Market capitalization and shock resilience: European stock market responses to economic and non-economic surges

Santiago Fortea Ballester & Karlo Kasljevic

Supervisor
Maryna Brychko

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Author information:

Karlo Kasljevic
kaks23@student.bth.se

Santiago Fortea Ballester
saft23@student.bth.se

Department of Industrial Economics
Blekinge Institute of Technology
SE-371 79 Karlskrona, Sweden

Website: www.bth.se
Telephone: +46 455 38 50 00
Fax: +46 455 38 50 57

Abstract

This study investigates how economic and non-economic shocks impact European stock market performance, with a particular focus on how firms of different market capitalizations, large, mid, and small, respond to systemic disruptions. Two pivotal events are analyzed: the Brexit referendum in 2016, representing a political shock, and the European energy crisis in 2022, representing an economic shock. An event study methodology is employed to measure abnormal returns and cumulative abnormal returns over both short-term and long-term event windows, allowing for a detailed assessment of the magnitude, timing, and persistence of market reactions.

The results reveal that firm size significantly moderates stock price sensitivity to shocks, with small- and mid-cap firms displaying greater volatility and deeper abnormal returns compared to large-cap firms across both events. The Brexit referendum generated sharp, immediate market reactions, particularly among smaller firms more exposed to regulatory uncertainty and regional dependencies, with effects that persisted well beyond the initial shock. Conversely, the energy crisis led to a more gradual adjustment process, as the economic nature of the shock allowed investors time to reassess fundamentals, resulting in a slower deterioration of returns and partial recoveries over extended periods.

A comparative analysis of these two events highlights important temporal and structural differences: political shocks tend to trigger concentrated, front-loaded declines driven by ambiguity and investor sentiment, while economic shocks disseminate more progressively through financial systems, affecting corporate performance via operational and macroeconomic channels. These findings align with historical evidence from prior crises, such as the Global Financial Crisis and the COVID-19 pandemic, reinforcing the critical importance of firm size, financial flexibility, and international exposure in determining resilience to external shocks.

However, it should be noted that several statistical tests, particularly non-parametric and cross-sectional methods, did not confirm significance across all indices and event windows. This highlights some limitations in statistical robustness, especially in long-term estimations and during periods of low volatility.

This research offers valuable contributions to the literature by providing a comparative perspective on political versus economic event impacts, emphasizing the heterogeneous effects across market capitalizations and time horizons. Practical implications are drawn for investors aiming to optimize risk management strategies and for policymakers seeking to enhance financial system stability. Limitations regarding event selection, regional scope, and methodological assumptions are acknowledged, suggesting avenues for future research, including cross-regional comparative studies, sector-specific analyses, and exploration of policy intervention effects in moderating shock transmission.

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List of abbreviations

AR	Abnormal Returns
CAR	Cumulative Abnormal Returns
AAR	Average Abnormal Returns
ER	Expected Returns
PIIGS	Portugal, Italy, Ireland, Greece, and Spain
GARCH	Generalized Autoregressive Conditional Heteroskedasticity

1. Introduction

Financial markets are often influenced by external events, which can be broadly categorized into economic and non-economic shocks. Economic disturbances, such as fluctuations in oil prices, inflation, and financial crises, have a direct impact on macroeconomic conditions and the fundamentals of firms. On the other hand, non-economic shocks including political events, policy changes, and geopolitical conflicts primarily introduce uncertainty, altering investor expectations and behavior. The European stock market serves as a dynamic and sensitive environment where such shocks can have profound and lasting effects on market stability, investment strategies, and corporate performance (Iglesias, 2021; Gottschalk, 2021). Over the past two decades, events like the 2008 global financial crisis, the European sovereign debt crisis, the COVID-19 pandemic, the Brexit referendum, and the 2022 European energy crisis have demonstrated how both systemic economic disruptions and unexpected geopolitical events can lead to heightened volatility, shifts in risk appetite, and structural changes in market behavior.

Among the significant events that have tested the resilience of European markets, Brexit stands out as a political shock that introduced uncertainty regarding trade agreements, regulatory frameworks, and economic stability. The referendum's outcome triggered immediate market turbulence, characterized by currency depreciation, capital outflows, and shifts in investment strategies as businesses and investors adjusted to new geopolitical realities. Similarly, the 2022 European energy crisis, driven by soaring energy prices, supply chain disruptions, and geopolitical tensions, exemplifies an economic shock with far-reaching consequences. Rising energy costs not only increased inflationary pressures but also disproportionately affected energy-intensive industries, contributing to broader market uncertainty and volatility.

While both Brexit and the energy crisis have been extensively studied individually (Angelidis et al. 2015; D'Arcangelis et al. 2024; Kenourgios et al. 2019), there remains a critical gap in the literature regarding their comparative impact on firms of different market capitalizations. Large-cap firms, with greater financial resources and global diversification, may exhibit more resilience compared to small- and mid-cap firms, which often operate in regionally focused markets and possess fewer financial safeguards (Ahmed et al. 2022; Chuliá & Torró, 2011). Understanding how firms of varying sizes react to these shocks is essential for investors, policymakers, and financial analysts seeking to mitigate risks and develop strategies for navigating financial instability more effectively.

Firm size, as measured by market capitalization, plays a critical role in determining how companies respond to economic and non-economic shocks. Small-, mid-, and large-cap firms exhibit distinct reactions to such events, primarily due to differences in financial resilience, market exposure, and access to resources. This is well-documented in the literature, for instance, Banz (1981) identified the size effect, showing that smaller firms tend to outperform larger firms over time but are also more vulnerable to market shocks. More recently, Ahmed et al. (2022) found that smaller firms experience significantly higher volatility during financial shocks, as they often lack the financial buffers and diversified revenue streams that larger firms possess. Similarly, Chuliá and Torró (2011) demonstrated that the volatility of small-cap firms increases severalfold compared to large-cap firms during periods of market stress. These differences in volatility underscore the importance of understanding how firm size influences stock price reactions to these shocks, as smaller firms are often more sensitive to external shocks, while larger firms may exhibit greater stability due to their scale and resources. Therefore, it is essential to assess how firm size influences stock market behavior during the Brexit referendum and the 2022 European energy crisis.

The impact of Brexit on European stock markets has been widely studied, with researchers highlighting its sectoral and regional variations. Kenourgios et al. (2019) found that while the financial sector experienced negative effects, other sectors such as basic materials and healthcare showed resilience or even positive returns. Surprisingly, D'Arcangelis et al. (2024) found that, in the short term, European firms with strong economic ties to the UK experienced lower volatility following the Brexit referendum compared to those without such ties.

The energy crisis, characterized by sharp fluctuations in oil and gas prices, has also been a focal point of financial research. Studies by Angelidis et al. (2015) and Jouini (2013) have demonstrated that energy price shocks significantly influence stock market volatility, particularly in energy-intensive industries. Benkraiem et al. (2018) further highlighted that while energy price shocks have a strong short-term impact, their predictive power diminishes over time as markets adjust to new price levels. Furthermore, oil price volatility has a greater impact on mid-cap and small-cap stocks than on large-cap stocks due to their limited ability to hedge costs (Salisu et al. 2017).

Unlike energy price shocks, political events such as Brexit affect stock markets through distinct mechanisms. Guo et al. (2021) highlight that crude oil price shocks are typically treated as exogenous in earlier research; however, more recent studies challenge this assumption by showing that oil prices can also be endogenous to financial markets. In their comparative analysis of China and the United States, they also find that oil shocks tend to have more significant short-term effects on stock markets, especially under specific market conditions, such as when markets are bullish or bearish. In contrast, the influence of political risk is more pronounced in the long term and varies depending on the market environment.

Guo et al. (2021) also emphasize that political shocks differ from oil shocks in their structure and dimensionality. Political risk encompasses multiple components, including government stability, law and order, and institutional quality, and its impact on financial markets is often non-linear and asymmetric across different quantiles of the stock return distribution. Moreover, political risk is inherently shaped by internal policy decisions and institutional dynamics, which makes it endogenous and complex to model. This is particularly relevant in events like Brexit, where future policy uncertainty plays a central role in shaping investor expectations. Thus, while both oil price and political risk shocks influence stock market behavior, their characteristics, timing, and transmission mechanisms are fundamentally different.

This study examines the differential effects of two major external shocks, Brexit as a political shock and the European energy crisis as an economic shock, on firms of varying market capitalizations. By analyzing both short-term and long-term market reactions, the research offers insight into how firm size influences resilience and volatility during periods of disruption. The findings contribute to the academic literature on market shocks by highlighting the heterogeneous impact of two distinct types of shocks, political (Brexit) and economic (the 2022 European energy crisis), on firms of different market capitalizations. While previous studies have examined these events individually (Kenourgios et al. 2019; Angelidis et al. 2015), there is limited research that compares their effects across firm sizes in a unified analytical framework. By filling this gap, the study offers new insights into how firm size influences market reactions to different categories of external disruptions, providing a more nuanced understanding of financial resilience and exposure to systemic events. For investors, these insights can support more nuanced risk management and asset allocation strategies, especially during times of heightened uncertainty. Policymakers may also benefit from understanding the specific vulnerabilities of smaller firms to external shocks. While the results are rooted in the European context, the study offers a framework for future research and practical application in other regions facing comparable challenges. What sets this study apart is its combined analysis of political and non-political related shocks across different firm sizes, looking at both the events themselves and how their effects change over time, something that previous research has not done in the same way.

1.1. Problem Formulation, Purpose and Research Questions

While numerous studies have examined the effects of individual shocks on European stock markets, such as Brexit (Kenourgios et al. 2019) and energy price fluctuations (Angelidis et al. 2015), there is still a lack of research that directly compares the market impact of different types of shocks. This is important because economic shocks and non-economic shocks may differ in how they affect markets, both in terms of timing and the uncertainty they create. A comparative approach is needed to better understand how these differences play out, especially across firms of different sizes. While some studies have explored short- and long-term stock market reactions to external shocks (Benkraiem et al. 2018; Guo et al. 2021), few have integrated firm size, shock typology (political vs. economic), and temporal dynamics into a single analytical framework. Filling this gap is important for getting a clearer picture of how markets react under different kinds of pressure.

Brexit, one of the more significant political and economic events in recent history, has induced uncertainty into financial markets around the world. While large firms are generally more financially stable, with global market exposure and diversified revenue streams, mid- and small-cap companies are typically more vulnerable to economic and regulatory changes due to their limited financial buffers and high dependence on regional markets (Ahmad et al. 2022; Chuliá & Torró 2011).

In contrast, economic shocks like the 2022 European energy crisis, driven by geopolitical tensions, supply chain disruptions, and sanctions following the Russia-Ukraine war had a direct impact on operational costs and inflation, often triggering immediate reactions in financial markets. Similar to the Brexit referendum, the 2022 energy price shock introduced significant uncertainty and heightened volatility. Earlier studies have shown that oil and energy price shocks can trigger strong short-term market reactions (Angelidis et al. 2015; Jouini, 2013); however, recent research highlights the distinct drivers and effects of the 2022 energy crisis (Heather, 2022; Dulak & Gnabo, 2024), such as the role of gas hub disruptions and energy security concerns in shaping investor behavior.

This study compares stock price movements triggered by the Brexit referendum and the 2022 energy price surge, with a focus on large-, mid-, and small-cap firms. Despite the differing nature and transmission mechanisms of political and economic shocks, both events introduced significant market volatility. However, their relative effects across firms of different sizes remain insufficiently explored, particularly in the European context. This study aims to fill that gap by examining how firm size influences market reactions to each type of shock.

The purpose of this study is to examine how European stock markets, segmented by firm size, respond to different types of shocks, one political and one economic. Specifically, it investigates and compares the stock price movements of large-, mid-, and small-cap European companies in response to

1. The 2016 Brexit referendum (political shock).
2. The 2022 European energy price surge (economical shock).

Using the event study methodology, this study seeks to determine the stock price impact of each event by analyzing key metrics such as abnormal returns (AR) and cumulative abnormal returns (CAR). These metrics will help quantify the magnitude and direction of stock price reactions. The study will also examine whether the magnitude of these effects varied across large-, mid-, and small-cap firms. Furthermore, the study will assess whether the impact of these events was short-lived or had prolonged effects on stock performance by comparing short-term and long-term CARs. These findings will offer valuable insights into how firms of different market capitalizations react to political and economic uncertainty in Europe, which will help investors and policymakers manage risks associated with similar events.

Research Question

How did large-, mid- and small-cap stocks in Europe react to Brexit (2016) compared to the 2022 energy price surge?

2. Theoretical background

The impact of economic and non-economic shocks on financial markets is a central topic in financial research, with extensive literature documenting how economic disruptions, such as financial crises and commodity price fluctuations, influence global and US stock market performance (Angelidis et al. 2015; Benkraiem et al. 2018; Bhatia 2024).

Similarly, numerous studies examine the effects of non-economic shocks, such as Brexit, the COVID19 pandemic, and the Russia-Ukraine war, on stock markets, highlighting the role of geopolitical and political uncertainties in shaping market behavior (Ahmed et al. 2022; D'Arcangelis et al. 2024; Iglesias 2021). However, while these studies provide valuable insights into the effects of individual events, there is still a need for comparative analysis of how economic and non-economic shocks differentially affect European stock markets. Specifically, limited research has directly contrasted the magnitude, speed, and persistence of abnormal returns resulting from these distinct types of disruptions.

A growing body of literature explores the effects of market shocks on firm performance at a granular level, considering factors such as sectoral exposure (Kenourgios et al. 2019). Despite evidence that firm size influences stock market response (Ahmed et al. 2022), there is a lack of studies that systematically compare the impact of economic and non-economic shocks across different market capitalizations, particularly distinguishing the effects on large-, mid-, and small-cap firms. Understanding the role of firm size in stock market resilience and volatility is crucial, as larger firms tend to have greater financial stability, diversified revenue streams, and global exposure, whereas mid- and small-cap firms are often more vulnerable to localized economic fluctuations and regulatory changes.

Additionally, while existing studies have examined the short- and long-term effects of specific shocks, the comparative analysis of economic and non-economic events across both time horizons remains underexplored. The persistence of abnormal returns, fluctuations in market correlations, and the influence of investor sentiment and policy responses on long-term market dynamics are critical areas that warrant further investigation.

Addressing those gaps this study will bring a more comprehensive understanding of market dynamics, helping investors refine risk management strategies and policymakers anticipate vulnerabilities arising from distinct categories of financial disruption.

2.1. The Impact of Non-Economic Shocks on the European Stock Market

Non-economic shocks, such as political uncertainty, geopolitical conflicts, and major policy decisions, have a profound impact on financial markets. Unlike economic shocks, which typically arise from macroeconomic imbalances or financial disruptions, non-economic shocks are often unexpected and exogenous, leading to heightened uncertainty and volatility (Ross, 2024; Anderson 2023; Pástor & Veronesi, 2013; Hudson et al. 2020). Various studies have examined their effects, such as Blanchard et al. (2018), who analyzed the impact of the 2016 U.S. presidential election on stock market performance, and Pástor and Veronesi (2020) who found evidence of higher average stock returns under Democratic presidencies in the U.S. These findings highlight how political events shape investor sentiment and market behavior, underscoring the broader significance of non-economic shocks in financial markets.

One of the most extensively studied non-economic shocks in recent history is Brexit, a political event that introduced uncertainty regarding not only the future economy of the United Kingdom and the European Union, but the whole globe (Natchimuthu & Nagarakatte G. 2022). Empirical research confirms that Brexit significantly affected European stock markets, though its impact varied across sectors. Kenourgios et al. (2019) found that financial sector experienced pronounced negative effects, other sectors such as basic materials and healthcare showed resilience or even positive returns across both short and long event windows, likely due to expected regulatory changes and market realignments. Similarly, D'Arcangelis et al. (2024) conducted complex network analysis on STOXX Europe 600 constituents and found that the short-term market reaction to Brexit was insignificant, suggesting that markets had already priced in the uncertainty surrounding a possible UK departure from the EU.

Beyond Brexit, geopolitical conflicts also represent major non-economic shocks with substantial market implications. The Russia-Ukraine war, for example, despite registering different reactions degrees for different sectors and countries, it has been concluded that led to negative and significant cumulative abnormal returns (CARs) in the European stock market, particularly affecting small- and mid-cap firms more than large-cap firms (Ahmed et al. 2022). This aligns with previous findings indicating that smaller firms, due to their greater exposure to regional markets and weaker financial buffers, tend to be more vulnerable to external shocks (Gottschalk 2021).

A unique non-economic shock with an even broader scope was the COVID-19 pandemic, which severely disrupted global financial markets. Unlike political or geopolitical events, the pandemic introduced uncertainty regarding public health, economic lockdowns, and global trade disruptions, leading to unprecedented levels of market volatility (Qiao et al. 2022). Research by Iglesias (2021) found that COVID-19 had a far more severe financial impact than Brexit, particularly in countries that imposed strict lockdown measures, such as Austria, Belgium, Italy, and Spain, independently on their debt-to GDP ratio. On the other hand, countries that had already implemented lockdowns, such as China and Japan, exhibited no significant abnormal stock returns, suggesting that investor expectations and preemptive policies played a key role in market stabilization (Iglesias 2021). A key distinction between COVID-19 and other non-economic shocks is its global scope and duration. Unlike Brexit or the Russia-Ukraine war, which were regionally concentrated events, COVID-19 simultaneously affected all major economies, leading to widespread stock market downturn and extreme volatility (Pandey & Kumari 2020).

Another key aspect of non-economic shocks is their spillover effect on global markets. Studies have shown that political uncertainty in one region can trigger volatility across international financial systems. For instance, Natchimuthu & Nagarakatte G (2022) identified a strong bidirectional volatility spillover between the UK, US, France, and Germany following the Brexit referendum, extending even to emerging markets such as India. Conversely, in other regions Gomes & Vieira Cicogna (2023) found that Brexit did not significantly alter the correlation between the US and UK stock markets, highlighting that non-economic shocks do not always produce uniform global market reactions.

