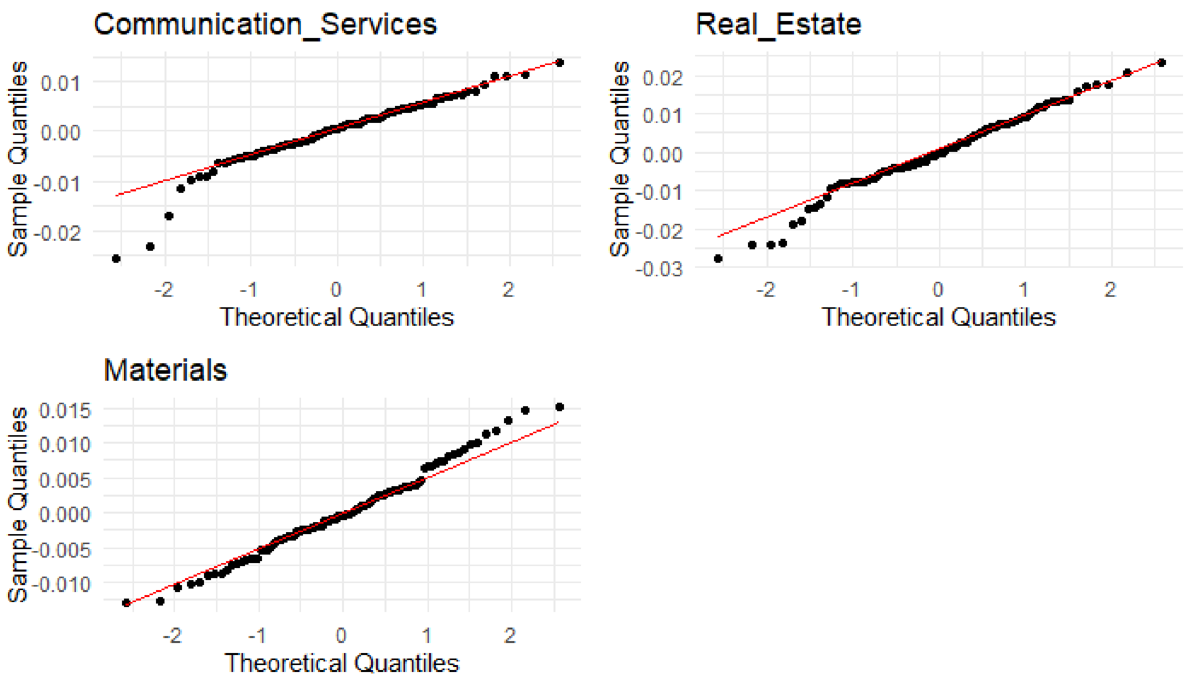


Figure A.16: QQ plots for various GICS sectors

A.5.2 U.S. Targeted Industries

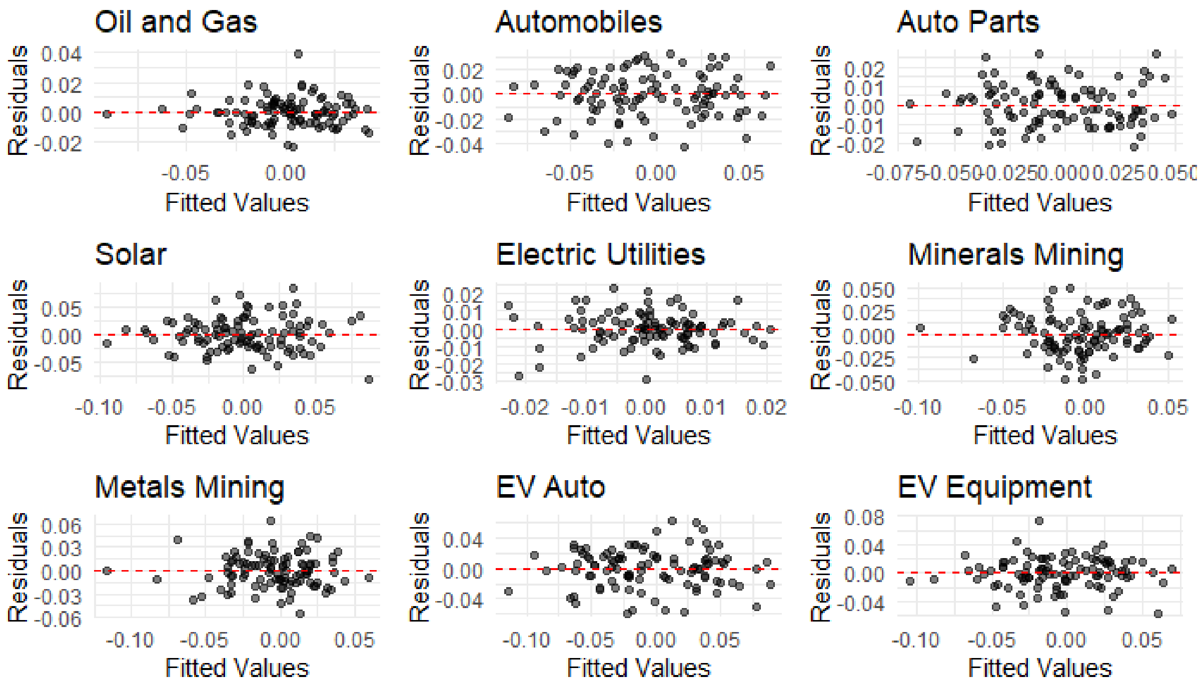


Figure A.17: Residual plots for various U.S. industries

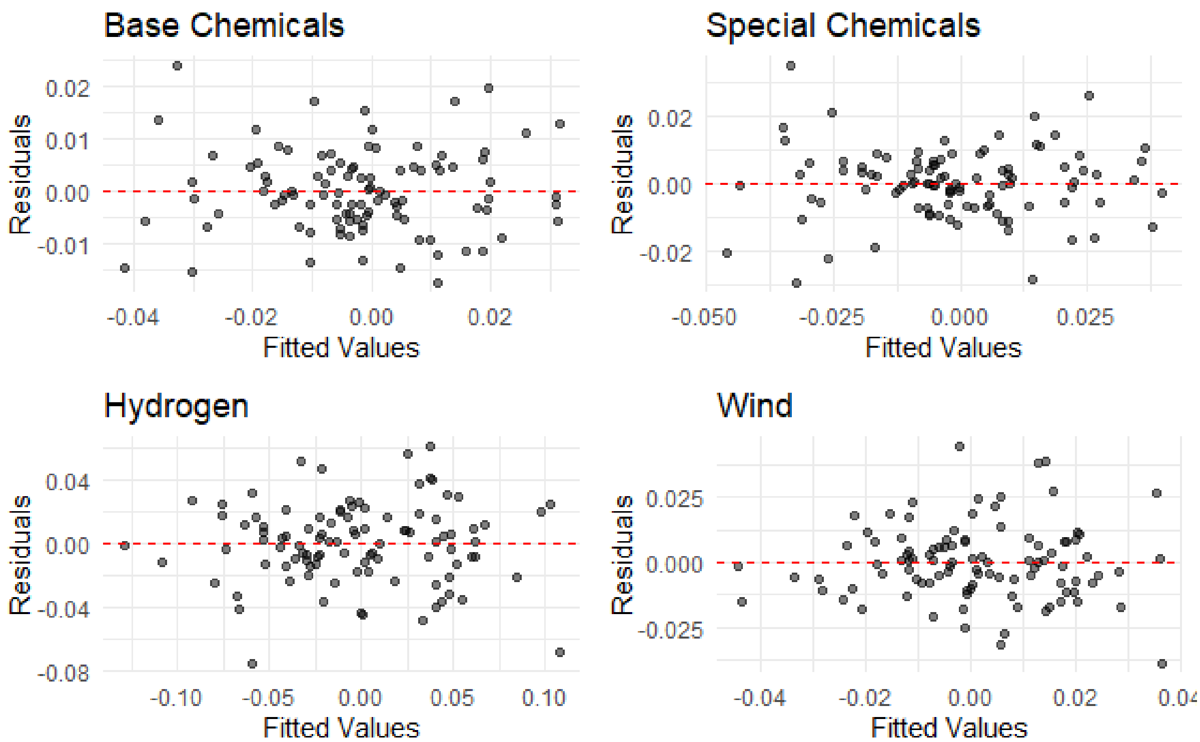


Figure A.18: Residual plots for various U.S. industries

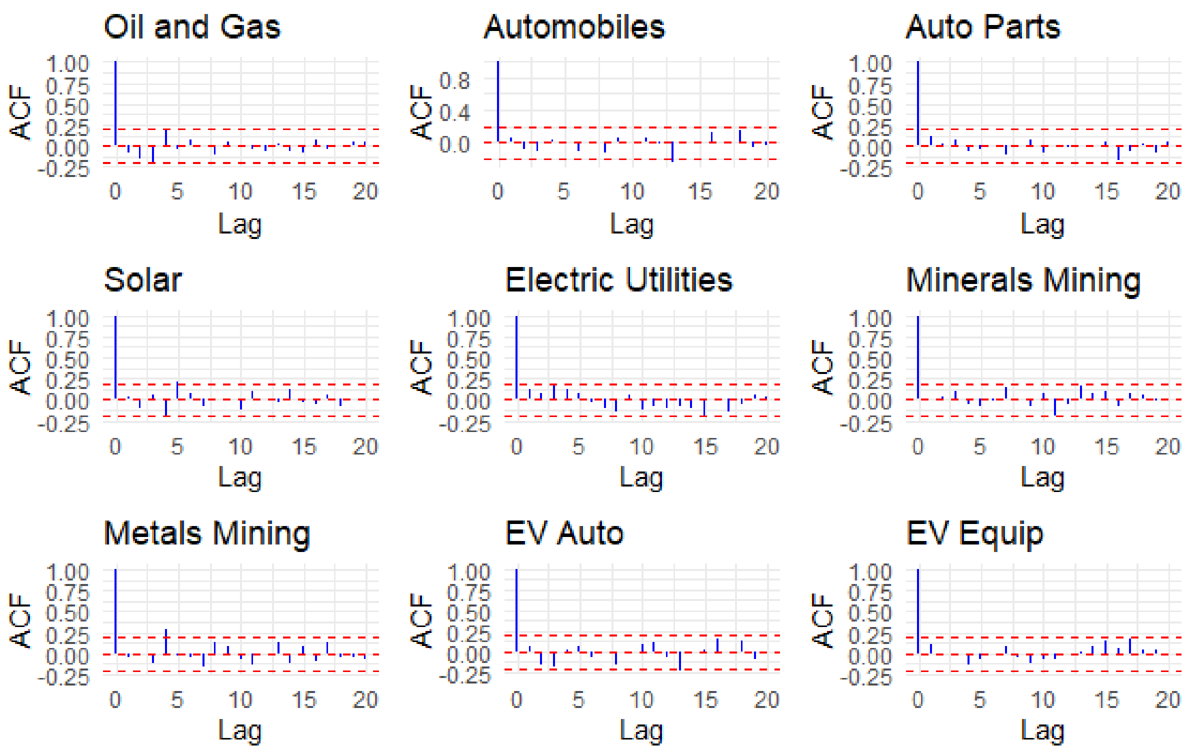