From a portfolio diversification perspective, non-economic shocks can both increase and decrease risk diversification opportunities. Gottschalk (2021) found that European non-economic shocks as Brexit decrease equity correlation among European countries and led to a decrease in stock return correlations between UK firms and those in France, Germany, Italy, and Spain, thereby improving risk diversification opportunities. However, other studies, such as Burdekin, Eric, & Jinlin (2018), confirm that highly indebted European economies, particularly Portugal, Italy, Ireland, Greece, and Spain (PIIGS), experienced more severe stock market declines following Brexit, reflecting their structural economic vulnerabilities and tight correlation for both long term and short term (Iglesias 2021).

2.2. The Effect of Economic Shocks on the European Stock Market

Economic shocks, such as financial crises, interest rate fluctuations, and commodity price surges, have historically influenced stock market performance (Kilian, 2008; Bhatia, 2024). Unlike non-economic shocks, which often stem from geopolitical or policy-driven events, economic shocks are primarily linked to macroeconomic imbalances, monetary policies, and changes in supply and demand dynamics (Nikkinen et al. 2006; Bohdalová & Greguš, 2017). These shocks can lead to increased volatility, shifts in investor sentiment, and changes in asset valuation, affecting European stock markets at various levels.

Understanding the effect of economic shocks on stock markets is crucial for investors, policymakers, and portfolio managers. Studies show the correlations between sectorial variations and their long and short terms effects in the economies, notably between energy prices and stock market returns and volatility, particularly in industries or economies heavily reliant on energy inputs (Cevik et al. 2020).

Angelidis et al. (2015) found that oil price shocks significantly affect US stock market returns and volatility, suggesting that commodity prices play a key role in global financial stability. Similarly, Jouini (2013) demonstrated that in Saudi Arabia, volatility spillovers from oil prices to stock markets are stronger than return spillovers, reinforcing the idea that economic shocks affect market stability more than individual asset prices. Aligned with previous cited studies, Oberndorfer (2009) found that oil price fluctuations directly impact oil and gas stocks, with oil price increases leading to higher stock returns, but oil price volatility negatively affecting the sector. However, his findings indicate that gas price movements do not have a significant effect on European energy stocks, likely due to long-term contract pricing mechanisms that stabilize prices in the Eurozone at that time. Additionally, the appreciation of the euro currency against the US dollar tends to generate positive stock market reactions in Europe, as it increases corporate purchasing power and financial stability (Oberndorfer 2009).

Beyond the energy sector, rising energy costs have a negative impact on industrial and consumer sectors, increasing operational costs and reducing profitability. Benkraiem et al. (2018) analyzed the relationship between WTI crude oil, Henry Hub natural gas prices, and the S&P 500, concluding that energy price shocks significantly influence stock prices in the short run but have a weaker predictive power in the long run. This aligns with findings by Pandey & Kumari (2020), who reported that developed markets experience stronger long-term effects from economic shocks compared to emerging markets.

In addition, Gottschalk (2021) highlighted those major global macroeconomic shocks (e.g., the 2008 financial crisis, Black Monday 1987 and Black Wednesday 1992) increased stock return correlations of European economies, while decreasing correlation between UK firms and those. Furthermore, Bohdalová & Greguš (2017) analyzed the impact of economic policy uncertainty on European markets, finding that market volatility co-moves strongly among major European indices (EUROSTOXX, DAX, FTSE 100), but the UK market remains independent of oil price shocks during bear market conditions. This suggests that, while energy price volatility affects stock markets broadly, its sectoral and country-specific effects differ.

Additionally, Nikkinen et al. (2006) provide further evidence of global stock market integration, showing that G7 countries, developed European and Asian economies react similarly to major U.S. macroeconomic news announcements, such as changes in the consumer price index, employment cost index, and NAPM reports. However, their findings indicate that Latin American and transition economies remain relatively segmented, demonstrating that while major stock markets exhibit high levels of integration, some emerging markets still offer diversification benefits for international investors. This reinforces the idea that the extent to which economic shocks influence stock markets depend not only on regional integration but also on market maturity and sensitivity to external financial developments.

Economic shocks, such as energy price surges, financial crises, and commodity fluctuations, have a significant but uneven impact on European stock markets, with effects varying by sector, firm size, and market conditions. Additionally, energy price surges heighten market volatility, affecting industries differently.

2.3. Firm Size Effects to European Stock Markets Shocks

The impact of economic and non-economic shocks on stock markets is not uniform across companies of different sizes. Firm size plays a crucial role in determining financial resilience, risk exposure, and stock price sensitivity to market disruptions. Large-cap companies generally have greater financial stability, diversified revenue streams, and access to international markets, while mid- and small-cap firms tend to be more exposed to regional economic fluctuations, regulatory changes, and liquidity constraints. Understanding how firms of different capitalizations respond to shocks is essential for investors, risk managers, and policymakers aiming to mitigate volatility and optimize asset allocation.

Empirical studies show that firm size influences how stocks react to both economic and non-economic shocks. Ahmed et al. (2022) analyzed the impact of the Russia-Ukraine crisis on European stock markets and found that small- and mid-cap firms suffered more severe negative effects than large-cap firms. This aligns with previous findings indicating that during great shocks, whether it is economic or non-economic (e.g., the, Black Monday 1987, Black Wednesday 1992, financial crisis 2008 and Brexit 2020), smaller firms, due to their greater exposure to regional markets and weaker financial buffers, tend to be more vulnerable to external shocks (Gottschalk 2021).

Furthermore, Angelidis et al. (2015) and Jouini (2013) highlighted the importance of hedging strategies in mitigating stock volatility, especially for small- and mid-cap firms, which lack the financial resilience of large-cap stocks. These findings may indicate that investors can optimize risk-adjusted returns by strategically allocating assets across firms of different capitalizations based on the nature of the shock.

Despite the extensive literature on how economic and non-economic shocks impact stock markets, as well as sector-specific responses, there remains a significant gap in research focusing on how these shocks differentially affect firms based on their market capitalization. While past studies have analyzed broad stock market movements and sectoral impacts, few have systematically compared the performance of large-, mid-, and small-cap firms under similar shock conditions. This lack of research leaves a crucial gap in understanding the role of firm size in stock market resilience and volatility, which this study seeks to address.

2.4. Temporal Dimensions of Stock Market Reactions

The impact of economic and non-economic shocks on stock markets is shaped significantly by the timing and persistence of their effects. Short-term market reactions typically reflect immediate shifts in investor sentiment, whereas long-term responses indicate structural changes in asset pricing and market fundamentals. However, evidence on these temporal dynamics varies notably across different studies, highlighting the complexity of market responses and implications for investment strategies.

The event study methodology frequently distinguishes between short-term market reactions, which reflect immediate investor sentiment, and long-term effects, which reveal structural adjustments in asset pricing and economic fundamentals. D'Arcangelis et al. (2024) analyzed the Brexit referendums short-term impact on the STOXX Europe 600 and found that, while initial reactions were negative, the event did not act as a significant structural breakpoint, indicating that much of the uncertainty was already priced in by the market. Similarly, Gomes & Vieira Cicogna (2023) examined S&P 500 volatility following Brexit and found no major correlation shifts between US and UK stock markets, suggesting effective short-term market resilience. In contrast, Natchimuthu & Nagarakatte (2022) identified strong bidirectional volatility spillovers between the UK, US, and European markets, which persisted in the weeks following Brexit, highlighting short-term contagion effects. Other studies reflected that responses are subject to cultural factors or purely qualitative interpretation of some extreme events, notably during COVID-19 lock down, the US was the only country showing no evidence of negative abnormal returns; being the only country that financial markets were trusting to provide a positive reply to the pandemic due to declaring the national emergency (Iglesias 2021).

Economic shocks, such as energy price surges, seems to have more prolonged market effects than non-economic events. Benkraiem et al. (2018) showed that while oil and natural gas prices significantly influenced stock market returns in the short run, their predictive power weakened over time, indicating that markets gradually adjusted to new energy price levels. Similarly, Pandey et al. (2020) found that the COVID-19 pandemic had an immediate and significant negative impact on global stock markets, but its effects varied depending on the region. Developed markets were more affected in the long-term, while emerging markets showed resilience after the initial shock.

The ability of markets to recover from shocks depends on factors such as policy responses, investor sentiment, and sectoral adaptability. Burdekin, Eric, & Jinlin (2018) found that the Brexit referendum had a disproportionately negative effect on highly indebted European economies (PIIGS: Portugal, Italy, Ireland, Greece, and Spain), with long-lasting repercussions on their stock markets (Iglesias 2021). On the other hand, Gottschalk (2021) observed that market correlations between UK and European firms declined after Brexit, indicating new diversification opportunities over the long term.

From a sectoral perspective, Kenourgios et al. (2019) found that Brexit's long-term effects varied by industry, with the financial sector experiencing prolonged negative impacts, while basic materials and healthcare saw positive effects due to deregulation expectations. This sectoral divergence reinforces the idea that different industries adapt to shocks at different speeds, influencing long-term portfolio strategies.

The temporal dimension of stock market reactions has important implications for investors, policymakers, and financial institutions. Short-term volatility presents opportunities for speculative trading, while long-term market adjustments influence strategic asset allocation. Angelidis et al. (2015) emphasized that oil price shocks significantly impact stock market volatility, requiring dynamic risk management strategies. Similarly, Jouini (2013) showed that shock spillovers are more frequent than volatility spillovers in Saudi Arabia, reinforcing the importance of timing when managing risk exposure.

Time plays a fundamental role in shaping stock market responses to economic and non-economic shocks. While some events, such as Brexit, produce short-lived volatility that is quickly absorbed, others, like energy price surges, create longer-term market disruptions. The magnitude and duration of these effects vary by sector, firm size, and market conditions, influencing both investment strategies and policy decisions.

2.5. Identifying Research Gaps in Comparative Studies

While extensive literature explores the impact of economic and non-economic shocks on financial markets, comparative analyses that explicitly differentiate between these two types of shocks remain limited as most studies tend to focus on either economic disruptions, such as oil price fluctuations and financial crises, or non-economic events, such as political instability and geopolitical conflicts, in isolation without systematically comparing the magnitude, speed, and persistence of stock market reactions to these shocks particularly in the European context and across different market capitalizations. There is substantial evidence that economic shocks, such as oil price surges, influence stock market volatility while political shocks, such as Brexit, introduce uncertainty that affects investment behavior, direct comparisons between these effects remain scarce despite indications that both economic and non-economic shocks shape market structures, correlations, and sectoral dynamics in distinct ways.

Firm size plays a critical role in determining how stock prices react to shocks, however studies that compare the effects of economic and non-economic shocks across large-, mid-, and small-cap firms are lacking. Kenourgios et al. (2019) found that Brexit disproportionately affected financial, basic materials, and healthcare stocks, but did not explore whether firm size influenced these reactions. Ahmed et al. (2022) found that small- and mid-cap firms were more vulnerable to geopolitical risks, but did not examine economic shocks for comparison. Bohdalová & Greguš (2017) showed that economic policy uncertainty had a greater impact on small- and mid-cap firms, but did not contrast this with political uncertainty. This lack of comparative research prevents a deeper understanding of whether small-cap firms are universally more vulnerable to shocks, or whether certain types of events impact different market capitalizations in distinct ways.

Another crucial area requiring further research is the time dimension of stock market responses. While some studies focus on short-term market fluctuations, fewer explore whether economic and non-economic shocks result in long-term structural changes in stock performance. Certain shocks, such as oil price surges, can trigger prolonged economic effects, whereas others, like political events, may cause brief volatility that stabilizes over time. However, there is no systematic comparison of how time influences stock market responses across different types of shocks, and even less research examining the role of firm size in these dynamics, a gap this study aims to address.

Existing studies often focus on specific variables such as sectoral performance, event-driven responses, or time-series methodologies. However, few adopt a holistic framework that integrates multiple factors like firm size, industry effects, time dynamics, and spillover effects. For instance, Jouini (2013) demonstrated that volatility spillovers between oil prices and Saudi stock sectors were stronger than return spillovers, indicating that risk dynamics vary depending on the type of shock. Similarly, Angelidis et al. (2015) emphasized that oil price shocks are key drivers of stock market volatility, reinforcing the need to incorporate external commodity price dynamics into market analysis. Meanwhile, Nikkinen et al. (2006) showed that US macroeconomic announcements significantly impact global stock markets, yet their spillover effects on different market capitalizations in Europe remain largely unexplored. These findings highlight the need for a comparative study that integrates market capitalization, sectoral effects, time dynamics, and external economic variables to provide a more comprehensive understanding of how European stock markets respond to various shocks.

To address these gaps, this study will directly compare economic and non-economic shocks in their impact on European stock market performance, examine firm size variations, analyzing how small-, mid-, and large-cap firms react differently, distinguish between short-term and long-term effects determining whether stock markets adapt differently to economic versus non-economic disruptions.

2.6. Hypothesis

The following hypotheses are developed based on the literature reviewed in Sections 2.1 to 2.4. They reflect theoretical expectations and empirical patterns identified in previous studies.

H1: The Brexit referendum and the 2022 energy crisis have no significant effect on abnormal returns or cumulative abnormal returns for European equities, regardless of firm size, during the event window.

H2: The Brexit referendum and the 2022 energy crisis lead to statistically significant negative AR and CAR in European equities, with effects varying by firm size (small-, mid-, and large-cap) and event duration (short- and long-term).

Hypothesis H1 and H2 are general hypotheses used in event studies, widely recognized in academic literature (Binder, 1998; Fama et. al., 1969; EventStudyTools, 2025) . Evaluating if the event had any effect on the stock price, and if the event had negative or positive effect on the stock price.

H3: The abnormal returns triggered by both events vary significantly across firm sizes, with mid- and small-cap stocks exhibiting greater sensitivity than large-cap stocks.

As shown in Section 2.3, firm size significantly affects vulnerability to market shocks (Ahmed et al. 2022; Chuliá & Torró, 2011). Smaller firms typically have fewer financial buffers and are more exposed to regional disruptions. Therefore, we expect mid- and small-cap firms to react more strongly in terms of abnormal returns.

H4. In the long run, market adaptation reduces firm size-related differences in stock price reactions, particularly for large-cap firms with greater financial flexibility, whereas small-cap firms remain more vulnerable to persistent uncertainty.

As shown in Section 2.3, firm size significantly affects vulnerability to market shocks (Ahmed et al., 2022; Chuliá & Torró, 2011). Smaller firms typically have fewer financial buffers and are more exposed to regional disruptions. Therefore, we expect mid- and small-cap firms to react more strongly in terms of abnormal returns.

3. Method

3.1. Methodology

This chapter describes the methodological approach adopted to assess the impact of political and economic shocks on European stock markets, segmented by firm size. The structure of this section follows the logic of 'research onion' (Saunders et al. 2016; Melnikovas, 2018), detailing the research philosophy, approach, strategy, methodological choice, time horizon, data collection, analysis, and ethical considerations.

Research Philosophy and Process

This study follows a positivist research philosophy, which assumes that financial market behavior can be observed, measured, and analyzed objectively using empirical data. Under this paradigm, knowledge is derived from observable phenomena and interpreted through quantitative methods, aligning well with the event study approach used to examine stock price reactions to external shocks. However, elements of critical realism are also acknowledged, recognizing that financial market movements are influenced by deeper structural and institutional dynamics, such as regulatory frameworks, geopolitical conditions, and investor behavior, that may not be fully captured through quantitative data alone.

The research process was structured using a deductive approach, where existing theories and empirical literature on stock market responses to economic and non-economic shocks informed the formulation of hypotheses. The study then tested these hypotheses using secondary data and established statistical techniques. This systematic and replicable process enhances the objectivity, reliability, and validity of the findings, and reflects the principles outlined in the research "onion" framework, moving from philosophical positioning to strategy, method, and analysis.

Research Approach

While the study primarily follows a deductive approach it also incorporates abductive reasoning. This is due to the exploratory nature of the research questions, which address underexamined relationships between firm size and the type and timing of market shocks. The abductive elements support the development of plausible explanations in areas where existing theory is incomplete or inconclusive.

Research Method

A mono-method quantitative design is used, involving only secondary quantitative data and numerical methods for analysis. This choice supports hypothesis testing through statistical models.

Research Strategy

This study adopts an archival research strategy, as it relies on the analysis of historical financial data to assess market reactions to external shocks

Time Horizon

The research applies a cross-sectional time horizon, capturing both immediate and persistent effects of market shocks. The specific design of short-term and long-term windows is detailed in section 3.4.1, which explains the rationale and structure of the selected event and estimation windows used for this analysis.

Table 1. *Summary of economic and non-economic event studies*

Research Layer	Choice Made	Justification
Philosophy	Positivism + Critical Realism	Objective measurement of market data + recognition of structural influences
Approach	Deductive and Abductive	Allows testing of known theories and reinterpretation of new findings
Methodological Choice	Mono-method quantitative	Sole use of secondary market data and statistical methods
Strategy	Archival research	Use of historical index data to assess past economic and political events
Time Horizon	Cross-sectional	Focus on market reactions over specific short and long event windows

3.2. Analysis

The event study methodology is a well-established approach in finance and economics for analyzing and assessing stock market reactions of specific events. Since the introduction by Fama et al. (1969), the event study methodology has been extensively applied in studies examining financial markets efficiency, corporate announcements, regulatory changes and macroeconomic events (MacKinlay 1997; Binder 1998).

The event study approach is particularly well-suited for this research for four key reasons. First, it effectively captures both short- and long-term market reactions, enabling the analysis of immediate fluctuations and structural shifts in stock prices following a shock. Second, it isolates the events impact by comparing actual stock returns to expected returns through the calculation of abnormal returns (ARs). Third, its well-established methodology ensures statistical rigor and credibility. Finally, it is versatile, applying to both economic and non-economic events. Previous studies have demonstrated its effectiveness in assessing firm-specific events (e.g., stock splits, earnings announcements, and mergers) as well as broader macroeconomic events (e.g., interest rate changes and political developments; Binder 1998). Given the advantages, the methodology is therefore well suited for analyzing how stock prices reacted to Brexit (non-economic, political shock) and the 2022 energy price surge (economic shock) across different market capitalization.

The research process began with a comprehensive literature review to establish a foundation for the study. This review focused on existing research on economic and non-economic shocks, firm size effects, and stock market reactions. Through this analysis, a research gap was identified, specifically, the lack of comparative studies analyzing how firms of varying market capitalizations respond to economic versus non-economic shocks, for a more comprehensive view, see Figure 1.