Figure A.19: ACF plots for various U.S. industries

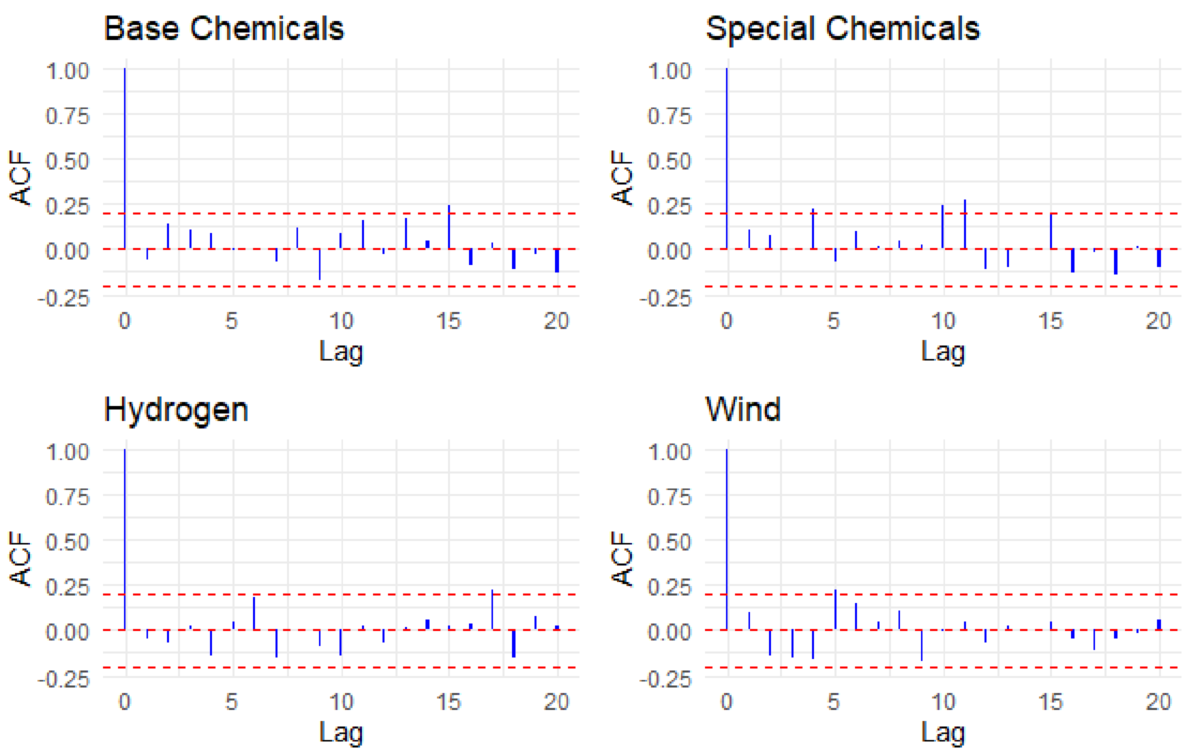


Figure A.20: ACF plots for various U.S. industries

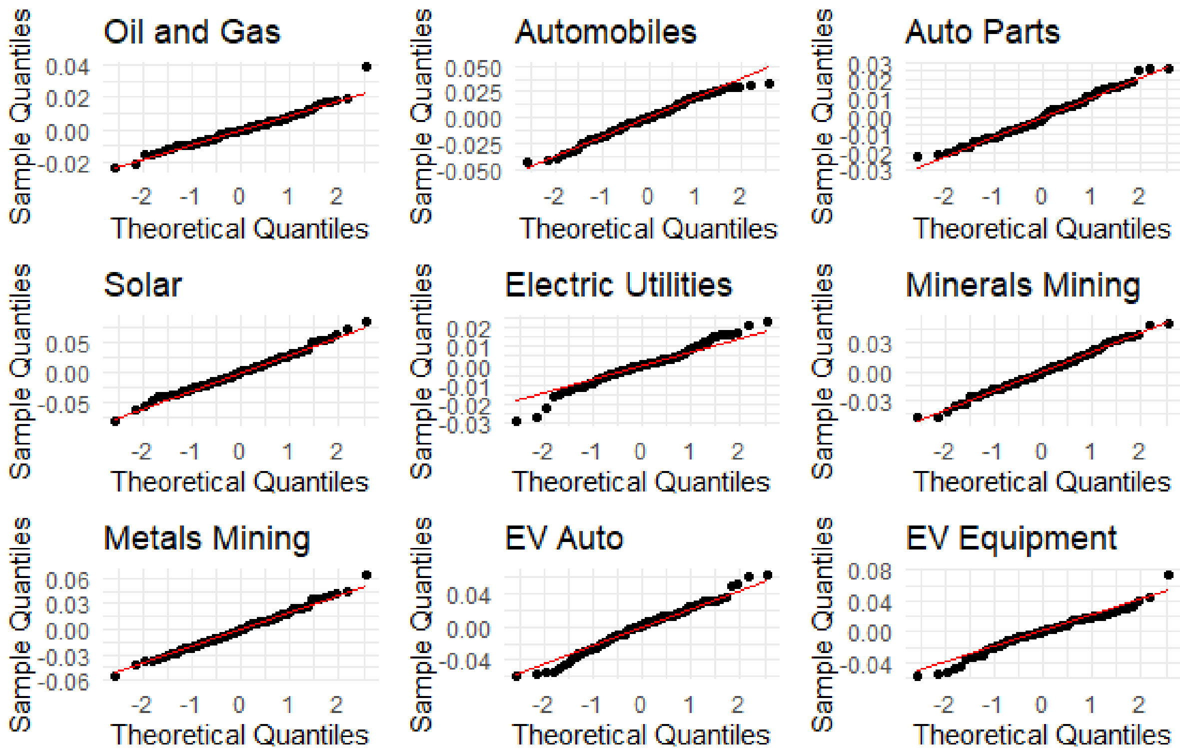


Figure A.21: QQ plots for various U.S. industries

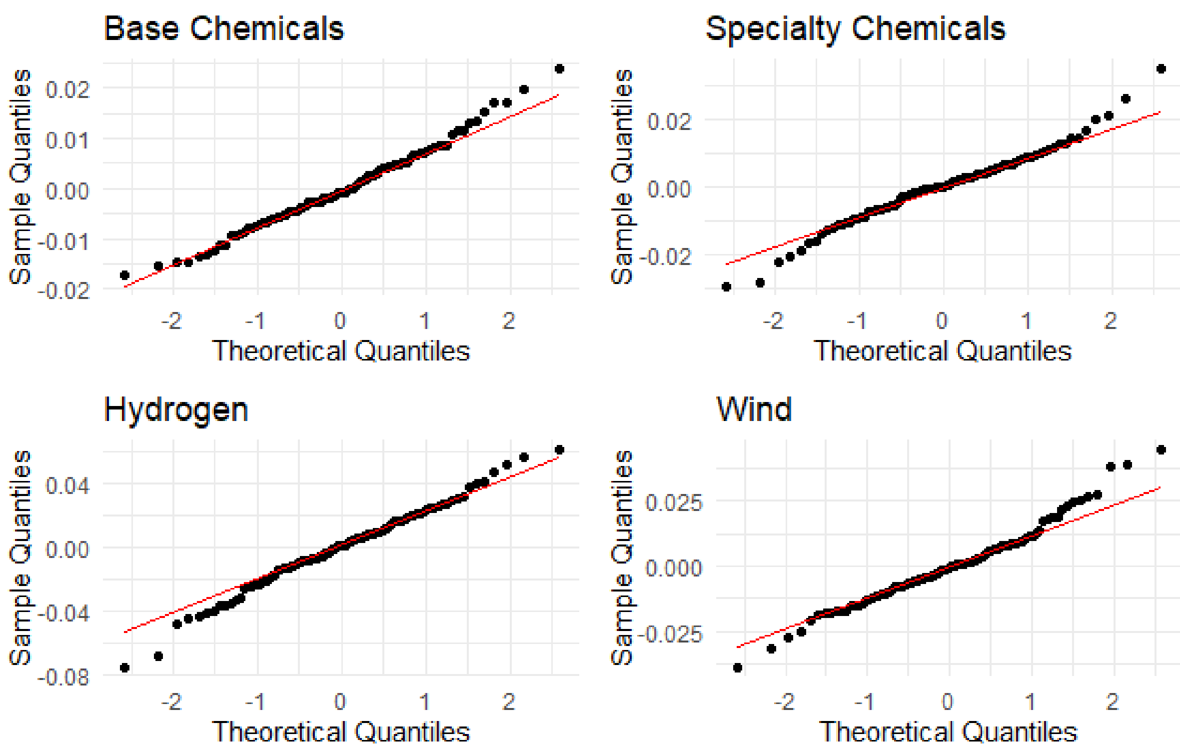


Figure A.22: QQ plots for various U.S. industries

A.5.3 European Industries

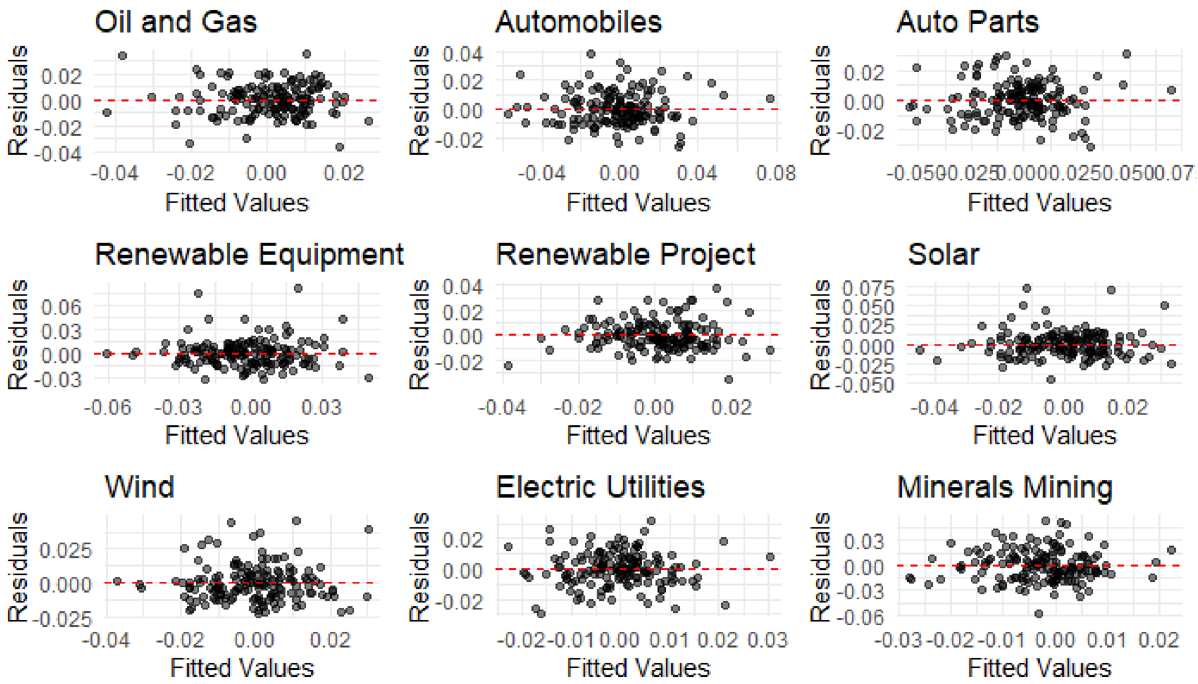


Figure A.23: Residual plots for various European industries

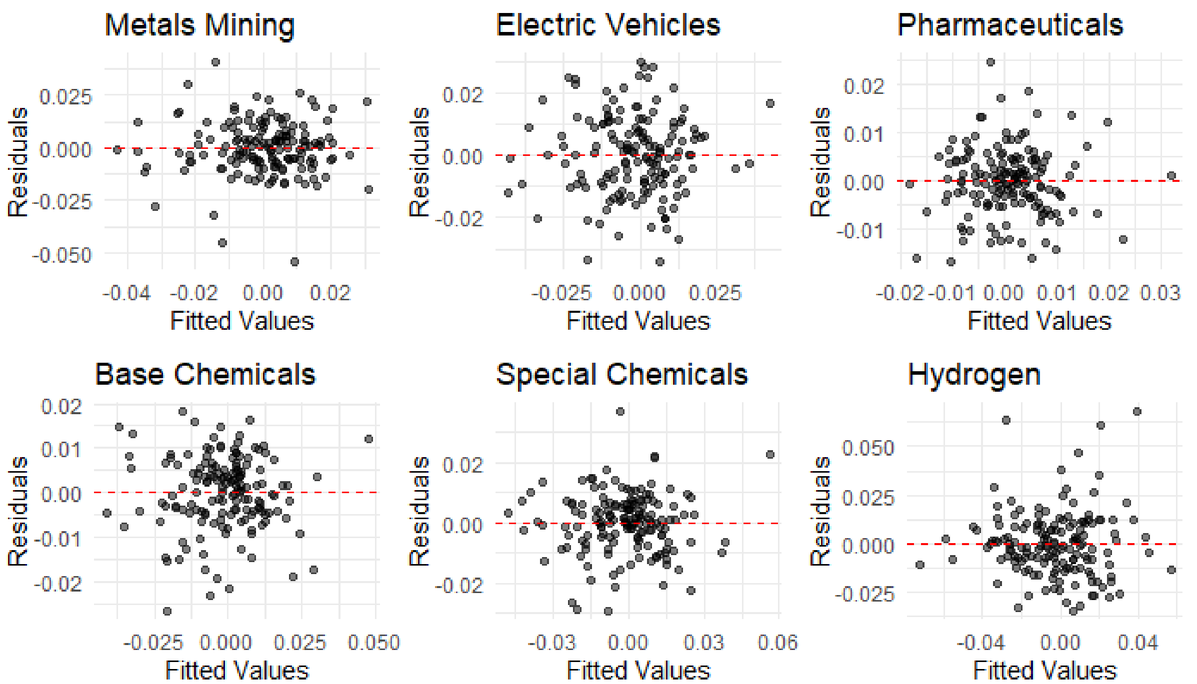


Figure A.24: Residual plots for various European industries

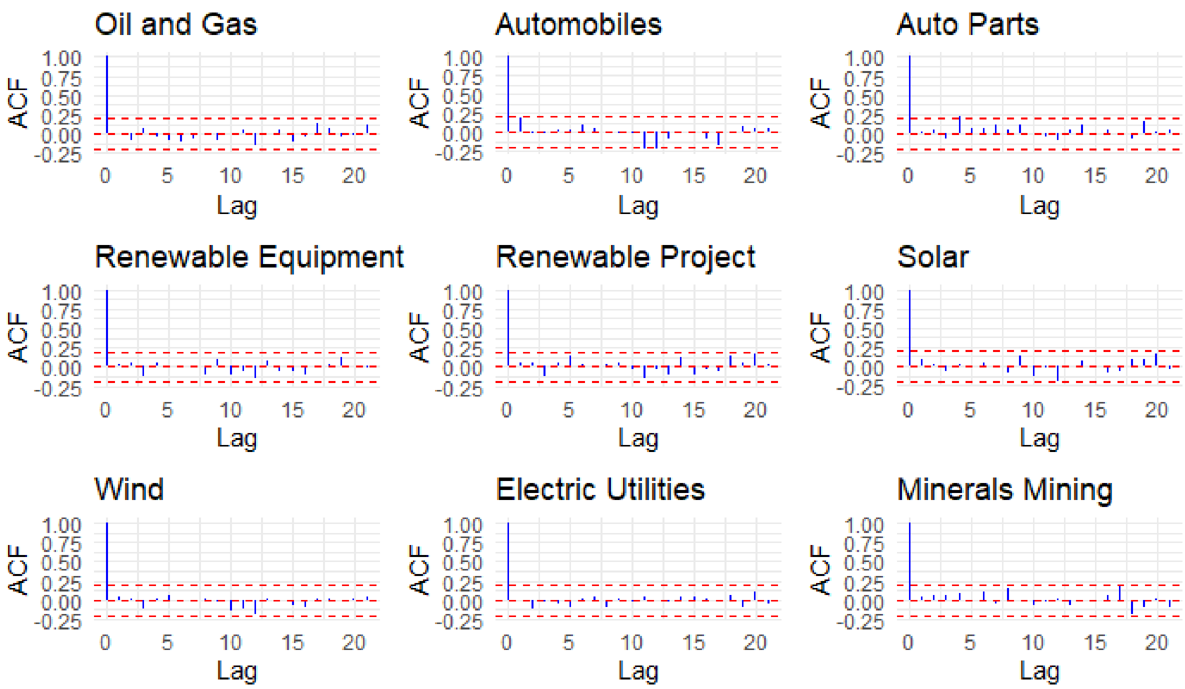


Figure A.25: ACF plots for various European industries

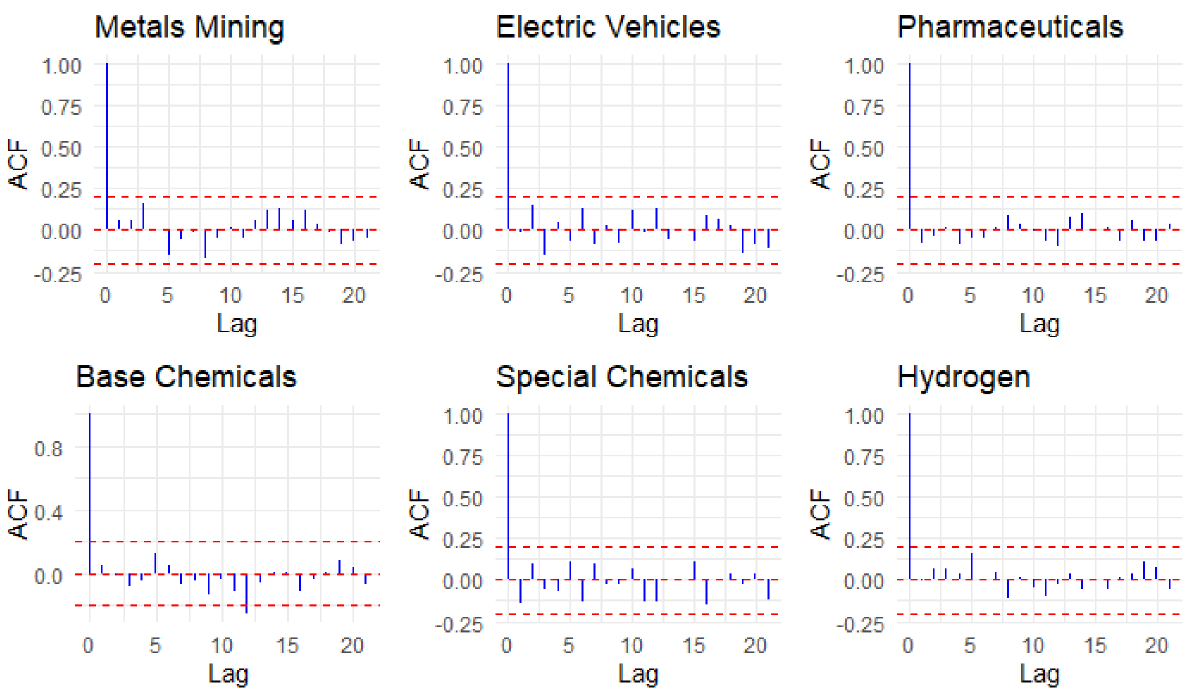