To analyze the effects of these two major events, the event study methodology was chosen. This approach allows for a structured analysis of stock price reactions by examining abnormal returns (AR) around specified event windows. Segmenting firms into small-, mid-, and large-cap categories enables a more granular assessment of how market capitalization influences these reactions. The closing price of MSCI Europe Small Cap, Mid Cap, and Large Cap indices were used as proxies for firm-level data, due to their comprehensive classifications and wide academic usage. Yet, it should be noted that this segmentation is based on index-level data rather than individual firms, which may limit the generalizability of the results.

While event studies provide a powerful tool to isolate the market impact of specific events through abnormal return estimation, several methodological limitations must be acknowledged. One key challenge lies in pinpointing a precise event date, especially when the shock unfolds gradually or coincides with other market developments. This is particularly relevant in the case of the 2022 European energy crisis, which overlapped with the Russia-Ukraine war, economic sanctions, and broader geopolitical instability. Unlike the Brexit referendum, which offers a clear exogenous shock date, the energy crisis lacks a single identifiable point in time that marks its market recognition. To address this, the Dutch TTF gas price was used as a proxy, with December 21, 2021 selected as the event date. The day TTF Month Ahead prices reached a record high, reflecting the culmination of the gas price surge across European energy markets (Heather 2022).

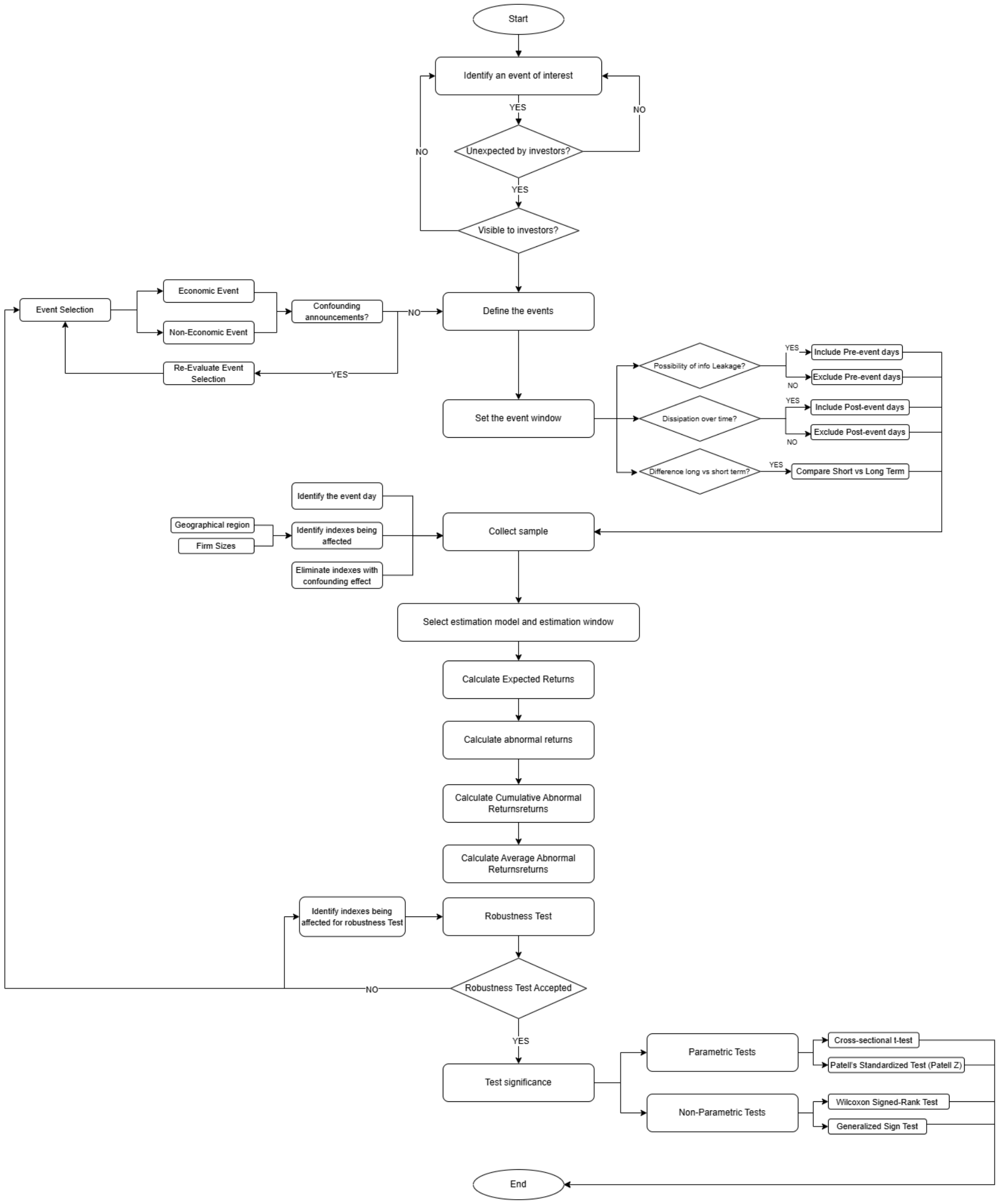

***Figure 1**: Event Study Decision Diagram*

In contrast, time-series models such as GARCH (Generalized Autoregressive Conditional Heteroskedasticity) provide a flexible framework for capturing volatility dynamics over time. As shown by Marisetty (2024), GARCH(1,1) models consistently demonstrate predictive strength across major indices and allow for modeling volatility clustering and persistence. However, such models are less suited to isolate the effects of discrete events and cannot distinguish between volatility arising from specific shocks versus ongoing market dynamics. Therefore, while time-series approaches offer valuable complementary insights, the event study remains uniquely suited for detecting the immediate market impact of clearly defined economic and political shocks.

Furthermore, event studies rely on the assumption of semi-strong market efficiency, implying that prices react instantaneously and rationally to new information which may not always hold in practice. Market participants may react before or after the formal announcement, leading to under- or overestimation of the events true effect. Additionally, the computation of cumulative abnormal returns (CARs) may be biased, particularly in samples involving small-cap firms where wide bid-ask spreads can distort return measures (Chen 2017). To ensure the validity of the results, both parametric and non-parametric tests were applied. While this study limits the sample to actively traded firms to mitigate such distortions, the risk remains.

The collection of closing stock price data was analyzed using Microsoft Excel as the statistical tool to compute abnormal returns, average abnormal returns, and cumulative abnormal returns for the event study.

Finally, the results were interpreted and conclusions were drawn based on the findings. The calculated AARs and CARs for each firm size and shock were compared to existing literature to help address the research question and evaluate the validity of the hypotheses. This also provided insight into whether firms of different market capitalizations exhibit consistent patterns in their responses to economic and non-economic shocks.

The overall process followed in this study is summarized in Figure 1, which outlines the key steps of the event study methodology, including event definition, sample selection, abnormal return calculation, and significance testing. In instances where statistical significance is not achieved, the framework facilitates the continuation of analysis through robustness checks and descriptive interpretation, as illustrated in the diagram. This structured approach ensures both methodological rigor and flexibility in interpreting market reactions under varying conditions.

Further, to better situate this research within the existing academic literature, the following tables provide a consolidated overview of prior event studies related to economic and non-economic shocks, the statistical methodologies employed, and the main testing approaches used to evaluate abnormal returns. Table 2, summarizes key event studies addressing financial market reactions to major shocks.

Table 2*. Summary of economic and non-economic event studies*

Event Study	Journal	Topic	Event Type	Event	Event Period	Data Source	Confounding Announcements
D'Arcangelis et al. (2024)	MDPI-Stats	Stock network reaction to Brexit	Non-Economic	Brexit Referendum	2016-2019	Euro STOXX 600	UK elections of 2019
Kenourgios et al. (2019)	Emerald. Managerial Finance	Sectoral response to Brexit	Non-Economic	Brexit Referendum	2016	Euro STOXX 600	UK elections of 2019
Ahmed et al. (2022)	European Financial Management Wiley	Geopolitical crisis impact	Non-Economic	Russia-Ukraine War	2021-2022	Euro STOXX 600	Not Reported
Hudson et al. (2020)	European Economic Review	Europe Economic Review	Non-Economic	Brexit Referendum	2012-2017	FTSE All Share index	Yes, several evento included

Harjoto et al. (2021)	Applied Economics Letters	Market reaction due to COVID-19 pandemic	Non-Economic	COVID-19 Outbreak	2020	MSCI indexes	Not Reported
Burdekin et al. (2018)	Applied Economics Letters	Brexit impact on global equity markets	Non-Economic	Brexit Referendum	2016	MSCI global price index, S&P Global Equity Index and Dow Jones Global Equity Index	Not Reported
Škrinjari´c (2019)	International Journal of Financial Studies, MDPI	Market reaction of some south, eastern and central countries to Brexit	Non-Economic	Brexit Referendum	2016	BELEX, BETI, BIRS, BUX, CROBEX, PFTS, PX, SAX, SBITOP, SOFIX, and WIG	Not Reported
Pandey et al. (2020)	International Review of Economics and Finance	Reaction of developed & emerging markets to COVID-19	Non-Economic	COVID-19 Outbreak	2019-2020	All Country World Index	Not Reported
Angelidis et al. (2015)	Global Finance Journal	US stock market regimes and oil price shocks	Economic	Oil Price Shocks	1989-2011	(RDOW) (DY) (CPI) (UNEMP) (INT) (DS)	Not Reported
Benkraiem et al. (2018)	Journal of International Financial	US stock market reactions to energy price	Economic	Energy Price Shocks	1999-2015	S&P 500, (WTI), crude oil, regular gasoline, diesel fuel, heating oil, Henry Hub natural gas	Not reported
Dulak & Gnabo (2024)	International Review of Financial Analysis	Climate litigation and financial markets	Economic	Climate Litigation	2005-2021	U.S. Climate Change Litigation and the Global Climate Change Litigation databases	Not reported
Salisu et al. (2017)	Economics and Business Letters	US stocks and oil price risk: Large vs. Small Cap	Economic	Oil Price Risk	1980-2004	(CRSP), DataStreams total return index	Not reported

3.3. Sample Selection and Data Collection

The dataset for this study consists of firms listed on European stock markets, segmented by market capitalization into small-, mid-, and large-cap categories. Two widely recognized index providers, MSCI and STOXX, are used to represent these firm sizes and construct the benchmark indices, enabling a robust and comparative framework. This dual-index approach allows for a granular analysis of how companies of different sizes respond to both economic and non-economic shocks while supporting methodological cross-validation and reducing the risk of index-specific biases.

For the primary analysis, firm-level data is sourced from the MSCI Europe Small Cap (2025), MSCI Europe Mid Cap (2025), and MSCI Europe Large Cap (2025) USD, which collectively cover 15 developed European markets and represent approximately 15%, 15%, and 70% of the free float-adjusted market capitalization in each country, respectively, see Figure 2. The MSCI Europe Index (2025) is used as the benchmark, capturing large- and mid-cap representation across the same markets and reflecting approximately 85% of the total investable universe in the region. MSCI indices are widely used in academic research and are denominated in USD, reported as gross total return indices, meaning dividends are assumed to be reinvested without tax deduction. This methodological consistency and broad market coverage support their suitability for event studies.

To strengthen robustness, the analysis is complemented by the STOXX Europe Small (2025), STOXX Europe Mid (2025), and STOXX Europe Large (2025) indices (EUR), each comprising the 200 most liquid and representative companies within their capitalization bands, selected based on free-float market capitalization and liquidity, see Figure 3. The STOXX Europe 600 (2025) Index serves as the benchmark, representing approximately 90% of the investable market capitalization across 17 European countries, including both Eurozone and non-Eurozone economies such as the United Kingdom, Switzerland, and the Nordics.

Importantly, the STOXX indices report price returns in EUR, excluding dividends, while MSCI indices provide gross total returns in USD, including dividend reinvestment. These differences in currency denomination and dividend treatment introduce additional variation, as exchange rate fluctuations and methodological inconsistencies can influence the comparability of results. Variations in CAR magnitudes are therefore partly attributable to these factors. Daily closing prices for MSCI indices were retrieved from the official MSCI website, while STOXX data were sourced from Investing.com.

It is important to clarify that this segmentation is based on indices rather than individual firms, which limits the granularity of firm-specific analysis and may impact the generalizability of the results.

As demonstrated in Table 2, several influential event studies have successfully employed index-based data to assess market responses to macroeconomic and geopolitical shocks, providing empirical support for the methodological choice of using capitalization-based indices in this thesis.

For the analysis of the 2022 energy shock, the Dutch TTF gas price was selected as the reference point instead of Brent crude oil. While Brent is a globally recognized benchmark often used to proxy broader energy market trends (Floros & Galyfianakis 2025), it was deemed less suitable due to its weaker alignment with regional gas market dynamics during the European energy crisis. The TTF Month-Ahead contract, traded at the Title Transfer Facility, Europes most liquid gas hub, was selected because of its strong relevance to European energy markets. As noted by Heather (2022), the surge in TTF prices was driven by a combination of extreme weather in northwest Russia, supply disruptions due to strike actions on North Sea platforms, and potential speculative trading activity.

The overall process followed in this study is summarized in Figure 1, which outlines the event study steps from event definition and sample selection to abnormal return calculation and significance testing. In cases where statistical significance was not achieved, the framework allows for continuation of analysis through robustness testing and descriptive interpretation, as shown in the diagram.

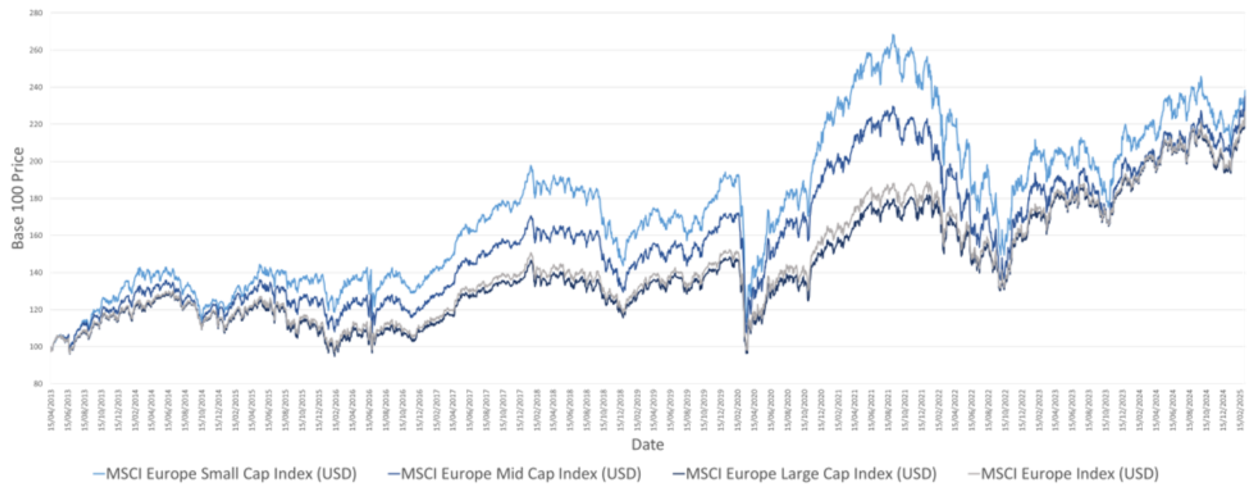

Figure 2: *Normalized Price Chart with Base 100, MSCI.*

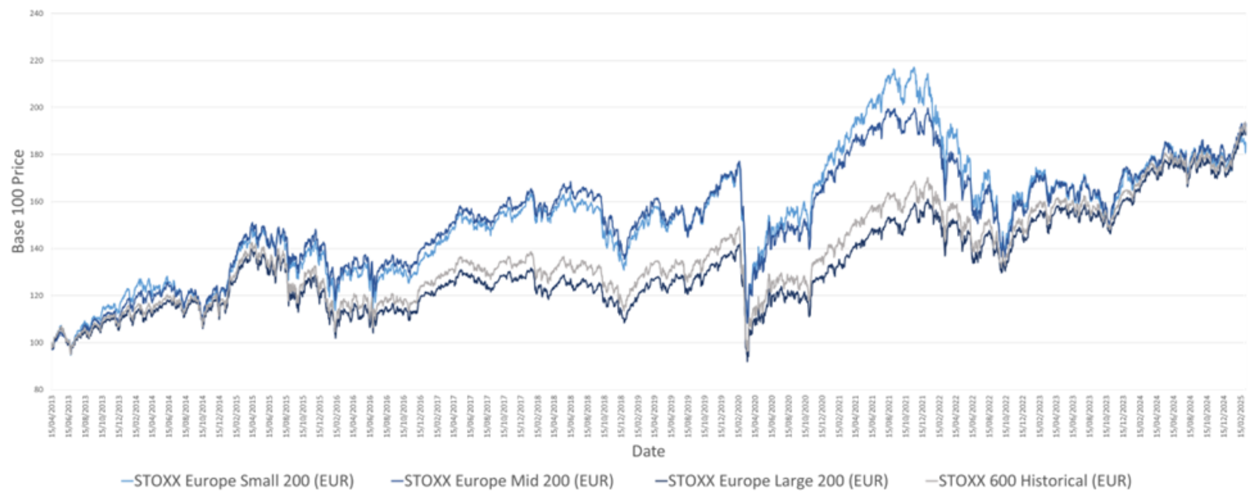

Figure 3: *Normalized Price Chart with Base 100, STOXX.*

3.4. Procedure, Event Study

The event study methodology will be applied to analyze the stock price reactions to the Brexit referendum and the European energy price surge. The procedure will follow the standard steps outlined in the event study literature, particularly referencing the foundational work by Fama et al. (1969) and the subsequent developments discussed by Binder (1998).

3.4.1. Event and Estimation Window Selection

To examine both short- and long-term stock market responses to the Brexit referendum and the 2022 European energy crisis, this study applies clearly defined event and estimation windows. The event date for the Brexit referendum is set to June 24, 2016 The Electoral Commission (2016), the first trading day following the vote outcome announcement. For short-term analysis, a [-3, +3] trading day window is applied around this date to capture immediate market reactions, including anticipatory trading and short delays in adjustment. This window length aligns with established event study practice, where most studies conclude within five days of the event to isolate short-run abnormal returns (Oler et al. 2008). According to a recent meta-review of over 400 event studies, event windows typically range between 1 and 11 days, most commonly centered symmetrically around the event date. A five-day window is the most frequently used, appearing in over 76% of studies reviewed (Holler 2014).

It is important to note that economic shocks such as the 2021–2022 energy crisis do not emerge instantaneously but rather unfold progressively, with market participants often reacting to early signals and incremental developments. As a result, abnormal returns observed in the days leading up to the selected event date (December 21, 2021) are consistent with investor behavior in anticipation of worsening conditions. This supports the use of a symmetric event window to capture both anticipatory and reactive market responses.

The long-term effects of both shocks are assessed using a [-3, +60] trading day window, enabling the detection of more persistent shifts in returns as markets reassess the broader implications over time. This extended window is particularly relevant for complex or evolving shocks, such as the energy crisis, where investor responses may unfold gradually rather than immediately.

A consistent estimation window of [-250, -11] trading days is applied in both cases to establish a robust benchmark for expected returns while minimizing contamination from early speculation or information leakage. Recent literature suggests that estimation windows in event studies vary widely, from 30 to 750 days, depending on the context (Holler 2014). However, sensitivity analyses show that estimation window lengths exceeding 100 days generally produce stable and reliable predictions of abnormal returns (Benninga 2008). This study's choice of a 240-day estimation window therefore lies within the robust range found in empirical research, see Figure 4.

However, there is no definitive rule regarding the ideal length of an estimation or event window. Researchers face a methodological trade-off: while longer estimation windows may increase accuracy by drawing on a larger sample of returns, they also raise the risk of structural shifts in the α and β parameters due to unrelated confounding events, potentially biasing the model. Similarly, event windows must balance the risk of including confounding influences with the possibility of information leakage or delayed market responses, which may justify extending the observation period (Benninga 2008).

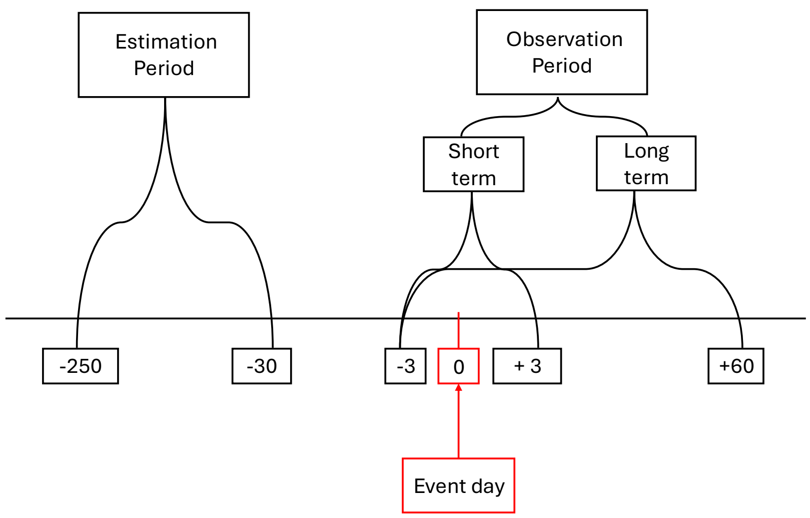

***Figure 4**: Event study timeline.*

For the energy crisis specifically, identifying a precise event date poses an additional challenge, as the shock developed progressively alongside the Russia-Ukraine conflict and other geopolitical factors. To avoid contamination from the 2022 invasion of Ukraine and its broader geopolitical consequences, this study selects December 21, 2021, as the event date. This corresponds to the highest recorded wholesale gas price in Europe. On that day, the Dutch TTF Month Ahead contract peaked at €180.31/MWh, as displayed in Figure 5, marking a significant point in a year characterized by extreme volatility in European gas markets. This date is endorsed by Heather (2022), who identifies it as the culmination of a second and particularly severe price rally. It followed an initial surge in October and a temporary decline, with the December peak driven by a combination of severe cold weather in north-west Russia, strike action on North Sea platforms that constrained supply, and speculative trading activity, likely intensified by year-end portfolio rebalancing in a context of reduced market liquidity.

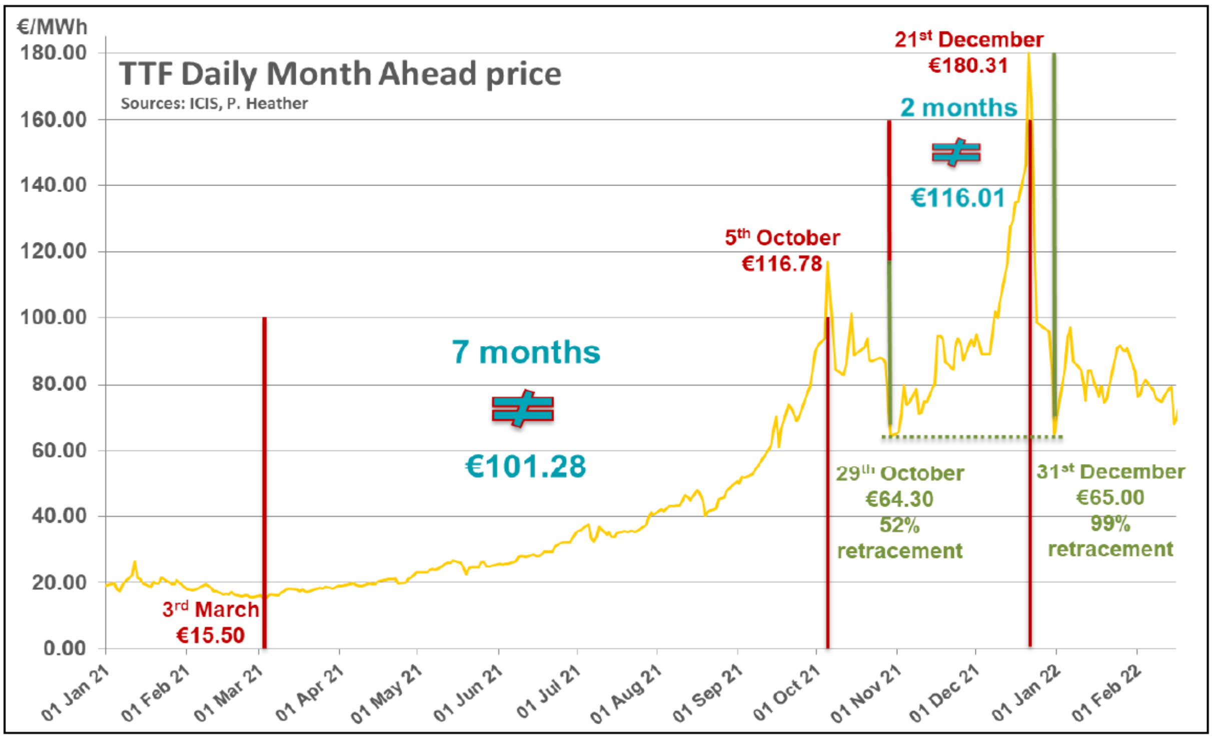

***Figure 5**: Evolution of Dutch TTF Month-Ahead Gas Prices in 2021 (Heather 2022).*

3.4.2. Estimation of Expected Return

For calculations the expected return the estimation model must be selected. Dyckman et al. (1984) compared three models and concluded that the OLS market model generates more accurate results. Therefore, the OLS market model was chosen to calculate the normal returns. The normal returns, $\boldsymbol{E}(\boldsymbol{R}_{it})$, is calculated as:

$$\boldsymbol{ER}_{it} = \alpha + \beta \boldsymbol{R}_{mt} \qquad (1)$$

Where α and β are the intercept and the slope of the OLS regression model and $\boldsymbol{R}_{mt}$ is the rate of return on the MSCI index on day t, where $\boldsymbol{R}_{mt}$ is calculated separately for each index. The α and β coefficients are calculated with the index data from t_a to t_b.

3.4.2.1. Logarithmic returns

To compute the actual daily returns of the indices, this study employs log-returns derived from closing prices. Log-returns are favored over simple returns in financial econometrics due to their desirable statistical properties. They stabilize variance, improve the reliability of volatility estimation, and allow for the consistent aggregation of returns across time, an essential feature for cumulative abnormal return analysis. Furthermore, their mathematical symmetry and compatibility with the assumptions of normality make them particularly suitable for parametric testing. As highlighted by Marisetty (2024), log-returns also offer superior numerical precision and enable more consistent comparisons across varying time intervals.

An additional advantage of using log-returns in a cross-country context is their ability to neutralize part of the currency base effect. Because log-returns express relative changes rather than absolute price levels, the analysis becomes less sensitive to differences in the nominal base currency of each index (e.g., euros vs. pounds), allowing for more meaningful comparison of price dynamics across markets. However, it is important to note that this approach does not eliminate differences arising from the treatment of dividends. Index values can vary depending on whether they are calculated as price indices (excluding dividends), net return indices (including dividends after withholding taxes), or gross return indices (including full dividends).

The actual return $\boldsymbol{R_{it}}$, is therefore calculated as:

$$\boldsymbol{R_{it}} = \mathrm{LN}\left(\frac{\boldsymbol{P_{it}}}{\boldsymbol{P_{it-1}}}\right) \cdot 100 \qquad (2)$$

LN is the natural number, $\boldsymbol{P_{it}}$ is the price of index i on day t, and $\boldsymbol{P_{it-1}}$ is the price of index i on day t-1.

3.4.3. Calculation of Abnormal Returns

Abnormal returns (AR) are calculated as the difference between the actual returns and expected returns derived from the market model. We subtract the estimated expected return, as per eq. (1), from the actual daily returns which equals the abnormal return $\boldsymbol{AR_{it}}$,

$$\boldsymbol{AR_{it}} = \boldsymbol{R_{it}} - \boldsymbol{ER_{it}} \qquad (3)$$

Where $\boldsymbol{AR_{it}}$ is the abnormal returns on index i on day t, $\boldsymbol{R_{it}}$ is the actual return on index i on day t and $\boldsymbol{ER_{it}}$ is the normal return on index i on day t, see eq. (1) above.

3.4.4. Average Abnormal Returns

AAR represents the average abnormal return (AR) across all indices in the sample for a given event day, it is used to analyze the common reaction of the stock idiocies to the event. The aggregated abnormal daily return is divided by the sample size **N** to calculate the average abnormal return:

$$\boldsymbol{AAR_t} = \frac{1}{N}\sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{AR_{it}} \qquad (4)$$

Where $\boldsymbol{AAR_t}$ is the average abnormal return on day t, N is the number of indices and $\boldsymbol{AR_{it}}$ is the abnormal return given in eq. (3).

3.4.5. Cumulative Abnormal Returns

To assess the cumulative impact of the event over time, the cumulative abnormal returns (CAR) are calculated by summing the $\boldsymbol{AR_{it}}$ over the event window t_a to t_b.

$$\boldsymbol{CAR_i} = \sum_{t=t_a}^{t_b} \boldsymbol{AR_{it}} \tag{5}$$

Where $\boldsymbol{CAR_i}$ is the cumulative abnormal return, $\boldsymbol{AR_{it}}$ is the abnormal return, see eq. (3), and t_a to t_b is the time specifying the event window.

3.4.6. Statistical Tests for Significance

3.4.6.1. Cross-sectional t-test

To determine whether the average abnormal return on a specific day is significantly different from zero, the cross-sectional t-test is applied. This parametric test evaluates the null hypothesis that the mean abnormal return is zero across the sample of indices.

The test statistic is calculated as:

$$\boldsymbol{t_t} = \sqrt{N}\,\frac{\boldsymbol{AAR_t}}{\boldsymbol{S_{AAR,t}}} \tag{6}$$

Where

$$\boldsymbol{S^2_{AAR,t}} = \frac{1}{N-1}\sum_{i=1}^{N}(\boldsymbol{AR_{i,t}} - \boldsymbol{AAR_t})^2 \tag{7}$$

Where t_t is the t- value on day t, $\boldsymbol{AAR_t}$ is the average abnormal return on day t, see eq. (4), $\boldsymbol{S_{AAR,t}}$ is the cross-sectional standard deviation of abnormal returns on day t, and N is the number of indices.

The cross-sectional t-test assumes that abnormal returns are independently and identically distributed across firms. It is widely used due to its simplicity and effectiveness in identifying statistically significant market reactions to events on a given day within the event window.

Similarly, same test can be performed on CAR to asses whether the cumulative market reaction over a given event window is statistically significant. The cross-sectional t-test on CAR is calculated as:

$$t = \sqrt{N}\,\frac{\boldsymbol{CAAR}}{\boldsymbol{S_{CAAR}}} \tag{8}$$

With

$$S_{CAAR}^2 = \frac{1}{N-1}\sum_{i=1}^{N}(CAR_i - CAAR)^2 \quad (9)$$

Where CAR_i is the average cumulative abnormal return across all indices, see eq. (5), S_{CAAR} is the cross-sectional standard deviation of the CARs, and N is the number of indices.

This approach enables the evaluation of whether the total abnormal return over multiple days, rather than just a single day, is significantly different from zero. It is especially useful in identifying sustained market reactions to events, providing insight into both short-term and long-term impacts.

3.4.6.2. Patell's Standardized Test

The Patell test, also referred to as the standardized residual test, provides a refined parametric approach for evaluating the statistical significance of abnormal returns. Unlike the traditional cross-sectional t-test, the Patell test enhances robustness by accounting for the forecast-error variance inherent in the expected return model. Each abnormal return is standardized using its own estimation variance, allowing the test to more accurately assess whether the average abnormal return across the sample significantly differs from zero.

The Patell Z-statistic is for AR is calculated as:

$$Z_{p.AR} = \frac{ASAR_0}{S_{ASAR}} \quad (10)$$

Where S_{ASAR} is the variance and is computed as:

$$S_{ASAR}^2 = \sum_{i=1}^{N}\frac{M_i - 2}{M_i - 4} \quad (11)$$

Where M_i is the size of the estimation window. To compute the aggregated standardization $ASAR_t$, the standardization of each abnormal return has to be calculated first:

$$SAR_{i,0} = \frac{AR_{i,0}}{S_{AR_{i,0}}} \quad (12)$$

Where $AR_{i,0}$ is the abnormal return on index i at day 0, see eq. (3). The denominator $S_{AR_{i,t}}$ is calculated as:

$$S_{AR_{i,0}}^2 = S_{AR_i}^2\left(1 + \frac{1}{M_i} + \frac{\left(R_{m,0} - \overline{R}_m\right)^2}{\sum_{t=T_0}^{T_1}\left(R_{m,t} - \overline{R}_m\right)^2}\right) \quad (13)$$

The variance of the residual is $S_{AR_i}^2$ and $\overline{R}_m$ is the average market return of the estimation window, both calculated as:

$$S_{AR_i}^2 = \frac{1}{M_i - 2}\sum_{t=T_0}^{T_1}\left(R_{i,t} - \alpha_i - \beta_i \cdot R_{mt}\right) \text{ and } \overline{R}_m = \frac{1}{L_1}\sum_{t=T_0}^{T_1}R_{m,t} \quad (14)$$

Similarly for the CAR, the Patell Z-statistic is calculated as:

$$Z_{p.CAR} = \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \frac{\boldsymbol{CSAR_i}}{\boldsymbol{S_{CSAR_i}}} \tag{15}$$

The cumulative standardized abnormal return of firm i is denoted as $\boldsymbol{CSAR_i}$,

$$\boldsymbol{CSAR_i} = \sum_{\boldsymbol{t}=T_1+1}^{T_2} \boldsymbol{SAR_{i,t}} \tag{16}$$

Where $\boldsymbol{SAR_{i,t}}$ is calculated as for the ARs, see eq. (8), but for the whole event window, not only the event day as for the ARs. Lastly, $\boldsymbol{S_{CSAR_i}}$ is computed as:

$$\boldsymbol{S_{CSAR_i}} = L_2 \frac{M_i - 2}{M_i - 1} \tag{17}$$

Where L_2 is the number of days in the observation window.

3.4.6.3. Generalized Sign Test

The Generalized Sign Test is a non-parametric statistical method used to test whether the distribution of ARs or CARs around an event is symmetric. Unlike traditional parametric tests, this approach does not rely on distributional assumptions such as normality, making it robust in the presence of outliers or skewed return distributions.

The test is based on the number of positive ARs ω, compared to the expected number $N \cdot \hat{p}$, where $\hat{p}$ is the empirical proportion of positive ARs observed during the estimation window. The statistical test is calculated by:

$$Z_G = \frac{\omega - N \cdot \hat{p}}{\sqrt{N \cdot \hat{p}(1 - \hat{p})}} \tag{18}$$

Where N is the number of non-zero AR or CAR observations. Applying the test to CAR, 7 day rolling window length $\hat{p}$, was chosen for the short term analysis and 64 day rolling window length for the long term analysis.

3.4.6.4. Wilcoxon Signed-Rank Test

The Wilcoxon Signed-Rank Test is used in event studies to evaluate whether ARs or CARs are significantly different from zero. It assesses whether the distribution of returns is symmetrically centered around zero, making it suitable for detecting consistent positive or negative reactions to an event across a sample of firms or indices.

The test is performed by first calculating d_i which represents either the AR or CAR for observation *i*. All observations where $d_i = 0$ are excluded. The remaining values are ranking in ascending order based on their absolute magnitude. After ranking, the original signs of d_i are re-applied to the ranks. The positive and negative signed ranks are then summed separately, denoted as $W^+$and W^-, respectively. The test statistic is defined as the smaller of these two rank sums:

$$W = \min{(W^+, W^+)} \tag{19}$$

Furthermore, for small samples, $n < 25$, the distribution of W is compared to critical values from the Wilcoxon tables. For larger samples, the test statistic is standardized using the normal approximation:

$$Z = \frac{W^{+} - \mu_W}{\sigma_W} \tag{20}$$

Where μ_W and σ_W is denoted as:

$$\mu_W = \frac{n(n+1)}{4}, \quad \mu_W = \sqrt{\frac{n(n+1)(2n+1)}{24}} \tag{21}$$

Thereafter, the Z value is compared to critical values of the standard normal distribution.