Figure A.26: ACF plots for various European industries

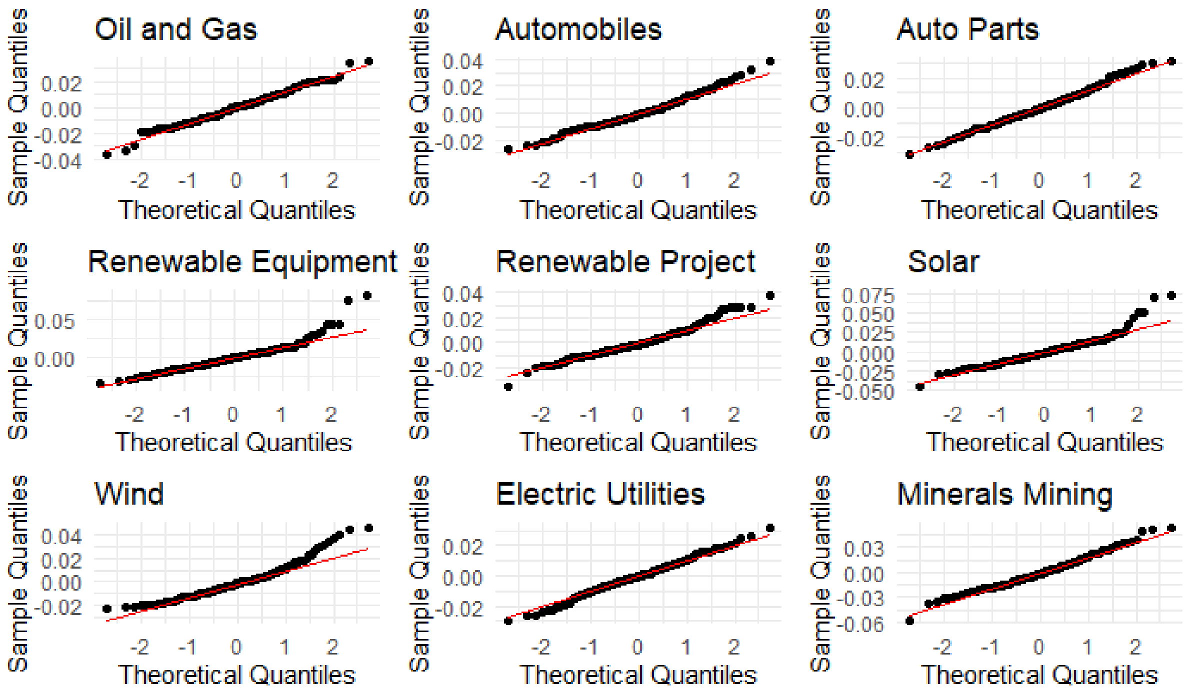


Figure A.27: QQ plots for various European industries

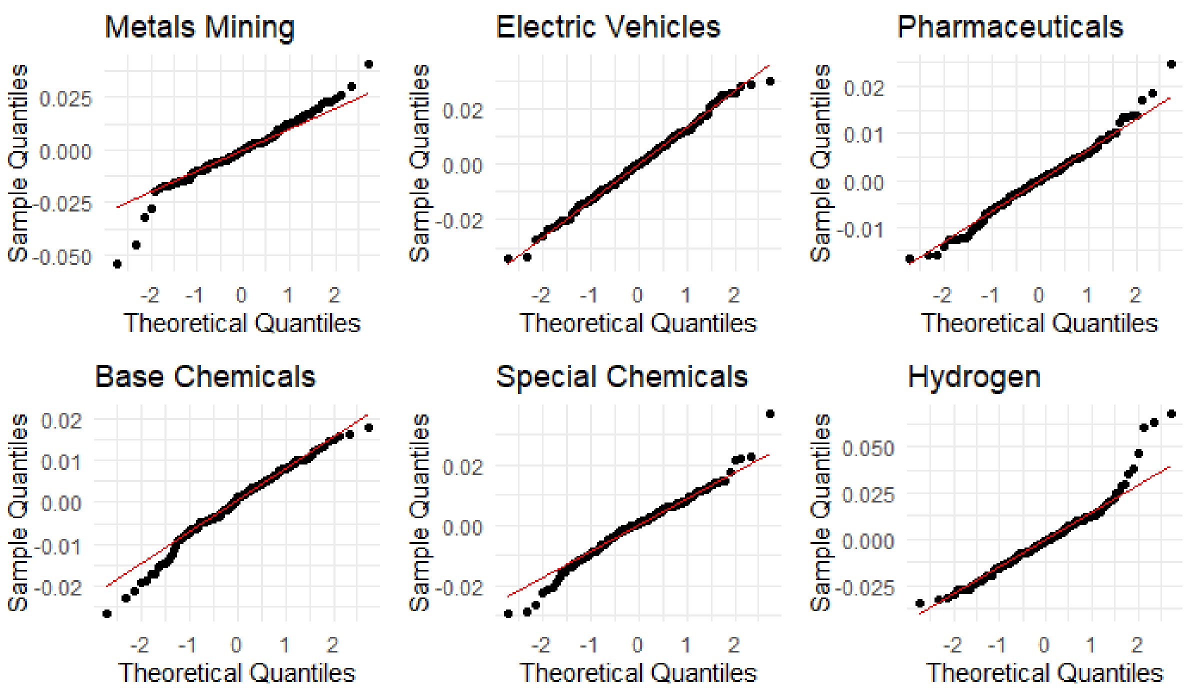


Figure A.28: QQ plots for various European industries

A.5.4 Asian Industries

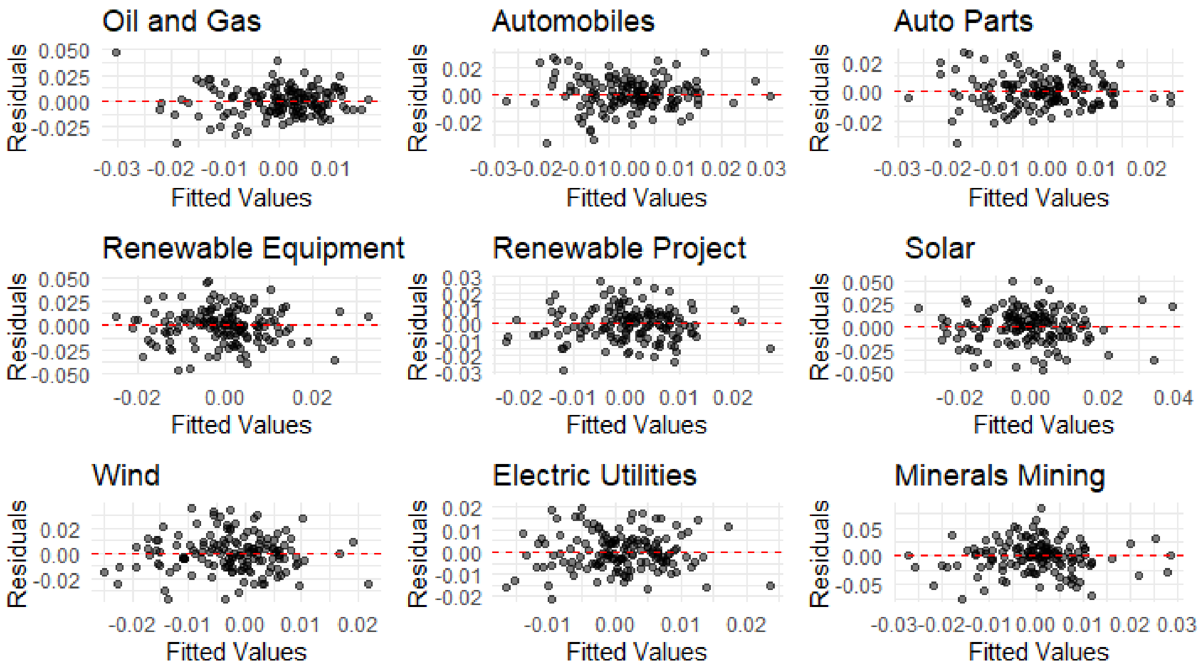