3.5. Ethical Considerations

All data used in the analysis, such as historical closing prices of MSCI and STOXX indices, Dutch TTF gas prices, and related macroeconomic indicators, were obtained from reputable and publicly accessible sources. Proper referencing and citation practices have been rigorously applied throughout to acknowledge the original authors and data providers.

Additionally, this research avoids any form of data manipulation, misrepresentation of findings, or selective reporting, in line with good academic practice. The statistical methods employed, both parametric and non-parametric, were transparently explained and applied consistently across datasets to ensure objectivity and replicability.

Finally, the thesis adheres to the ethical guidelines established by the university and complies with the standards outlined in the research methods course. Since no proprietary or confidential information was accessed, and no identifiable personal data were collected or analyzed, the study falls under low-risk research. Nonetheless, ethical responsibility was maintained throughout the entire research process, from literature review and data collection to interpretation and reporting of results.

4. Results and discussion

This chapter presents the empirical findings of the event study, structured to assess the market impact of two major external shocks: the 2016 Brexit referendum, representing a non-economic political disruption, and the 2022 energy crisis, an economic shock driven by supply constraints and geopolitical tensions. The analysis is segmented by firm size; small, mid, and large capitalization; and distinguishes between short-term and long-term event windows to capture both immediate and persistent market reactions. For each event, the chapter examines the abnormal returns (ARs) and cumulative abnormal returns (CARs) across different firm sizes, enabling a comparative view of how varying levels of financial resilience and market exposure influence stock price sensitivity.

The chapter is structured into several sections. The first two sections present the core results for each event, respectively, highlighting differences in timing, intensity, and persistence of market responses. This is followed by a direct comparison of the two shocks across capitalization tiers, offering insights into the interaction between firm size and the nature of the shock. To verify the robustness of the findings, the subsequent section introduces a sensitivity analysis using an alternative dataset (STOXX Europe indices), allowing for cross-validation of patterns observed with MSCI indices. **Statistical significance tests are then applied to assess the reliability of AR and CAR estimates.** The final section of the chapter provides a broader discussion of the results, revisiting the initial research questions and hypotheses, exploring theoretical and practical implications, and drawing connections to historical events and relevant literature.

4.1. Impact of Non-Economic Factors on European stock market by capitalization size

4.1.1. Brexit Referendum Short-Term

The short-term market data following the Brexit referendum reveal distinct variations in abnormal return (AR) patterns across firm sizes. As observed in Figure 6, the small-cap index exhibited the most substantial negative ARs within the event window. On the event day, small-cap AR dropped to -2.63%, followed by a further decline of -3.63% on day +1. These movements resulted in a cumulative abnormal return (CAR) of -6.49% by day +1 and -5.47% by the end of the event window on day +3, see Figure 7.

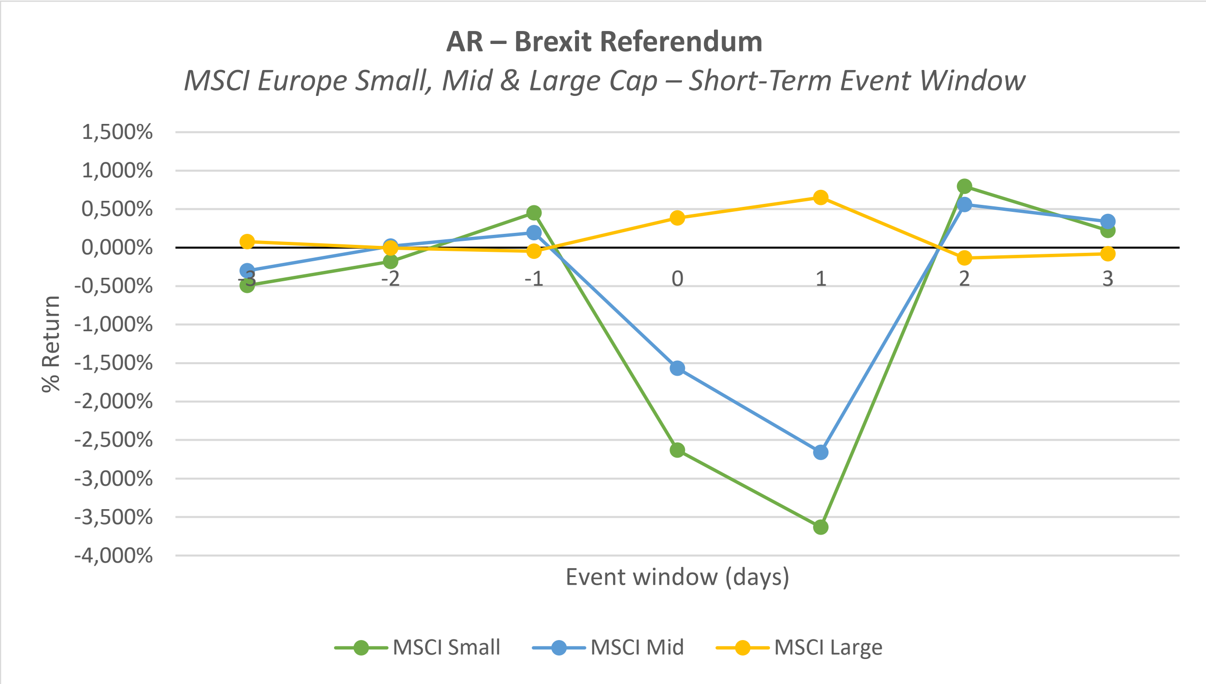

Figure 6*. Daily abnormal returns for MSCI Europe Small, Mid, and Large Cap indices during the short-term event window surrounding the Brexit referendum.*

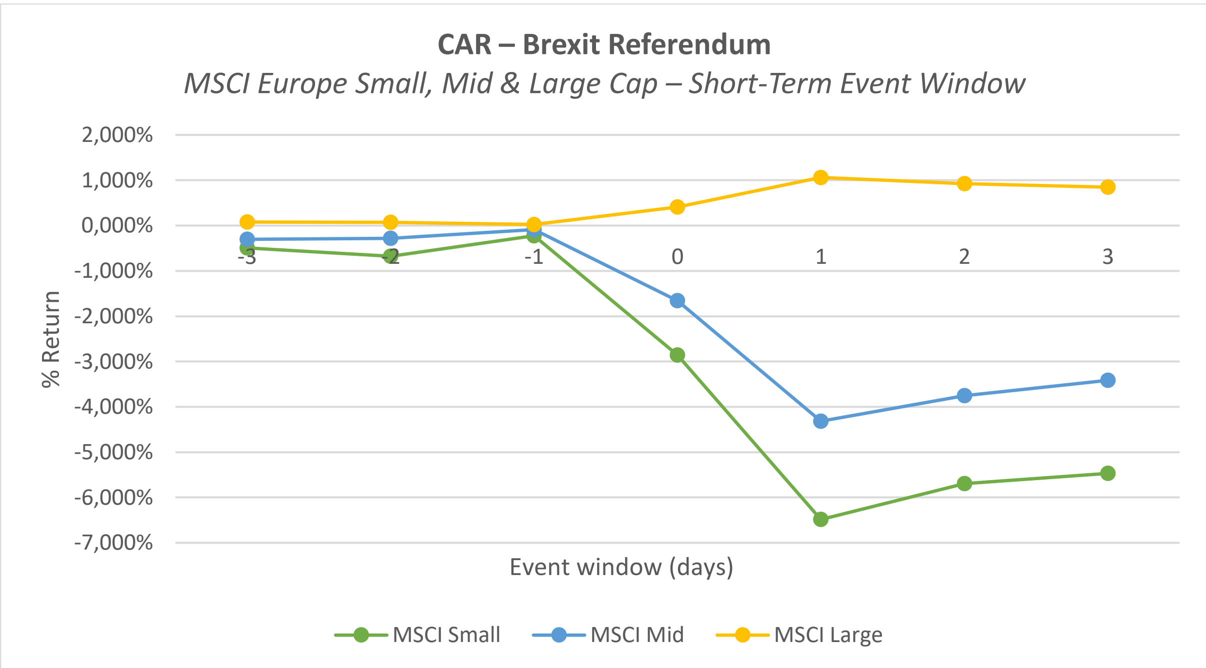

Figure 7*. Cumulative abnormal returns for MSCI Europe Small, Mid, and Large Cap indices following the Brexit referendum.*

Mid-cap indices followed a similar trajectory, though the magnitudes were moderately lower. The AR on day 0 was -1.57%, declining to -2.66% on day +1, with the CAR reaching -4.32% at its lowest point. By day +3, the mid-cap CAR had recovered slightly to -3.41%.

Large-cap indices, by comparison, experienced a different pattern. On the event day, the AR was positive at 0.39%, increasing to 0.65% on day +1. The large-cap CAR peaked at 1.06% before settling at 0.85% by day +3, suggesting greater stability within this segment over the same period.

Average abnormal returns (AARs), presented in Figure 14, support this trend. The most negative AAR occurred on day +1 at -1.88%, driven largely by the steep negative ARs in the small- and mid-cap indices. Large-cap AARs remained relatively stable, showing smaller fluctuations throughout the window.

In addition, detailed graphical representations of abnormal, expected, and cumulative abnormal returns for each firm size are provided in Appendix A, covering MSCI Europe Small Cap, Mid Cap, and Large Cap indices, respectively.

4.1.2. Brexit Referendum Long-Term

Across the 60-day event window, the Brexit referendum produced sustained and size-dependent movements in ARs, as displayed in Figure 8. For small-cap firms, daily ARs continued to fluctuate well beyond the initial event window. Although occasional rebounds were recorded, the overall series remained volatile, with frequent negative observations contributing to a CAR that stayed below zero throughout. By day +60, the small-cap CAR reached -2.08%.

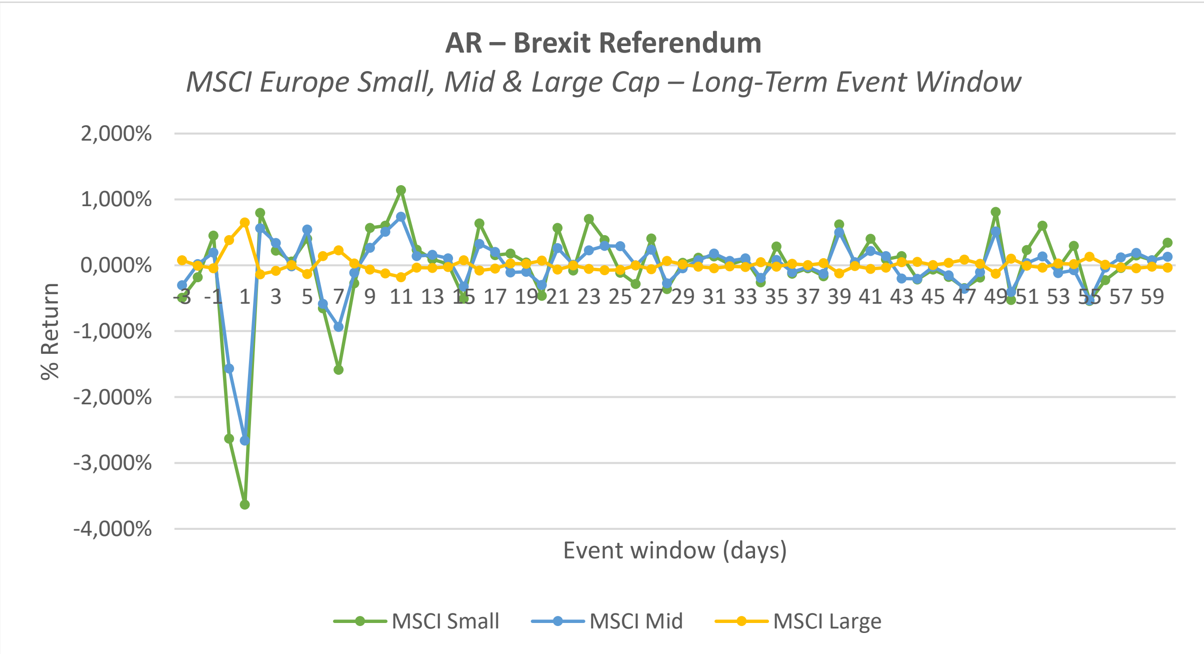

***Figure 8**. Daily abnormal returns for MSCI Europe Small, Mid, and Large Cap indices during the long-term event window surrounding the Brexit referendum.*

Mid-cap indices followed a similar long-term pattern, ARs alternated between positive and negative values over the window, but without consistent recovery. The corresponding CAR in Figure 9, declined more gradually compared to the small-cap group, ultimately settling at -1.94%.

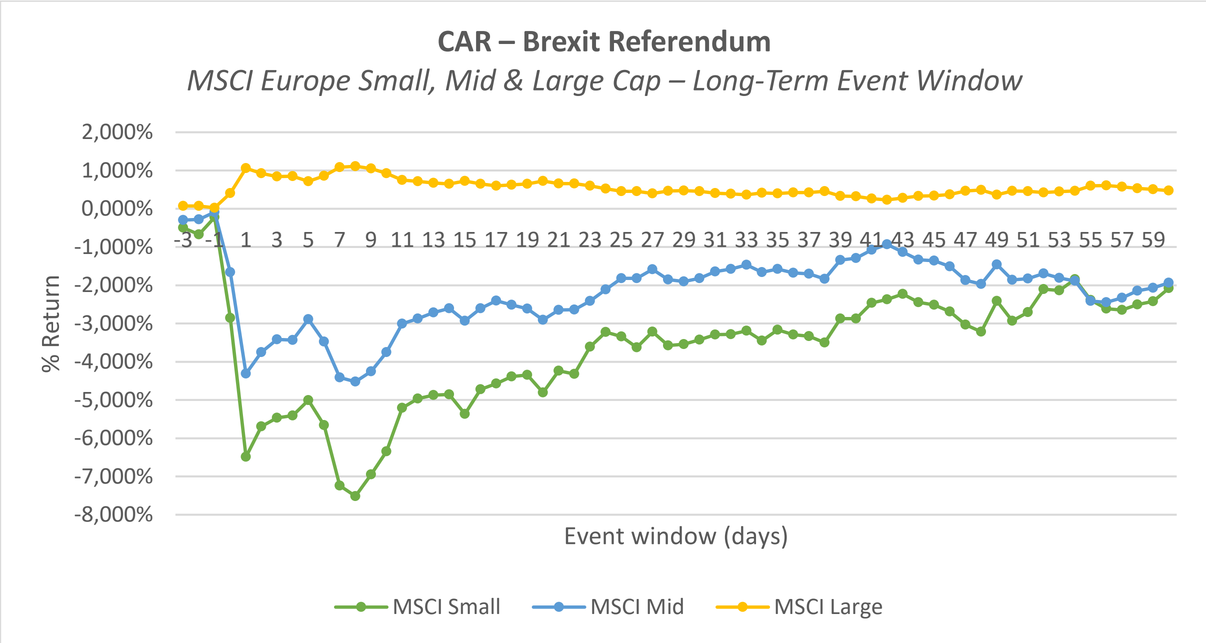

Figure 9*. Cumulative abnormal returns for MSCI Europe Small, Mid, and Large Cap indices following the Brexit referendum.*

In contrast, large-cap firms exhibited a relatively stable AR profile during the same period. Following the initial movements already reported in Section 4.1.1, the ARs in the subsequent days tended to cluster around zero, with moderate fluctuations. As a result, the large-cap CAR, after peaking early in the window, gradually declined and stabilized at 0.48% by the end of the period.

Referring to the evolution of CARs across the long-term event window showed in Figure 9. Small-cap CARs remained markedly negative throughout the entire period, signaling a sustained underperformance relative to expected returns and underscoring their heightened vulnerability to political shocks. Mid-cap CARs closely mirrored this trend but with less severity, demonstrating partial recovery while still ending in modestly negative territory. In contrast, large-cap CARs initially rose above zero, reflecting short-term resilience, before gradually declining and stabilizing near zero. This pattern suggests that investors may have favored large-cap firms during the post-referendum uncertainty, viewing them as more robust and better positioned to weather political turbulence. In summery the CARs across the three size groups, illustrating a clear divergence in long-term behavior. While large-cap CARs remained in positive territory, both mid- and small-cap indices exhibited continued underperformance relative to their expected returns.

These findings collectively underscore that the initial market shock from Brexit was not a short-lived anomaly for small- and mid-cap firms

Supplementary visualizations illustrating the abnormal, expected, and cumulative abnormal returns by firm size can be found in Appendix C. These figures correspond to the MSCI Europe Small Cap, Mid Cap, and Large Cap indices.

4.2. Impact of Economic Factors on European stock market by capitalization size

4.2.1. 2022 Energy Shock Short-Term

In response to the 2022 energy price spike, short-term AR patterns differed across capitalization groups. As shown in Figure 10, small-cap firms recorded a negative AR of -0.37% on day -3, followed by modest positive values through day +3. On the event day (day 0), the AR for small caps was -0.05%. Mid-cap firms showed a similar structure, with an AR of -0.46% on day -3 and -0.01% on day 0. Large-cap ARs fluctuated narrowly between -0.08% and 0.11% during the entire event window, with no significant directional movement, reflecting low volatility or muted sensitivity.