Figure A.29: Residual plots for various Asian industries

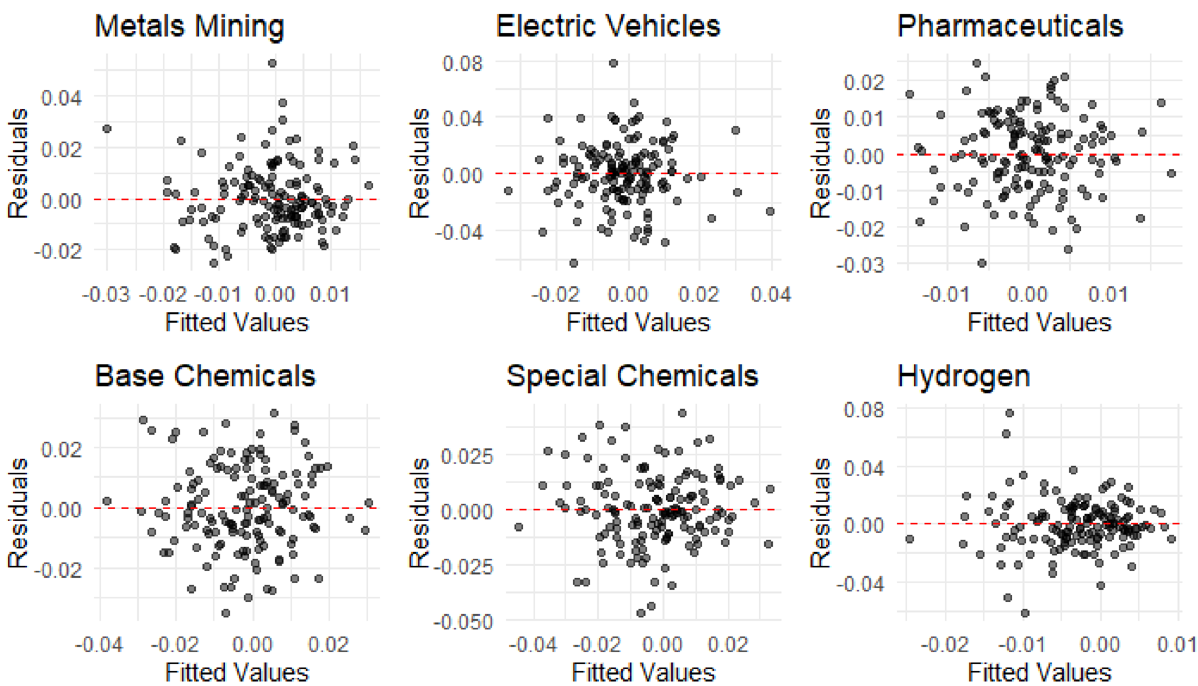


Figure A.30: Residual plots for various Asian industries

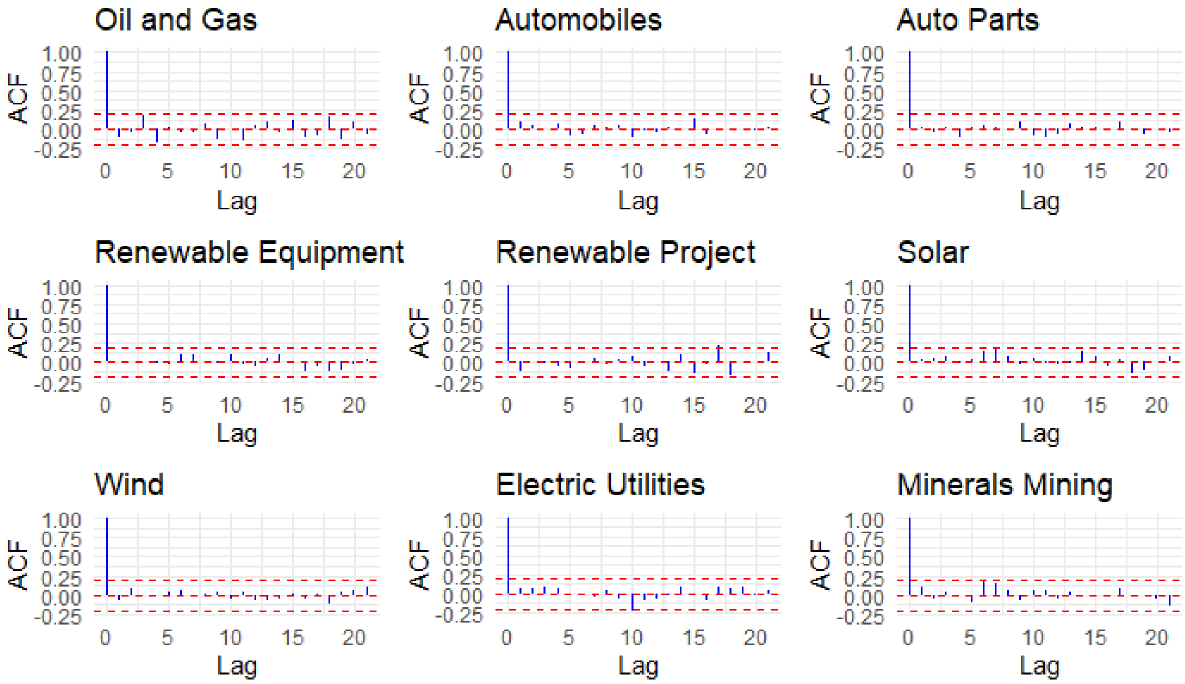


Figure A.31: ACF plots for various Asian industries

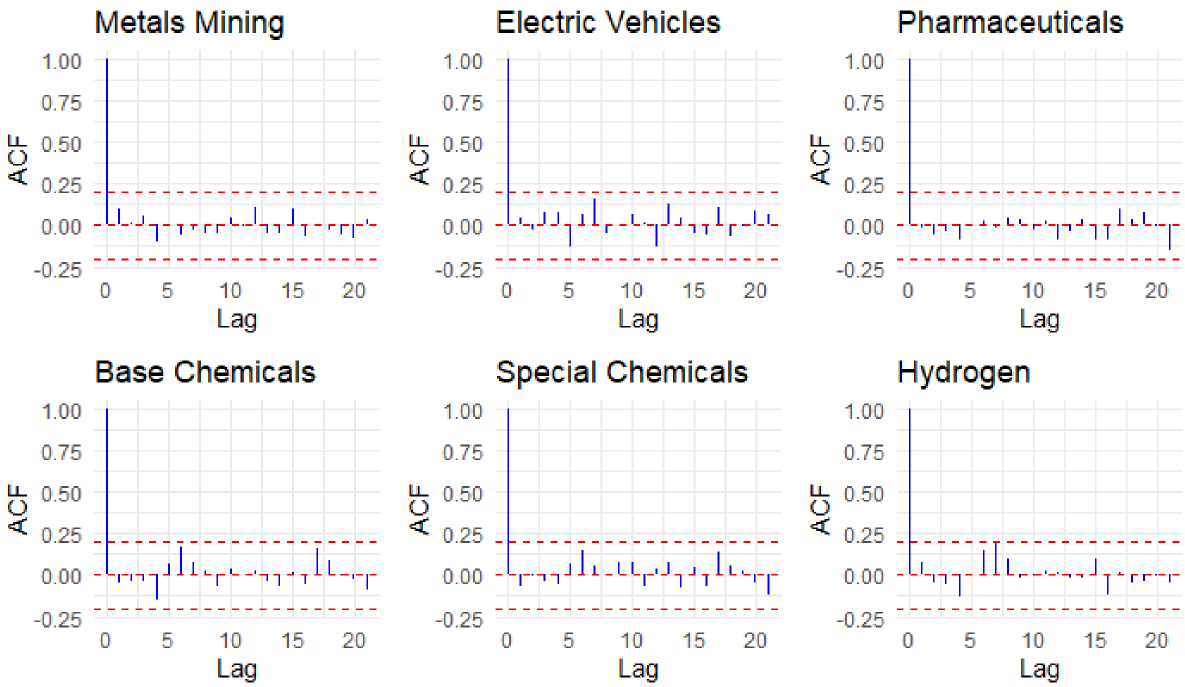


Figure A.32: ACF plots for various Asian industries

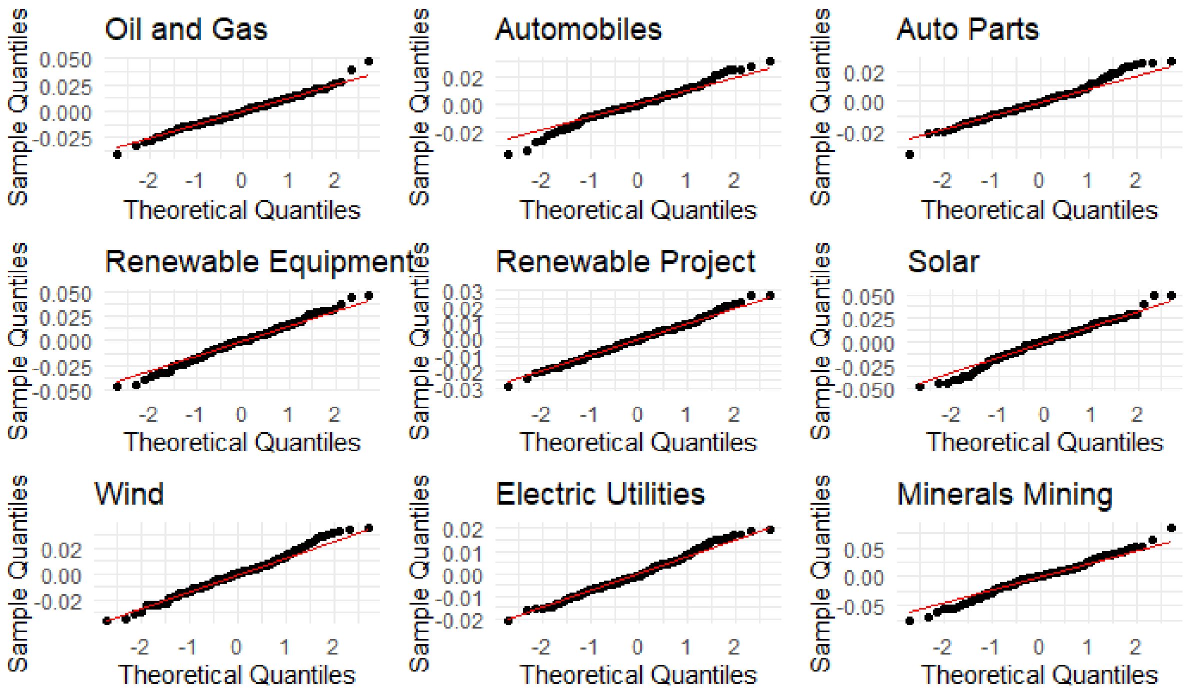