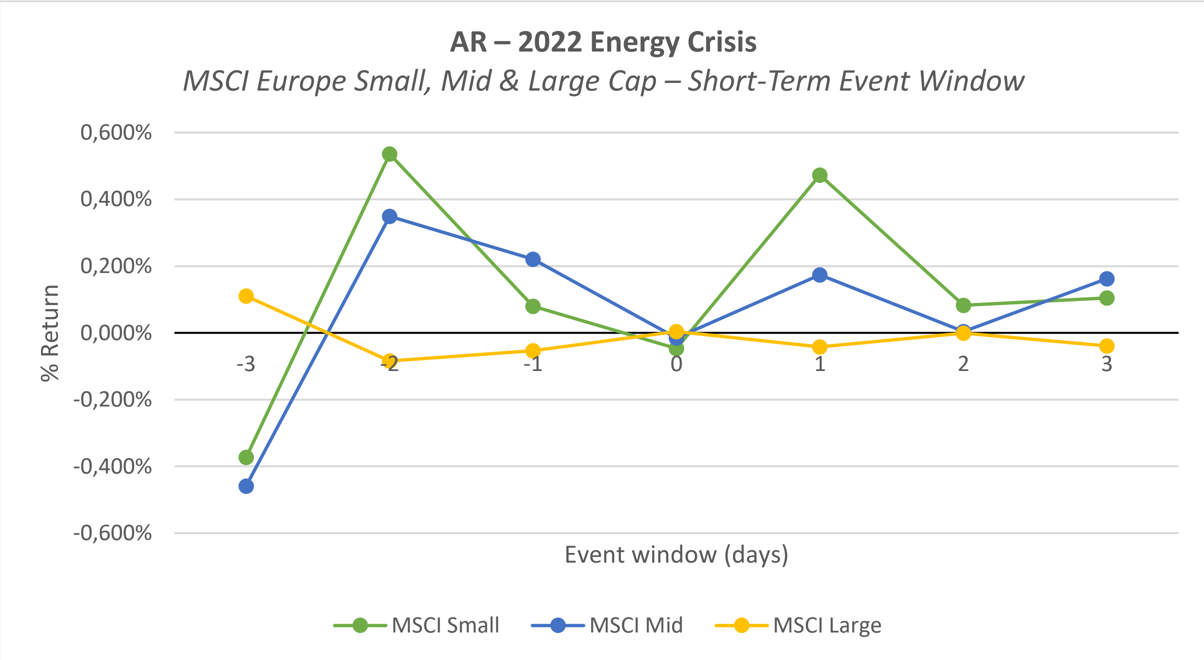

***Figure 10**. Daily abnormal returns for MSCI Europe Small, Mid, and Large Cap indices during the short-term event window surrounding the 2022 Energy crisis.*

The CAR trajectories in Figure 11, reflect gradual accumulation for small- and mid-cap firms. By day +3, the CAR reached 0.86% for small caps and 0.44% for mid-caps. Large-cap CARs remained near neutral levels throughout the period, ending at -0.11%.

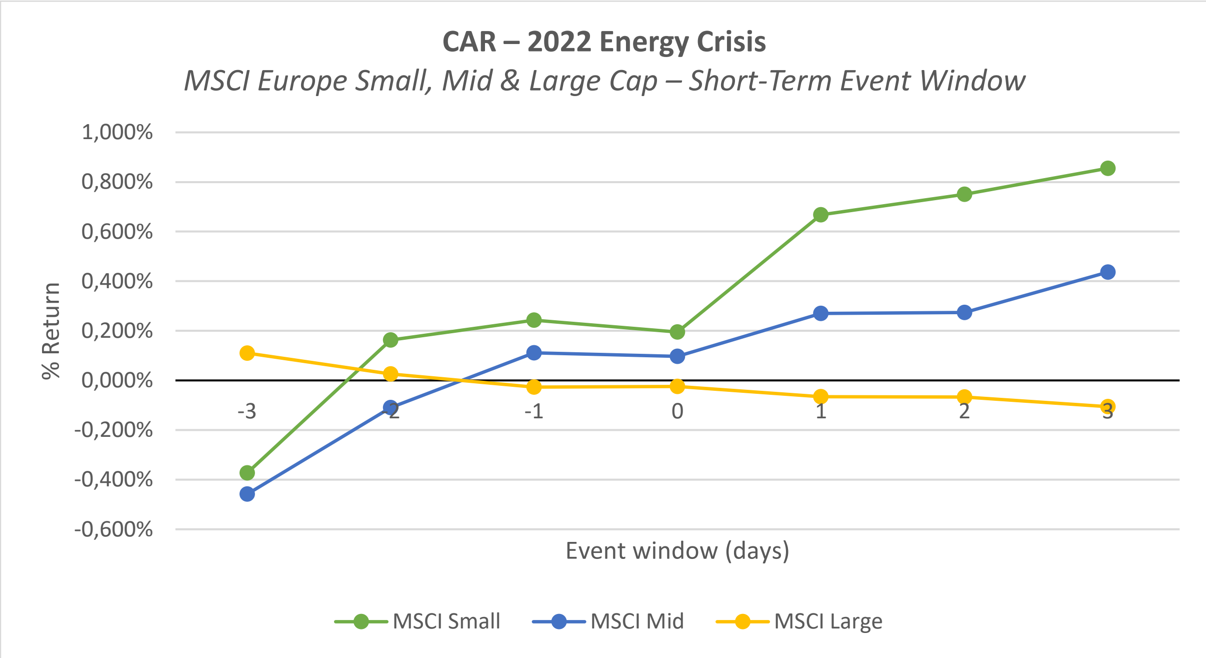

Figure 11. *Cumulative abnormal returns for MSCI Europe Small, Mid, and Large Cap indices following 2022 Energy crisis.*

Detailed views for each capitalization segment are shown in Appendix E. Figure 35 highlights the gradual CAR increase for small-cap firms after the initial decline. Figure 36 captures the flatter CAR build-up among mid-caps. In Figure 37, large-cap indices exhibit a relatively stationary CAR line, reflecting muted market response in the short-term horizon.

4.2.2. 2022 Energy Shock Long-Term

The long-term evolution of ARs following the 2022 energy crisis displayed distinct trajectories across capitalization segments. As presented in Figure 12, small-cap firms exhibited continued fluctuations throughout the 60-day window. Notably, a cluster of negative ARs appeared between days 10 and 40, with some of the most pronounced volatility observed after day 45. Mid-cap firms followed a similar pattern, though with smaller magnitudes and slightly more consistency in the later stages of the window. Large-cap ARs, by contrast, remained more stable throughout, oscillating within a narrow range close to zero. This stability supports the notion that large-cap firms, due to stronger financial buffers, were less impacted by operational cost pressures from energy price volatility.

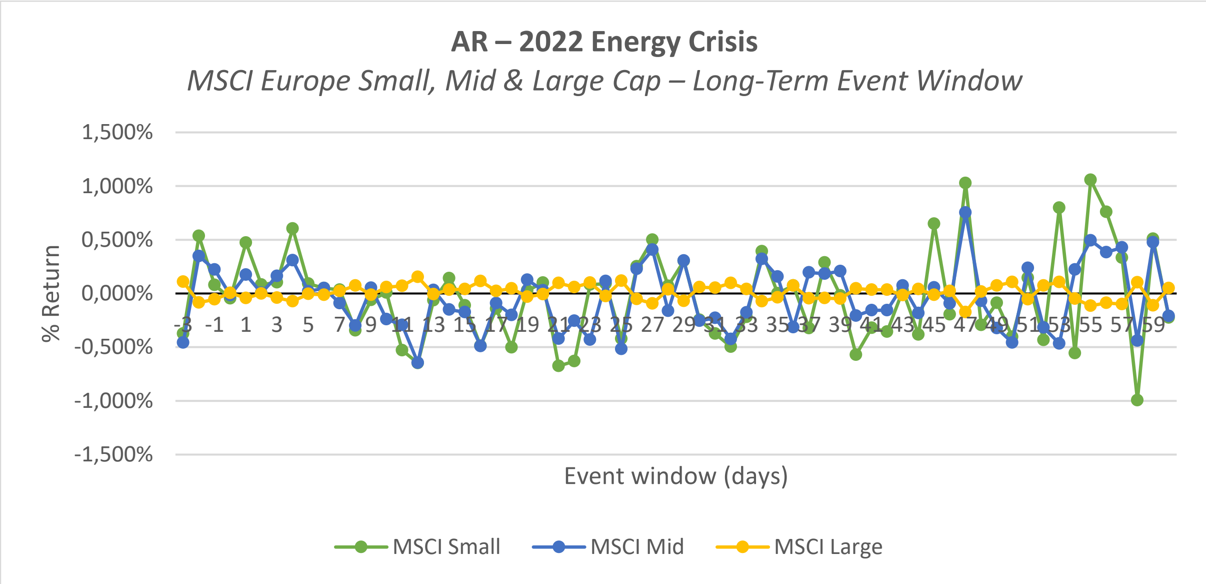

Figure 12*. Daily abnormal returns for MSCI Europe Small, Mid, and Large Cap indices during the long-term event window surrounding the 2022 Energy crisis.*

CARs, shown in Figure 13, provide further clarity on these developments. Large-cap CARs remained above zero for nearly the entire period, gradually increasing and stabilizing around +0.60% to +0.80% in the second half of the window. Small- and mid-cap CARs initially increased during the first week but began to trend downward thereafter. From day 10 to day 40, both segments experienced consistent CAR declines, reaching lows of approximately -4%. In the final 10 days, small caps recorded partial recovery, while mid-caps remained relatively flat, with CARs ending below -2%. Additionally, Appendix G presents visual summaries of the abnormal, expected, and cumulative abnormal returns across different firm sizes

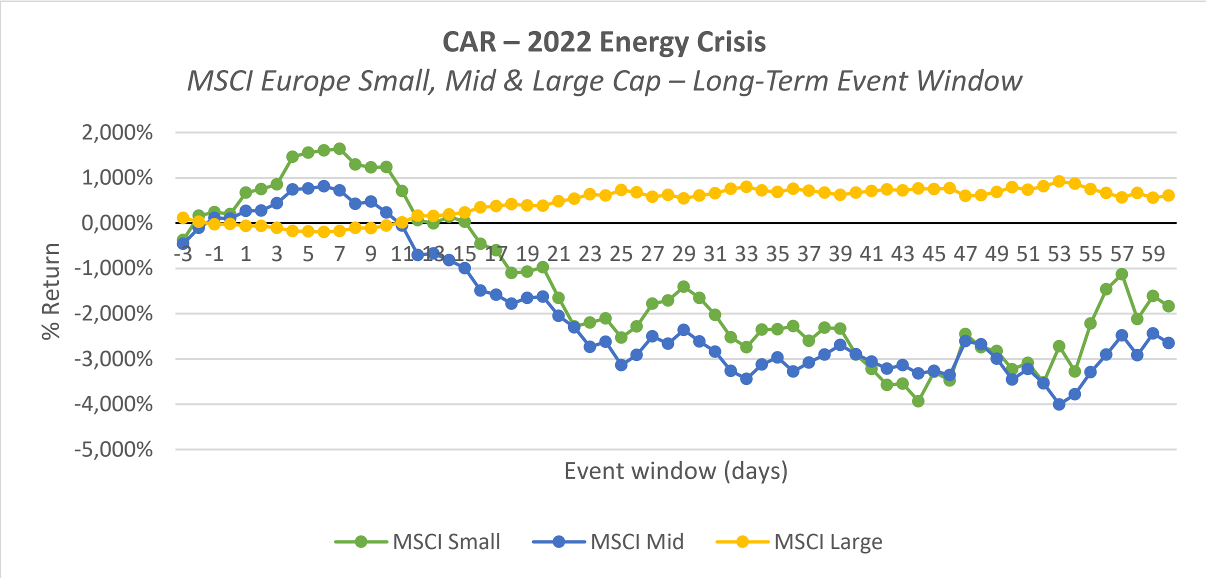

Figure 13*. Cumulative abnormal returns for MSCI Europe Small, Mid, and Large Cap indices following the 2022 Energy crisis.*

4.3. Comparison effect of two event nature per capitalization

4.3.1. Small Cap

In the short-term event window, small-cap firms exhibited more pronounced ARs in response to the Brexit referendum than to the 2022 energy crisis. On the event day of Brexit, the AR dropped by -2.63%, followed by an additional decline of -3.63% on the next trading day. During the energy crisis, ARs were more moderate, measured at -0.05% on day 0 and 0.47% on day 1.

CARs across the short-term window followed divergent trajectories. For Brexit, small-cap CARs declined progressively, reaching -5.47% by day 3. In contrast, the energy crisis saw a steady increase in small-cap CARs, reaching a value of 0.86% over the same period. This shows a sharp contrast in market sentiment, panic for Brexit versus a delayed, more rational response to energy prices.

In the long-term event window, ARs for small-cap firms remained volatile following the Brexit referendum, particularly during the first half of the 60-day period. The corresponding CAR reached a low of -7.51% by day 8 and gradually recovered to -2.08% by day 60. This trajectory may reflect initial investor overreaction followed by partial correction, a pattern consistent with behavioral finance studies on political uncertainty (Thaler & De Bondt 1985).

During the energy crisis, CARs for small-cap firms initially increased but began to decline after day 15, reaching a low of approximately -3.5% before partially recovering to -1.84% by the end of the window.

4.3.2. Mid Cap

In the short-term event window, mid-cap firms experienced a sharp decline in abnormal returns (ARs) during the Brexit referendum. On the event day, ARs fell to -1.57%, followed by an additional drop to -2.66% on the subsequent day. During the 2022 energy crisis, ARs for mid-cap firms remained closer to zero, ranging from -0.09% to 0.17% across the same window.

CARs highlight this divergence. In the Brexit window, CARs for mid-cap firms declined to -4.32% by day 1 and reached -3.41% by day 3, with minimal short-term recovery. During the energy crisis, CARs rose modestly, reaching 0.44% by day 3.

Over the long-term window, Brexit-related ARs for mid-cap firms continued to fluctuate, especially during the first half of the period. CARs declined to -4.41% by day 7 and gradually recovered to -1.94% by day 60. In the energy crisis window, mid-cap CARs increased slightly in the initial phase but then declined steadily, reaching a low point near -3.5% by day 45 before stabilizing at -2.65% by the end of the window.

4.3.3. Large Cap

In the short-term event window, large-cap firms displayed limited AR movement in response to both the Brexit referendum and the energy crisis. During Brexit, ARs registered at 0.39% on the event day and increased to 0.65% on the following day. In the case of the energy crisis, ARs remained near zero throughout the window, with fluctuations ranging from -0.08% to 0.11%.

CARs over the short-term window reflected this stability. Brexit CARs increased consistently across the period, reaching 0.85% by day 3. During the energy crisis, large-cap CARs remained close to the baseline and ended the window at -0.11%.

Across the long-term event window, large-cap ARs following the Brexit referendum showed only minor day-to-day variations, with most values remaining close to zero. During the energy crisis, ARs demonstrated slightly more fluctuation but without sustained directional movement. CARs in both events followed similar long-term trends, gradually rising to between 0.5% and 0.6% by day 60.

4.4. Robustness test

To validate the reliability of the MSCI-based event study results, this analysis uses STOXX Europe indices as a robustness check for both short- and long-term windows. MSCI indices report gross total returns in USD, including reinvested dividends, while STOXX indices reflect price returns in EUR and exclude dividend effects. Given these structural differences, the goal is not to match absolute magnitudes of abnormal or cumulative returns but to verify consistency in direction, timing, and relative impact across firm sizes. Observing similar patterns across both datasets enhances the internal validity of the findings and reduces the likelihood that results are dataset-dependent.

4.4.1. Short Term Robustness Test

Short-term results from the STOXX indices closely mirror those derived from MSCI data, refer to Appendix B and Appendix F. During the Brexit shock, small-cap firms exhibit the strongest negative response in both datasets, while large-cap firms show relatively stable or mildly positive movements. Mid-caps consistently fall in between, supporting the conclusion that the smaller the firms are the more vulnerable to political uncertainty. Although STOXX ARs and CARs show slightly deeper declines than MSCI, this is consistent with the absence of dividend reinvestment and the impact of currency differences. Despite these magnitude discrepancies, the direction and intensity of reactions across firm sizes are mostly aligned, with some disparity in large cap, validating of the MSCI-based results.

A similar pattern is observed in the short-term results of the 2022 energy crisis, Appendix F. Both MSCI and STOXX small-cap indices display modest abnormal returns with gradually increasing cumulative values throughout the event window. While STOXX values rise more consistently toward the end of the window, the overall direction and trajectory of both datasets are comparable. Mid-cap indices follow a similar trend, though STOXX data shows a more pronounced cumulative increase by day +3. Large-cap indices exhibit the strongest and most sustained upward movement across both datasets, with STOXX showing a clearer cumulative climb. These patterns indicate that despite some differences in magnitude, the short-term market responses are largely consistent between the MSCI and STOXX datasets

Although differences in return scale are present, especially due to structural factors like dividend treatment and currency denomination, the relative performance and directional trends across firm sizes remain stable. This consistency supports the robustness of the short-term findings.

4.4.2. Long Term Robustness Test

In the long-term analysis of the Brexit referendum, the STOXX data broadly replicate the directional patterns seen in the MSCI-based results, though with some notable differences across firm sizes (see Appendix D and Appendix H). In the MSCI dataset, small caps show the most persistent downward trends in both AR and CAR, with mid-caps following a similar but slightly less severe trajectory, and large caps remaining relatively flat over the event window. In contrast, STOXX small caps are more stable than both their mid- and large-cap counterparts. Mid-caps in the STOXX dataset resemble the movement of large caps, showing gradual upward recovery, while large caps appear the most volatile among the three, diverging from the more stable large-cap behavior observed in the MSCI data.

Magnitude discrepancies are consistent with structural differences, including the absence of dividend reinvestment and the EUR-denomination of STOXX indices. Despite these variations, the alignment in timing and relative ordering of firm-size responses between the datasets confirms the consistency of the observed patterns.

The comparison for the long-term energy crisis window reveals notable differences in firm-size behavior between the MSCI and STOXX datasets. While CAR levels vary across both due to volatility, the firm-size ordering is not consistent. In the MSCI data, small caps show the most persistent declines, followed by mid caps, with large caps displaying relative stability. In contrast, STOXX small caps appear more stable than both mid and large caps, with large caps exhibiting the highest volatility. These divergences suggest that capitalization risk was not perceived or priced uniformly across datasets.

Taken together, these robustness checks suggest that while general market reactions are observable across datasets, firm-size-specific responses, particularly during the long-term window, show notable variation. This indicates that while core patterns are partially robust, the magnitude and ordering of effects may differ depending on the index provider.

4.5. Statistical significance test

In order to evaluate whether the AR and CAR observed during the event windows reflect statistically meaningful deviations from the estimated ER, a series of significance tests were applied. These include the Cross-sectional t-test and Patell Z-test, along with an initial consideration of the Generalized Sign Test. Each test offers a different perspective on whether the market reactions following the events were systematic or occurred due to random variation.

The Cross-sectional t-test evaluates whether the average AR or CAR on a given day significantly differs from zero across indices. The Patell Z-test extends this by accounting for forecast error from the estimation window, providing a more refined measure, particularly suitable under volatile market conditions.

Although the Generalized Sign Test was initially considered, it was ultimately deemed unsuitable for this study. As with the Wilcoxon Signed-Rank Test, it requires a sufficiently large sample size to produce meaningful results. Since the analysis was performed using index-level data rather than firm-level data, the sample was limited to three MSCI indices, making the application of these non-parametric tests inappropriate.

4.5.1. Brexit Referendum

We begin by assessing the short-term statistical significance of the Brexit referendum using AR and CAR for the MSCI Europe Small, Mid, and Large Cap indices, within the event window from day −3 to +3.

The Patell Z-test, depicted in Table 3, shows statistically significant effects across all index sizes for both AR and CAR. All test statistics exceed ±4.9, and the corresponding p-values are well below 0.001.

The Cross-sectional t-tests, seen in Appendix I and applied daily over the short-term window, show no statistically significant results. None of the daily t-statistics exceed the ±1.96 threshold, and all p-values remain above 0.28.

To complement the short-term analysis, the evaluation is extended to a long-term event window covering day −3 to +60.The Patell Z-test, see Table 3, for AR continues to show statistically significant deviations across all indices, with test statistics above ±5.7 and p-values near zero. For CAR, the Mid and Large Cap indices report p-values of 0.008 and 0.006, respectively, while the Small Cap index shows a p-value of 0.099.

The Cross-sectional t-tests, conducted daily from −3 to +60 and listed in Appendix I, also show no statistically significant outcomes. T-statistics remain within ±1.45, and p-values exceed 0.28 for both AR and CAR.

***Table 3**: Statistical test results for MSCI Europe Small, Mid, and Large Cap indices during the short-term and long-term event window of the Brexit referendum.*

Brexit Statistical tests

	Short-Term			Long-Term		
Test	**Small**	**Mid**	**Large**	**Small**	**Mid**	**Large**
Patell Z (AR)	-6,103	-5,789	5,927	-6,103	-5,789	5,927
P-test	1,04E-09	7,09E-09	3,08E-09	1,04E-09	7,09E-09	3,08E-09
Patell Z (CAR)	-4,964	-4,927	5,086	-1,650	-2,633	2,709
P-test	6,90E-07	8,33E-07	3,66E-07	9,90E-02	8,46E-03	6,76E-03

4.5.2. 2022 Energy Crisis

We assess the statistical significance of the 2022 Energy Crisis using AR and CAR for the MSCI Europe Small, Mid, and Large Cap indices, beginning with the short-term event window from day −3 to +3 around the crisis onset.

The Patell Z-test results for both AR and CAR Table 4 indicate no statistically significant effects across any of the indices. Test statistics remain close to zero, and p-values range from 0.35 to 0.95.

The Cross-sectional t-tests conducted daily from day −3 to +3 also show no statistical significance. T-statistics remain well within ±1.96, and all p-values exceed 0.28, see Appendix J.

To complement the short-term analysis, the window is extended to day −3 to +60 to examine the persistence of AR and CAR over a longer period. In the long-term window, the Patell Z-test results for AR remain statistically insignificant across all index sizes. However, when assessing CAR, significant cumulative effects are observed for the Mid and Large Cap indices, with p-values of 2.36E-06 and 3.12E-05, respectively. The Small Cap index shows a p-value of 0.051.

The daily Cross-sectional t-tests show similar results. T-statistics across the long-term window remain within ±1.47, and no p-value falls below 0.27. This pattern is consistent for both AR and CAR.

***Table 4**: Statistical test results for MSCI Europe Small, Mid, and Large Cap indices during the short-term and long-term event window of the 2022 Energy Crisis.*

2022 Energy Crisis Statistical tests

	Short-Term			Long-Term		
Test	**Small**	**Mid**	**Large**	**Small**	**Mid**	**Large**
Patell Z (AR)	-0,134	-0,070	0,066	-0,134	-0,070	0,066
P-test	0,893	0,944	0,947	0,893	0,944	0,947
Patell Z (CAR)	0,929	0,774	-0,725	-1,951	-4,720	4,164
P-test	0,353	0,439	0,469	0,051	2,36E-06	3,12E-05

4.6. Discussion

4.6.1. General Reflections on Findings

The empirical results point to meaningful differences in how European firms responded to the two shocks under investigation, the Brexit referendum and the 2022 energy crisis, both across time horizons and firm sizes. One of the most consistent patterns was the heightened sensitivity of small- and mid-cap firms to both shocks, particularly in the immediate aftermath. In contrast, large-cap indices displayed greater resilience, with more contained short-term responses and limited long-term deviations. This pattern is common for both event and is totally aligned with previous research for other event in European stock market (Ahmed et al. 2022; Gottschalk 2021; Dinh 2023).

A key observation was the sharper and more immediate repricing of small- and mid-cap equities following the Brexit referendum. This suggests that political uncertainty, especially when tied to structural and regulatory ambiguity, triggered more abrupt and significant market reactions for firms with greater domestic exposure and lower financial flexibility. Large-cap firms, benefiting from broader diversification and stronger financial buffers, exhibited muted volatility and a faster return to baseline levels. These results are consistent with earlier findings by Ahmed et al. (2022), Chuliá and Torró (2011) and Gottschalk (2021).

In contrast, the energy crisis prompted a more gradual repricing process. While small- and mid-cap stocks eventually declined in value, the trajectory was more staggered and less extreme in the short term. This pattern may reflect the way economic disruptions unfold more diffusely over time, allowing investors to reassess risks and adjust expectations as new information becomes available. Interestingly, large-cap firms not only maintained relative stability during this period but also exhibited upward drift over the long-term horizon, suggesting that investor expectations tied to firm fundamentals played a critical role in cushioning the effects of the energy shock. These findings are in line with prior research by Salisu, Swaray, and Oloko (2017), who found that large-cap firms are less sensitive to oil price shocks and tend to perform better under energy-related uncertainty.

Another important distinction relates to the persistence of effects. The Brexit shock resulted in longer-lasting underperformance for smaller firms, with cumulative return gaps persisting well into the extended event window. The energy crisis, by contrast, while still impactful, was associated with signs of recovery in later stages, particularly among small caps. This could indicate greater adaptive capacity over time when the source of the disruption is economic rather than political, although this interpretation should be made cautiously. This is aligned with previous research studies, as for example, suggesting that market efficiency is not static but evolves over the time as investors learn and adapt (Andrew 2004; Pástor & Veronesi 2013).

It is also important to note that many of the applied statistical tests did not yield significant results, particularly for the energy crisis. While some AR and CAR reactions were notable in magnitude, especially for Brexit, the lack of statistical significance in several of the non-parametric and cross-sectional tests indicates that these findings should be interpreted with care. In several cases, especially for the energy crisis, p-values remained well above conventional thresholds, and t-statistics stayed within non-significant ranges. This underlines that observed return movements were not always statistically robust across different test methodologies or consistent across index sizes.

Taken together, these findings reinforce the importance of both firm characteristics and shock typology in understanding equity market responses. The data suggest that firm size is not merely a control variable but a central mechanism in determining exposure and adjustment. Moreover, the contrast in timing and intensity between the two events illustrates that political and economic shocks may follow different pathways in terms of how they transmit through financial markets. These distinctions are critical for investors, policymakers, and researchers aiming to assess market fragility under conditions of macro-level uncertainty.

4.6.2. Revisiting the research questions

The research question guiding this thesis asked how large-, mid-, and small-cap stocks in Europe responded to two major shocks: the 2016 Brexit referendum and the 2022 energy price surge. By applying an event study methodology and analyzing both short- and long-term abnormal returns across firm sizes, the study was able to explore how the two different shocks impact market behavior.

H1: The Brexit referendum and the 2022 energy crisis have no significant effect on abnormal returns or cumulative abnormal returns for European equities, regardless of firm size, during the event window.

The results do not support Hypothesis 1. Statistically significant abnormal returns were detected in several instances, particularly during the short-term window following the Brexit referendum. The Patell Z-test showed strong deviations from expected returns, especially for small- and mid-cap firms. While the energy crisis did not yield significant short-term abnormal returns across most indices, long-term CARs showed significance in mid- and large-cap firms. This indicates that both events had measurable impacts on stock prices, contrary to the null assumption of no effect.

H2: The Brexit referendum and the 2022 energy crisis lead to statistically significant negative AR and CAR in European equities, with effects varying by firm size (small-, mid-, and large-cap) and event duration (short- and long-term).

The results offer partial support for Hypothesis H2. During the short-term window following the Brexit referendum, small- and mid-cap indices exhibited clear negative abnormal returns, while large-cap stocks showed a mild positive response. Over the long-term window, the effects on small- and mid-cap stocks persisted, with cumulative returns remaining below baseline, whereas large-cap stocks showed greater stability with only limited long-term movement.

The energy crisis generated more moderate short-term reactions. Small- and mid-cap indices recorded slight positive returns, while large-cap stocks showed minimal movement. Over the longer window, small- and mid-cap stocks experienced increased volatility and a gradual decline in cumulative returns. Large-cap stocks, however, remained comparatively stable and finished the period with modest positive gains.

Overall, the findings confirm that market reactions varied by firm size and event type, with smaller firms showing greater sensitivity to both shocks. However, the direction and strength of these responses differed across the events and time horizons, offering only partial support for the hypothesis.

H3: The abnormal returns following the Brexit referendum persist over a longer event window, whereas the effects of the energy price surge are more transient as firms adjust to cost changes more rapidly than to regulatory uncertainty.

The evidence also supports Hypothesis 3, which proposed that the effects of Brexit would persist over a longer period, while the energy crisis would have a more short-lived impact. Long-term event window analysis shows that Brexit led to prolonged underperformance, particularly for smaller firms, whereas the energy crisis, although impactful, allowed for partial recoveries over time, especially among small caps.

H4. In the long run, market adaptation reduces firm size-related differences in stock price reactions, particularly for large-cap firms with greater financial flexibility, whereas small-cap firms remain more vulnerable to persistent uncertainty.

Hypothesis 4 is largely confirmed. Over the long run, large-cap firms demonstrated greater resilience, maintaining relatively stable performance and limited deviation from expected returns. In contrast, small-cap firms exhibited greater exposure to prolonged market pressure, reflecting a higher vulnerability to uncertainty and lower capacity to adapt under sustained disruptions.

4.6.3. Patterns and Differences Between Economic and Non-Economic Shocks

The comparative analysis of the Brexit referendum and the 2022 energy crisis reveals clear distinctions in how economic and non-economic shocks propagate through equity markets. While both events disrupted investor expectations and asset prices, the mechanisms of transmission and timing of impact differed substantially.

Non-economic shocks, such as the Brexit referendum, appear to exert their influence through sudden, binary information updates that leave little room for pre-emptive adjustment. The data indicate that market reactions were immediate and severe, particularly for small- and mid-cap firms. Abnormal returns dropped sharply on the event day and continued to decline over the following sessions. This pattern suggests that political uncertainty, especially when tied to institutional changes, can trigger rapid repricing, driven by concerns over regulatory fragmentation, changes in market access, and prolonged uncertainty around implementation outcomes (Kenourgios et al. 2019; Natchimuthu & Nagarakatte G. 2022). These shocks tend to concentrate volatility at the beginning of the event window (Škrinjaric 2019), followed by extended periods of instability, particularly among firms with less diversification and lower financial flexibility.

By contrast, economic shocks, such as the 2022 energy crisis, demonstrate a more gradual and staggered impact. While markets responded to the initial news, the magnitude and immediacy of short-term price movements were comparatively muted. Rather than a single moment of disruption, the energy crisis unfolded over weeks, with price signals evolving alongside macroeconomic developments (Benkraiem et al. 2018). The long-term data show a slow deterioration in returns for small- and mid-cap firms, with volatility increasing in the second half of the window. This reflects a delayed transmission, where investor sentiment adjusts progressively as the broader economic implications become clearer.

These differences are also reflected in the cumulative return trajectories. In the case of Brexit, returns exhibited an immediate and pronounced downward trajectory, followed by an incomplete recovery. In contrast, during the energy crisis, early return trends were more positive or neutral, followed by gradual erosion and partial rebounds. This sequential contrast underlines how political shocks tend to compress market responses into narrow timeframes, while economic shocks diffuse their effects across longer horizons, consistent with prior research indicating that, in developed markets, economic uncertainty typically leads to more gradual and persistent market adjustments (Pandey & Kumari 2020).

Furthermore, the response of large-cap firms remained relatively stable in both contexts, though slight gains were observed during the energy crisis window. This consistency reinforces the idea that firm characteristics, such as international exposure, operational flexibility, and access to capital, buffer the impact of both types of shocks, albeit through different transmission channels (Salisu et al. 2017; Dinh 2023). Such stability can be attributed to structural advantages commonly associated with large-cap firms, including broader diversification, stronger liquidity positions, and greater access to international markets.

These findings suggest that the nature of the shock, whether political or economic, not only shapes the intensity of market reactions but also affects their timing and duration. Non-economic shocks provoke sharp, front-loaded responses driven primarily by uncertainty and lack of precedent, while economic shocks result in slower, more persistent adjustments tied to macroeconomic fundamentals. These dynamics have important implications for investors seeking to optimize risk management strategies and for policymakers tasked with safeguarding market stability during periods of systemic disruption.

4.6.4. Comparison with Historical Events

The findings of this study are consistent with a broader historical pattern in which firm size plays a critical role in shaping market sensitivity to shocks. By comparing a non-economic event (the Brexit referendum) with an economic shock (the European energy crisis), this study provides an opportunity to contextualize the observed effects alongside major global disruptions, particularly in terms of how firms of different sizes respond under uncertainty.

The Brexit referendum, as a political and institutional shock, shows clear parallels with the COVID-19 pandemic. The COVID-19 induced health crisis and sudden and profound uncertainty, with no clear mechanism for immediate market recalibration. As in the case of Brexit, this uncertainty disproportionately affected smaller firms. Empirical study by Harjoto et al. (2021) found that small-cap stocks experienced significantly more negative abnormal returns following major pandemic-related announcements, especially during the onset of lockdowns. Similarly, Iglesias (2021) highlights that political and health-related uncertainties provoke faster, sharper sell-offs, especially among firms with limited international diversification.

Evidence from country-specific analyses, such as Dinh's (2023) study on the Norwegian stock market, further supports this pattern. Small-cap portfolios were most adversely affected, while large-cap indices remained relatively stable (Pandey & Kumari 2020). This dynamic mirrors the results of this study in the context of Brexit, where prolonged institutional uncertainty and the absence of clear policy direction contributed to deeper and more persistent reactions among small- and mid-cap indices. More broadly, prior research emphasizes that political uncertainty tends to increase overall market volatility and destabilize investor sentiment (Hudson et al. 2020), creating conditions under which smaller firms are particularly vulnerable.

By contrast, the European energy crisis aligns more closely with historical economic shocks such as the 2008 Global Financial Crisis and the Eurozone debt crisis. In these cases, the transmission mechanisms were immediate and economic in nature, typically operating through credit markets, liquidity constraints, and inflationary pressures. Although the disruption was substantial, market participants were often better able to identify the channels of transmission, allowing for more deliberate reallocations of capital toward larger, more resilient firms (Benkraiem et al. 2018). Switzer (2010) documents how, during the 2008 financial crisis, investors sought refuge in large-cap equities, resulting in sharper declines among small-cap stocks.

Findings during the energy crisis exhibit a similar pattern. Although short-term market reactions were not as severe as might have been expected, smaller firms still showed a greater degree of sensitivity compared to larger firms. This resonates with historical behavior during the Eurozone crisis, when regional economic distress was more deeply felt by firms lacking international exposure or financial resilience (Dinh 2023; Harjoto et al. 2021).

These comparisons suggest that the market's reaction to both economic and non-economic shocks is strongly mediated by firm size. The conclusions drawn in this study are thus supported not only by the immediate data, but also by a broader empirical literature that spans multiple decades and types of crises. Whether in response to institutional uncertainty or macroeconomic disruption, smaller firms consistently exhibit higher sensitivity and greater volatility, reinforcing the relevance of size as a core variable in event-driven financial research.

5. Conclusion and recommendations

This final chapter summarizes the key findings of the study, links them to the initial research questions, and reflects on their theoretical and practical implications. It also highlights the study's contributions, discusses its limitations, and outlines recommendations for future research. By bringing together the results and interpretations developed throughout the thesis, this chapter aims to provide a coherent and critical assessment of how firm size and shock typology shape financial market reactions in Europe.

5.1. Conclusion

This thesis set out to investigate how European equity markets, segmented by firm size, responded to two distinct external shocks: the 2016 Brexit referendum and the 2022 European energy price crisis. By examining abnormal returns (ARs) and cumulative abnormal returns (CARs) across both short- and long-term event windows, the study sought to disentangle the differential effects of non-economic and economic disruptions on small-, mid-, and large-cap indices.

The empirical findings suggest that firm size plays a pivotal role in moderating stock market reactions to external shocks. Across both events, small- and mid-cap firms consistently exhibited higher sensitivity in the immediate aftermath of the shocks and experienced greater volatility over the long term. In contrast, large-cap firms demonstrated comparatively muted and stable responses, particularly over extended horizons. This pattern is consistent with the notion that larger firms benefit from broader geographic diversification, superior access to capital markets, and stronger institutional credibility, which collectively serve to cushion the impact of macro-level uncertainty.

Moreover, the results indicate that the nature of the shock, whether non-economic or economic, conditions the temporal dynamics of market adjustment. The Brexit referendum, as a sudden non-economic event with far-reaching institutional implications, generated sharp and immediate market reactions, particularly among smaller firms. In contrast, the energy crisis unfolded more gradually; although it exerted sustained pressure on stock prices, its effects were more staggered and allowed for partial recovery as firms and investors recalibrated expectations over time. These contrasting dynamics may indicate that non-economic shocks tend to produce concentrated short-term disruptions due to heightened regulatory ambiguity, whereas economic shocks, though equally significant, often translate into longer-term structural adjustments.

These findings highlight the importance of considering firm size when analyzing stock market reactions to systemic events. The differences between small-, mid-, and large-cap firms were not only consistent across both shocks but also varied significantly in terms of timing, volatility, and recovery dynamics. This suggests that analyses based solely on broad market indices risk overlooking important heterogeneity across different segments of the market.