Figure A.33: QQ plots for various Asian industries

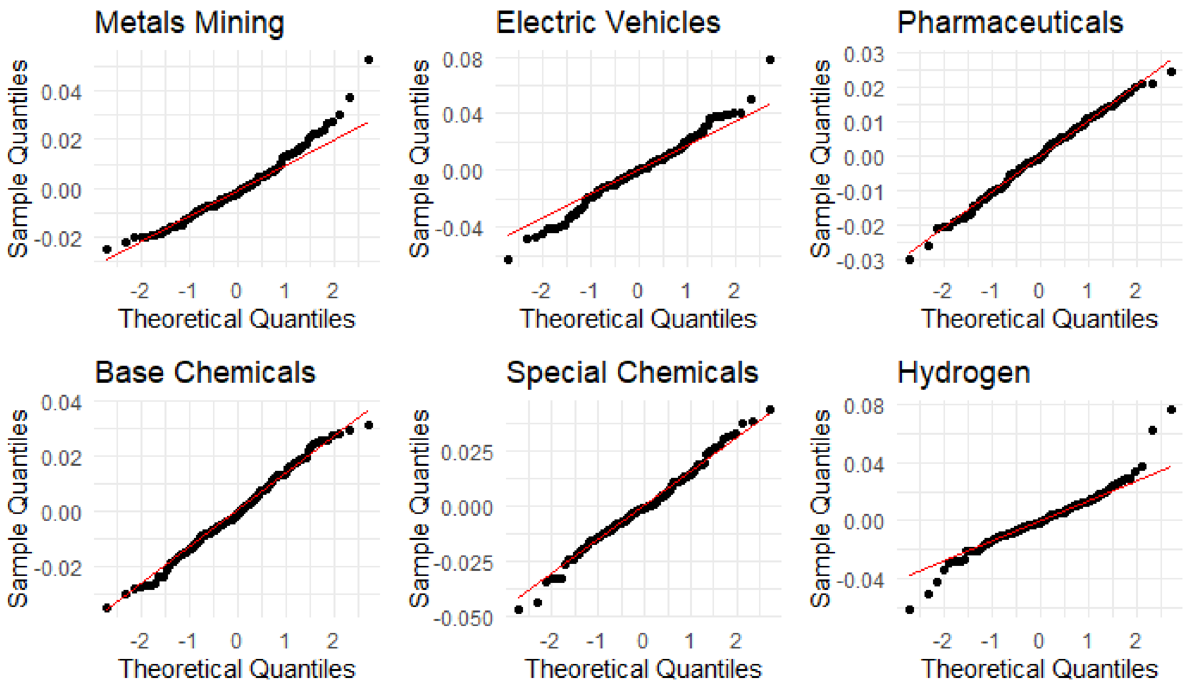


Figure A.34: QQ plots for various Asian industries

	Variance Inflation Factor					
	Mkt.RF	**SMB**	**HML**	**RMW**	**CMA**	**UMD**
USA	1,65	1,53	5,39	1,85	5,60	4,92
Europe	2,27	1,41	8,35	4,20	5,60	1,49
Asia	2,87	1,85	6,27	1,11	4,24	1,59

Table A.14: Variance Inflation Factor across regions

A.6 Overview of Companies in Industries

A.6.1 U.S. Industries Overview

Renewable Equipment	**Renewable Project**
Enphase Energy Inc	Sunrun Inc
Plug Power Inc	Ameresco Inc-Cl A
First Solar Inc	Sunnova Energy International
Shoals Technologies Group -A	Emeren Group Ltd
Array Technologies Inc	Eneti Inc
Fluence Energy Inc	Isun Inc
Fuelcell Energy Inc	
Stem Inc	
Ess Tech Inc	
Heliogen Inc	
Beam Global	
Eos Energy Enterprises Inc	
Broadwind Inc	
Ocean Power Technologies Inc	
Sun Pacific Holding Corp	

Table A.15: U.S. Renewable Companies

Solar	**Hydrogen**	**Wind**
Enphase Energy Inc	FuelCell Energy Inc	Nextera Energy
First Solar Inc	Plug Power Inc	Clearway Energy Inc
Sunrun Inc	Nikola Corp	Broadwind Inc
Sunpower Corp	Bloom Energy Corp Class A	TPI Composites Inc
Sunnova Energy International		
Shoals Technologies Group -A		
Array Technologies Inc		
Altus Power Inc		
Emeren Group Ltd		

Table A.16: U.S, Solar, Hydrogen, Wind

Electric Vehicles	**EV Auto**	**EV Equipment**
Tesla Inc	Tesla Inc	Enovix Corporation
Lucid Group	Lucid Group	Ses AI Corp
Rivian Automotive	Rivian Automotive	Microvast Holdings
Enovix Corporation		Romeo Power Inc
Ses AI Corp		Electrovaya Inc
Microvast Holdings		Beem
Romeo Power Inc		Flux Power Holdings
Electrovaya Inc		Piedmont Lithium Inc
Beem		American Battery Technology Co
Flux Power Holdings		Standard Lithium Ltd
Piedmont Lithium Inc		American Lithium Corp
American Battery Technology Co		Chargepoint Holdings Inc
Standard Lithium Ltd		
American Lithium Corp		
Chargepoint Holdings Inc		

Table A.17: U.S. Electric Vehicles Companies

Minerals Mining	**Metals Mining**
MP Materials Corp	Freeport-McMoRan Inc
Piedmont Lithium Inc	Energy Fuels Inc
American Battery Technology	Uranium Energy Corp
Texas Mineral Resources Corp	Ur-Energy Inc
Standard Lithium Ltd	Rare Element Resources Ltd
International Battery Metals	Westwater Resources Inc
American Lithium Corp	Scandium International Minin
Achme Lithium Unc	Talon Metals

Table A.18: U.S. Mining Companies

Oil & Gas	**Automobiles**	**Auto Parts**
Exxon Mobil Corp	Tesla Inc	Lear Corp
Chevron Corp	General Motors Co	Gentex Corp
EOG Resources Inc	Ford Motor Co	Quantumscape Corp
Pioneer Natural Resources Co	Lucid Group Inc	Dorman Products Inc
Schlumberger Ltd	Rivian Automotive Inc-A	Fox Factory Holding Corp
Marathon Petroleum Corp		Goodyear Tire & Rubber Co
Valero Energy Corp		Visteon Corp
Phillips 66		Adient PLC
Kinder Morgan Inc		Aurora Innovation Inc
Williams Cos Inc		Luminar Technologies Inc
Devon Energy Corp		Gentherm Inc
Cheniere Energy Inc		Dana Inc
Hess Corp		Methode Electronics Inc
MPLX LP		Holley Inc
Baker Hughes Co		Xpel Inc
Halliburton Co		Solid Power Inc
Oneok Inc		Indie Semiconductor Inc-A
Continental Resources Inc/Ok		Microvast Holdings Inc
Diamondback Energy Inc		
Cheniere Energy Partners LP		
Coterra Energy Inc		
Marathon Oil Corp		
Targa Resources Corp		
EQT Corp		
APA Corp		
Texas Pacific Land Corp		

Table A.19: U.S. Oil & Gas, Automobiles, Auto Parts companies

Electric Utilities	**Pharmaceuticals**
Nextera Energy Inc	Johnson & Johnson
Duke Energy Corp	Eli Lilly & Co
Southern Co/The	Pfizer Inc
Dominion Energy Inc	Abbvie Inc
American Electric Power	Merck & Co. Inc.
Sempra	Bristol-Myers Squibb Co
Exelon Corp	Viatris Inc
Xcel Energy Inc	Jazz Pharmaceuticals PLC
Consolidated Edison Inc	Neurocrine Biosciences Inc
WEC Energy Group Inc	Organon & Co
Public Service Enterprise GP	Harmony Biosciences Holdings
Eversource Energy	Corcept Therapeutics Inc
DTE Energy Company	Pacira Biosciences Inc
Edison International	Arvinas Inc
Ameren Corporation	Ironwood Pharmaceuticals Inc
Entergy Corp	Amphastar Pharmaceuticals Inc
Firstenergy Corp	Supernus Pharmaceuticals Inc
PPL Corp	
P G & E Corp	
CMS Energy Corp	
Centerpoint Energy Inc	
Constellation Energy	
Avangrid Inc	
Evergy Inc	

Table A.20: U.S. Electric Utilities and Pharmaceuticals Companies

Basic Chemicals	**Special Chemicals**
Linde PLC	Albemarle Corp
Air Products & Chemicals Inc	Ashland Inc
Dupont De Nemours Inc	Rogers Corp
Celanese Corp	Chemours Co/The
Huntsman Corp	Element Solutions Inc
Cabot Corp	Avient Corp
Innospec Inc	Ingevity Corp
Stepan Co	

Table A.21: U.S. Chemicals Companies

A.6.2 European Industries Overview

Renewable Equipment	**Renewable Project**
Vestas Wind Systems A/S	Corp Acciona Energias Renova
Nel ASA	Cadeler A/S
Aker Carbon Capture ASA	Everfuel A/S
Powercell Sweden AB	Cloudberry Clean Energy ASA
Nordex SE	Eolus Vind AB-B Shs
SMA Solar Technology AG	Minesto AB
Green Hydrogen Systems A/S	Hydrogenpro ASA
ITM Power PLC	PNE AG
Ceres Power Holdings PLC	Grenergy Renovables
Climeon AB	Energia Innovacion Y Desarro
Soltec Power Holdings SA	Photon Energy NV
SFC Energy AG-BR	ABO Energy GmbH & Co. KGAA
Hydrogen Refueling Solutions	Hydrogene De France SACA
Absolicon Solar Collector AB	Ecoener SA

Table A.22: European Renewable Energy Companies

Solar	**Hydrogen**	**Wind**
Scatec ASA	Nel ASA	Vestas Wind Systems A/S
Neoen SA (42% Sol)	ITM Power PLC	Nordex SE
Atlantica Sustainable Infrastructue	Ceres Power Holdings PLC	Cadeler A/S
Encavis AG	PowerCell Sweden AB	Eolus Vind AB-B Shs
Solaria Energia Y Medio Ambiente	Green Hydrogen Systems A/S	PNE AG
SMA Solar Technology AG	AFC Energy PLC	BW Ideol AS
Meyer Burger Technology AG	Proton Motor Power Systems P	Ecoener SA
Grenergy Renovables	Enapter AG	Orsted AS (70%)
Soltec Power Holdings SA	Hydrogen Refueling Solutions	Galata Wind Enerji AS
Soltech Energy Sweden AB	Clean Power Hydrogen PLC	
Absolicon Solar Collector AB	Everfuel A/S	
Photon Energy NV	HydrogenPro ASA	
	Hydrogène De France S.A.	
	AFC Energy PLC	
	McPhy Energy SA	

Table A.23: European Solar, Hydrogen and Wind Companies

Electric Vehicles	Minerals Mining	Metals Mining
AMG Critical Materials	Green Minerals AS	Boliden AB
Infineon Technologies AG	Rainbow Rare Earths Ltd	Glencore PLC
Polestar	Kodal Minerals PLC	Aurubis AG
Zinnwald Lithium	Technology Minerals PLC	Eramet
Technology Minerals PLC	Zinnwald Lithium PLC	Gruvaktiebolaget Viscaria
Kodal Minerals PLC	Cadence Minerals PLC	Ferroglobe PLC
Freyr Battery Inc		Yellow Cake PLC
Eramet		Atalaya Mining PLC
Eurobattery Minerals		Eurobattery Minerals AB
		KME Group SPA

Table A.24: European Electric Vehicles and Mining Companies

Oil & Gas	Automobiles	Auto Parts
Equinor ASA	Volvo Car AB-B	Michelin (CGDE)
Aker BP ASA	Volkswagen AG	Continental AG
Shell PLC	Bayerische Motoren Werke AG	Hella GmbH & Co KGaA
TotalEnergies SE	Ferrari NV	Autoliv Inc
Var Energi ASA	Porsche Automobil Hldg-Prf	Valeo
BP PLC	Renault SA	Pirelli & C SPA
ENI SPA	Stellantis	Forvia
Neste OYJ	Mercedes Benz Group	Brembo N.V.
Repsol SA		CIE Automotive SA
OMV AG		Opmobility
Galp Energia SGPS SA		Gestamp Automocion SA
DCC PLC		
Gaztransport Et Techniga SA		
Harbour Energy PLC		
Vopak		

Table A.25: European Oil & Gas, Automobiles and Auto Parts Companies

Electric Utilities	**Pharmaceuticals**
Orsted A/S	Novo Nordisk A/S-B
Iberdrola SA	Roche Holding AG-Genussschein
Enel SPA	Novartis AG-Reg
National Grid PLC	AstraZeneca PLC
Verbund AG	Sanofi
Engie	GSK PLC
RWE AG	Bayer AG-Reg
EnBW Energie Baden-Wuerttemb	ALK-Abello A/S
EDP Renovaveis SA	Karo Pharma AB
E.ON SE	Camurus AB
Endesa SA	Vifor Pharma AG
EDP SA	Recordati Industria Chimica
SSE PLC	Orion OYJ-Class B
Terna-Rete Elettrica Naziona	
Elia Group SA/NV	
Redeia Corp SA	
Uniper SE	
Neoen SA	
A2A SPA	
EVN AG	

Table A.26: European Electric Utilities and Pharmaceuticals Companies

Basic Chemicals	**Special Chemicals**
Air Liquide SA	Croda International PLC
BASF SE	Umicore
EMS-Chemie Holding AG-Reg	Clariant AG-Reg
Solvay SA	Johnson Matthey PLC
Wacker Chemie AG	Lanxess AG
Covestro AG	Victrex PLC
Nabaltec AG	AMG Critical Materials N.V.
H&R GmbH & Co KGaA	

Table A.27: European Chemicals Companies

A.6.3 Asian Industries Overview

Renewable Equipment	**Renewable Project**
L&F Co Ltd	Ecobio Holdings Co Ltd
CS Wind Corp	Sterling and Wilson Renewabl
LONGi Green Energy Technol-A	Sichuan New Energy Power C-A
Tongwei Co Ltd-A	BCPG PCL
JA Solar Technology Co Ltd-A	Xinyi Energy Holdings Ltd
GS Yuasa Corp	Shenzhen Hopewind Electric-A
Sungrow Power Supply Co Lt-A	Century Wind Power Co Ltd
Xinjiang Daqo New Energy C-A	Jinko Power Technology Co -A
Trina Solar Co Ltd-A	KPI Green Energy Ltd
Exide Industries Ltd	EF-ON Inc
Xinyi Solar Holdings Ltd	Gensol Engineering Ltd
GCL Technology Holdings Ltd	Beijing Energy International
Hangzhou First Applied Mat-A	

Table A.28: Asian Renewable Energy Companies

Solar	Hydrogen	Wind
Hanwha Solutions Corp	Bumhan Fuel Cell Co Ltd	CS Wind Corp
Renova Inc	S-Fuelcell Co Ltd	Goldwind Sci & Tech
West Holdings Corp	Doosan Fuel Cell Co Ltd	Ming Yang Smart Energy
Xinyi Solar Holdings Ltd	Iljin Hysolus Co	Shanghai Electric Wind
GCL Tech Holdings Ltd	Beijing Sinohytech Co Ltd	Suzlon Energy Ltd
Flat Glass Group Co Ltd		Inox Wind Ltd
United Renewable Energy		Tien Li Offshore Wind
Xinyi Energy Holdings Ltd		Century Wind Power
Triumph New Energy-H		Titan Wind Energy Suzhou
Xinte Energy Co Ltd-H		Jiangsu Haili Wind Power
GCL New Energy Holdings Ltd		
LONGi Green Energy Tech Ltd		
Sungrow Power Supply Co Ltd		
JA Solar Tech Co Ltd		
TCL Zhonghuan Renewable		
Hangzhou First Applied Mat		
Shanghai Aiko Solar Energy		

Table A.29: Asian Solar, Hydrogen and Wind Companies

Electric Vehicles	Minerals Mining	Metals Mining
Ganfeng Lithium Group	Pam Mineral TBK	Vale Indonesia TBK
Tianqi Lithium	China Northern Rare Earth	Masan High-Tech Materials
Chengxin Lithium Group	Chengxin Lithium Group	Ifishdeco TBK
Eve Energy	Youngy Co Ltd	Sumitomo Metal Mining
CATL (Contemporary Amperex)	China Rare Earth Resources	Poongsan Corp
BYD Co Ltd	Benguet Corp	Central Omega Resources
Sunwoda Electronic	China Rare Earth Hldgs	Tembaga Mulia TBK
ECOPRO BM Co	Sinomine Group	Mitsubishi Materials
Samsung SDI Co		
Guangzhou Tinci Materials		
Shanghai Putailai Tech		
Gotion High-Tech		

Table A.30: Asian Electric Vehicles and Mining Companies

Electric Utilities	Pharmaceuticals
Korea Electric Power Corp	Kalbe Farma TBK PT
Adani Green Energy Ltd	Celltrion Inc
Adani Energy Solutions Ltd	DHG Pharmaceutical JSC
China Yangtze Power Co Ltd-A	Celltrion Healthcare Co Ltd
China Longyuan Power Group-H	Daiichi Sankyo Co Ltd
CLP Holdings Ltd	Takeda Pharmaceutical Co Ltd
China National Nuclear Pow-A	Chugai Pharmaceutical Co Ltd
Huaneng Lancang River Hydr-A	Yuhan Corp
CGN Power Co Ltd-H	Astellas Pharma Inc
Power Grid Corp of India Ltd	Hanmi Pharm Co Ltd
NTPC Ltd	Celltrion Pharm Inc
Gulf Energy Development PCL	Otsuka Holdings Co Ltd
Adani Power Ltd	Shionogi & Co Ltd
Power Assets Holdings Ltd	
SDIC Power Holdings Co Ltd-A	

Table A.31: Asian Electric Utilities and Pharmaceuticals Companies

Basic Chemicals	Special Chemicals
LG Chem Ltd	SK IE Technology Co Ltd
SKC Co Ltd	Chunbo Co Ltd
Soulbrain Co Ltd	Nitto Denko Corp
ECOPRO Co Ltd	Daejoo Electronic Materials
SK Chemicals Co Ltd	JSR Corp
Kolon Industries Inc	Duk San Neolux Co Ltd
Mitsubishi Chemical Group	Advanced Nano Products Co
TKG Huchems	Enchem Co Ltd
	Pharmicell Co Ltd

Table A.32: Asian Chemicals Companies

Oil & Gas	**Automobiles**	**Auto Parts**
Petrovietnam Gas JSC	Hyundai Motor Co	LG Energy Solution
Binh Son Refining	Toyota Motor Corp	Multistrada Arah Sarana TBK
Vietnam Nat'l Petroleum	Kia Corp	Hyundai Mobis Co Ltd
SK Innovation Co Ltd	Honda Motor Co Ltd	Denso Corp
Reliance Industries Ltd	Maruti Suzuki India Ltd	Hanon Systems
SK Inc	Nissan Motor Co Ltd	Hankook Tire & Technology
Medco Energi Intl TBK	Suzuki Motor Corp	Bridgestone Corp
Essa Industries TBK	Subaru Corp	Toyota Industries Corp
S-Oil Corp	BYD Co Ltd-H	HL Mando Co Ltd
HD Hyundai	Mazda Motor Corp	Aisin Corp
Inpex Corp		Sumitomo Electric Industries
PetroChina Co Ltd-H		Kumho Tire Co Inc
Eneos Holdings Inc		Sebang Global Battery Co Ltd
		Koito Manufacturing Co Ltd
		NGK Insulators Ltd

Table A.33: Asian Oil & Gas, Automobiles, and Auto Parts Companies