By comparing two distinct types of shocks, one non-economic and one economic, this study provides new insights into how financial markets process uncertainty. Although the empirical focus was limited to Brexit and the energy crisis, the methodological approach developed here could be applied to future research investigating other shocks. The findings offer practical implications for investors seeking to better manage risk exposure across firm sizes and for policymakers aiming to strengthen market resilience in the face of systemic disruptions.

It should also be noted that several statistical tests, particularly non-parametric and cross-sectional methods, did not consistently confirm significance across all time windows and indices. This suggests that some of the observed patterns, while directionally clear, should be interpreted with caution.

The key research findings are listed below:

- Small- and mid-cap firms consistently exhibited higher short- and long-term volatility, whereas large-cap firms demonstrated greater stability, particularly over extended horizons.
- Non-economic shocks, such as Brexit, produced more immediate and intense market reactions, while economic shocks, such as the energy crisis, generated more gradual and persistent adjustments.
- The differential reactions across firm sizes were consistent for both types of shocks, underscoring the importance of firm-specific characteristics in determining resilience.
- Non-economic shocks, such as Brexit, were associated with sharp early declines and prolonged underperformance among smaller firms, while economic shocks, such as the energy crisis, caused a delayed but more gradual downturn, followed by earlier signs of partial recovery, indicating a potentially greater adaptive capacity when the disruption is economic rather than non-economic.

Table 5 provides a consolidated summary of the findings regarding firm size, shock typology, and market behavior across both short- and long-term horizons. The table captures differences in volatility, timing of impact, and recovery dynamics, underscoring the central role of firm-specific characteristics in moderating stock market responses to systemic shocks.

Table 5. *Conclusion summary*

Firm Size	Shock Type	Short-Term Impact
Small-cap	Non-economic (Brexit)	Sharp, immediate decline; highest volatility observed.
	Economic (Energy Crisis)	Gradual, delayed decline; moderate initial volatility.
Mid-cap	Non-economic (Brexit)	Strong immediate decline; elevated volatility.
	Economic (Energy Crisis)	Gradual, delayed decline; moderate initial volatility.
Large-cap	Non-economic (Brexit)	Limited immediate impact; volatility contained.
	Economic (Energy Crisis)	Minimal reaction; in some cases, slight positive drift.
		Long-Term Impact
Small-cap	Non-economic (Brexit)	Sustained underperformance; slow recovery trajectory.
	Economic (Energy Crisis)	Partial recovery over time; earlier stabilization compared to Brexit.
Mid-cap	Non-economic (Brexit)	Sustained underperformance; slow recovery trajectory.
	Economic (Energy Crisis)	Partial recovery over time; earlier stabilization compared to Brexit.
Large-cap	Non-economic (Brexit)	Stable long-term performance; minimal deviation.
	Economic (Energy Crisis)	Early recovery and sustained stability.
		Key Observations
Small-cap	Non-economic (Brexit)	Highly vulnerable to sudden institutional uncertainty; weak adaptive capacity.
	Economic (Energy Crisis)	Better adaptive response under economic shocks relative to non-economic shocks.
Mid-cap	Non-economic (Brexit)	Sensitive to non-economic shocks; intermediate resilience.
	Economic (Energy Crisis)	Better adaptive response under economic shocks relative to non-economic shocks.
Large-cap	Non-economic (Brexit)	Strong shock absorption capacity; benefits from diversification and scale.
	Economic (Energy Crisis)	Highest resilience across shocks; strong financial and geographic buffers.

5.2. Research contribution and limitations

This study contributes to the growing body of research examining market responses to different types of shocks by demonstrating that stock markets react differently depending on the nature of the event, economic or non-economic, and that firm size significantly moderates this reaction. As previously discussed, we confirm that small-cap firms are consistently more vulnerable than large-cap firms, irrespective of the event type. This sensitivity is evident in both economic and non-economic scenarios, suggesting that smaller firms, likely due to lower liquidity and reduced access to capital, are more exposed to uncertainty and volatility.

Furthermore, our findings show that non-economic events tend to provoke more immediate and pronounced short-term effects on the market, especially for small- and mid-cap stocks, which are inherently more volatile. In contrast, economic shocks generally elicit a more delayed response, reflecting the time it takes for market participants to fully assess macroeconomic implications. Interestingly, our findings also show that non-economic shocks tend to recover more quickly, while economic shocks often lead to a prolonged recovery period, reflecting deeper structural and policy-related implications. However, it should be noted that not all observed reactions were statistically confirmed across the tests employed. In particular, non-parametric and cross-sectional methods yielded several non-significant results, especially in the case of the energy crisis. This suggests that some patterns, although directionally apparent, lacked strong statistical support and should be interpreted with caution.

Further, the study is not without limitations, and these must be taken into account when interpreting the results. First and foremost, we apply the event study methodology, which inherently relies on the assumption of semi-strong form market efficiency, that all publicly available information is rapidly and accurately reflected in stock prices. While this assumption is generally acceptable under stable conditions, its validity becomes questionable during turbulent periods characterized by uncertainty and information asymmetry. In such cases, investor behavior may be driven more by emotion, speculation, or panic than by rational processing of information, potentially distorting the measured abnormal returns.

Secondly, our reliance on index-level data, while appropriate for a macro-level perspective, introduces several constraints. Aggregated index data masks sector-specific characteristics and variations in firm fundamentals, which could play a significant role in how different industries respond to shocks. Moreover, the indices used in the study may differ in terms of methodology (e.g., net vs. gross return calculation), base currency, and constituent weighting. These technical inconsistencies can introduce noise into the results and affect the result of the robustness check.

Another important limitation lies in the selection and number of events studied. While we focused on two high-impact events, one economic and one non-economic, this narrow scope may not capture the full diversity of possible market reactions. For instance, a broader sample including additional shocks (e.g., interest rate hikes, natural disasters, cyberattacks) would enhance the robustness and generalizability of the findings. The selection of the event day is also critical, particularly for the 2022 energy shock. Identifying the precise moment when the market began to internalize the shock is inherently subjective, and any misalignment could affect the estimation of abnormal returns and the shape of the event window.

Additionally, it is important to highlight that even having selected the event days with this in mind and with the goal to avoid event interferences, some could have been present.

Lastly, the geographical scope of the study is restricted to European markets. While this focus provides consistency and relevance within a specific regional context, it limits the applicability of our findings to other regions such as North America, or emerging markets, where market dynamics, regulatory environments, and investor behavior may differ substantially.

5.3. Quality of research

The quality of this research is grounded in the use of an established and widely accepted methodological framework, the event study approach, to analyze stock market reactions to external shocks. This method was chosen for its suitability in capturing short-term market responses, and it was applied consistently throughout the study using clearly defined estimation and event windows. Although the method relies on assumptions about market efficiency, it remains one of the most robust tools for empirical analysis in financial research.

Efforts were made to ensure the reliability and consistency of data. Financial market data was sourced from reputable platforms, and care was taken to align data selection with the research objectives, especially in distinguishing between economic and non-economic events. The segmentation by firm size added depth to the analysis, allowing for more nuanced insights than a purely index-level study might provide. The events selected, while limited in number, were relevant, recent, and representative of broader categories of shocks that continue to affect global markets. Nonetheless, due to the use of aggregated index-level data and a relatively small sample of observations per index, some of the statistical tests lacked the power to detect significance across all methods. This was especially evident in non-parametric testing and during the long-term analysis, where results were often inconclusive.

Throughout the research process, attention was paid to maintaining transparency and consistency. All methodological decisions, such as the definition of event windows or the choice of abnormal return calculation, were clearly documented, allowing for replicability. Literature was carefully reviewed and used to contextualize the findings within existing academic work, which strengthens the theoretical grounding of the study.

5.4. Recommendations for future research

While this study provides valuable insights into the differential effects of economic and non-economic shocks on stock market performance across firm sizes, there are several avenues for future research that could build upon and deepen these findings.

Future studies should consider expanding the geographical scope beyond European indices. While focusing on Europe ensures consistency in market structure and policy response, limiting the analysis to one region restricts the global applicability of the conclusions. Including data from North American, Asian, and emerging markets could uncover important regional differences in market behavior, investor sentiment, and policy response to shocks. These comparisons could highlight how institutional settings, market maturity, and macroeconomic frameworks influence resilience to external disruptions.

In addition to the geographical diversification, research would benefit from shifting from index-level data to more granular firm-level or sector-level data. Index-level analysis provides a high-level overview but obscures variations among industries and individual firms. Sector-specific responses may differ significantly depending on their exposure to the nature of the event, e.g., energy companies versus technology firms in the case of economic policy shocks. Firm-level analysis could also allow researchers to account for company fundamentals, such as leverage, liquidity, or international exposure, that may affect their sensitivity to shocks.

The inclusion of a larger and more diverse set of events, both economic and non-economic, would also enhance the robustness and generalizability of future studies. Examining multiple cases of geopolitical crises, natural disasters, monetary policy changes, pandemics, or financial market disruptions could reveal patterns or divergences in market reactions. This broader dataset would also allow for a more rigorous statistical comparison across event types, time periods, and market conditions.

Finally, it is crucial to examine how government and central bank interventions moderate the impact of shocks on financial markets. Economic downturns and shocks are often followed by fiscal stimulus measures, regulatory changes, or monetary policy actions such as interest rate cuts or quantitative easing. These policy responses play a critical role in shaping investor expectations and influencing the speed and nature of market recovery. Future research could integrate the timing and scale of such interventions to assess whether they help to dampen volatility, accelerate recovery, or generate unintended consequences.

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Appendix A Event Study Results: Brexit Referendum (Short-Term Event Window)

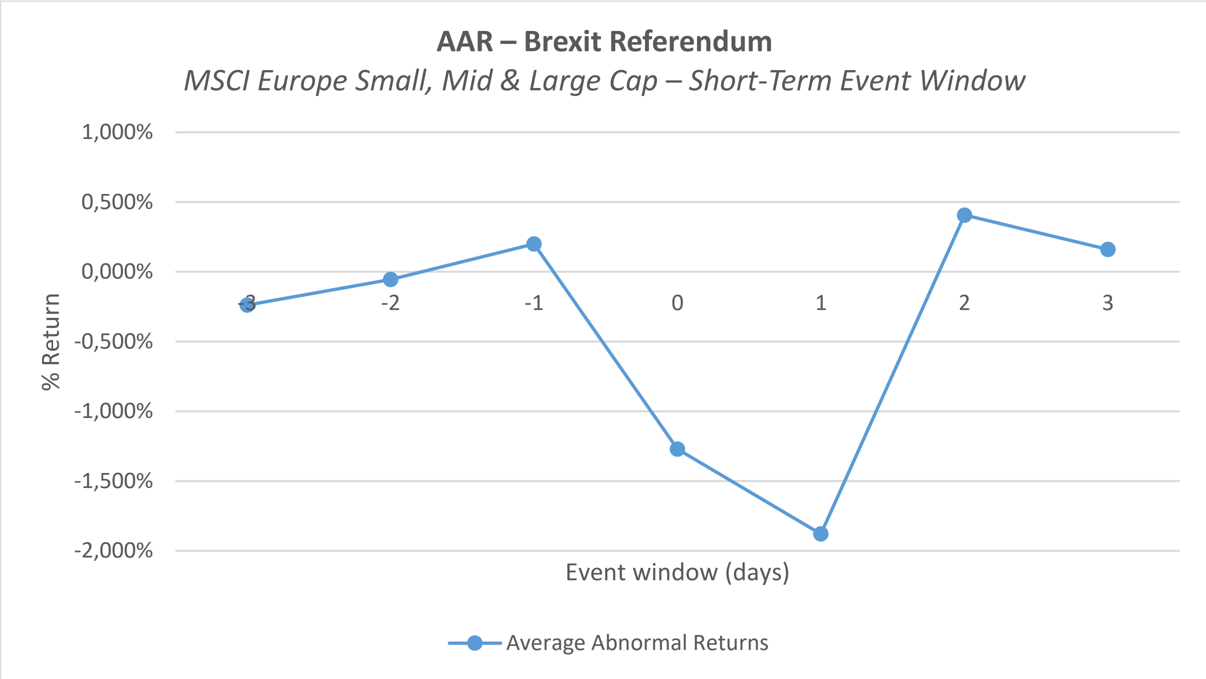

Figure 14*. Average abnormal returns across MSCI Europe Small, Mid, and Large Cap indices.*

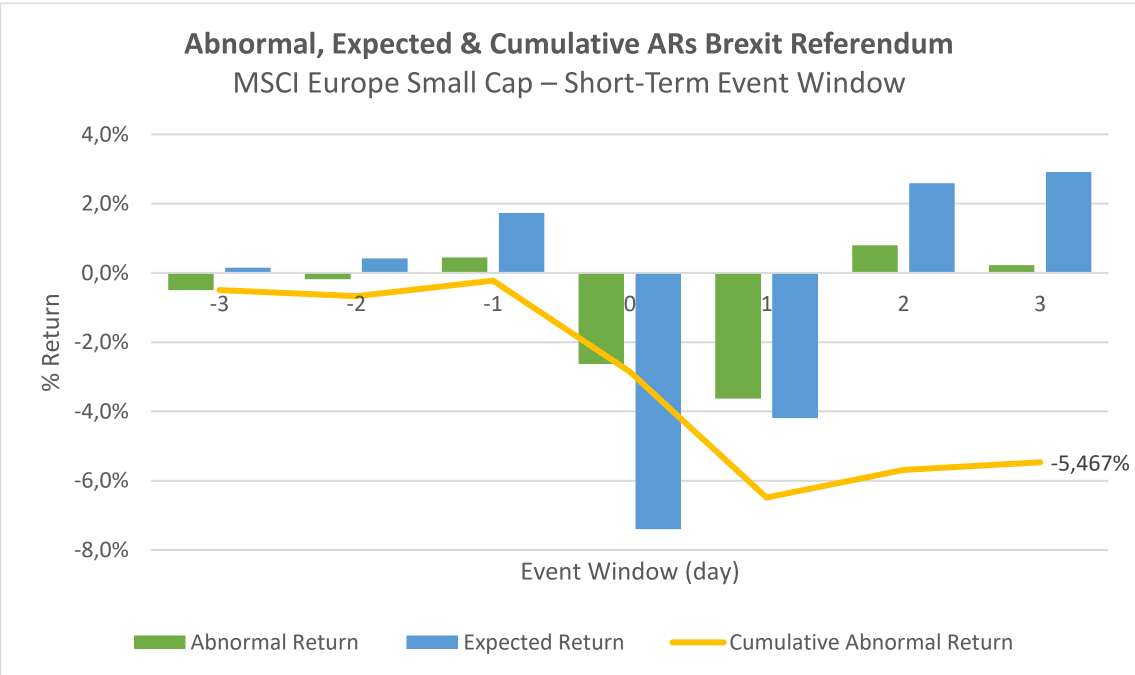

Figure 15*. Abnormal, expected, and cumulative abnormal returns for MSCI Europe Small Cap during the short-term event window surrounding the Brexit referendum.*

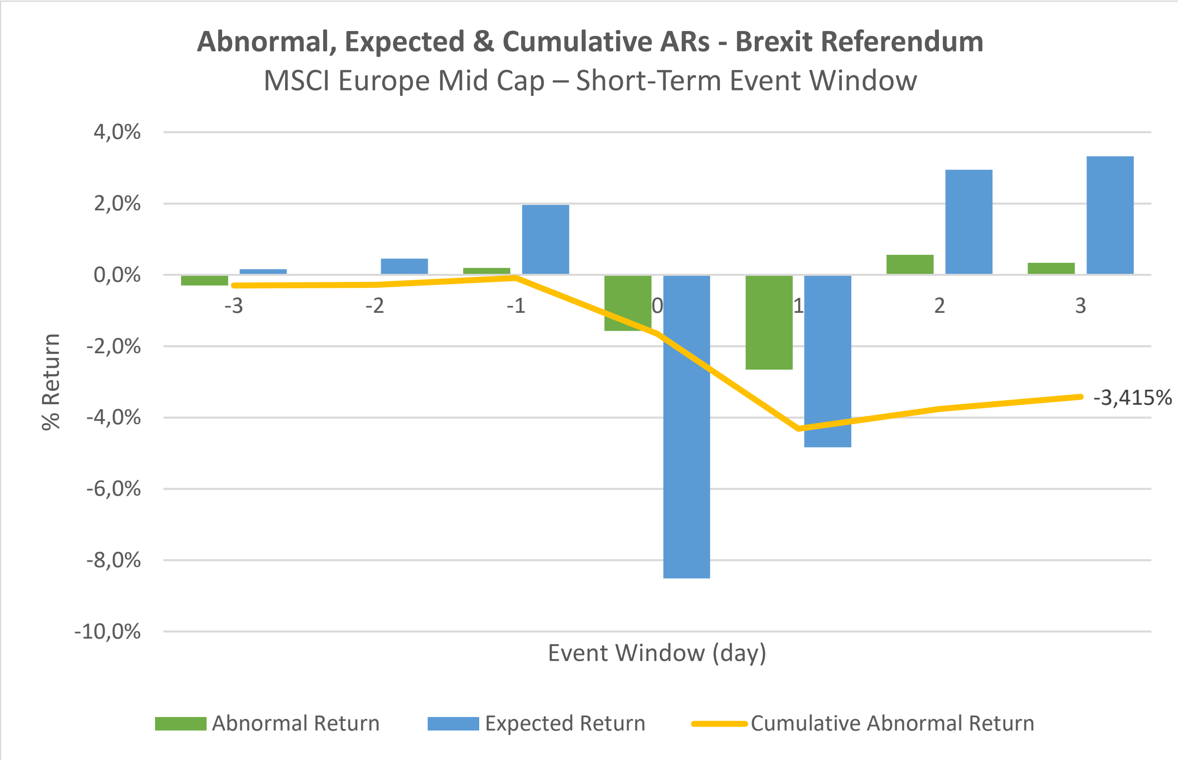

***Figure 16**. Abnormal, expected, and cumulative abnormal returns for MSCI Europe Mid Cap during the short-term event window surrounding the Brexit referendum.*

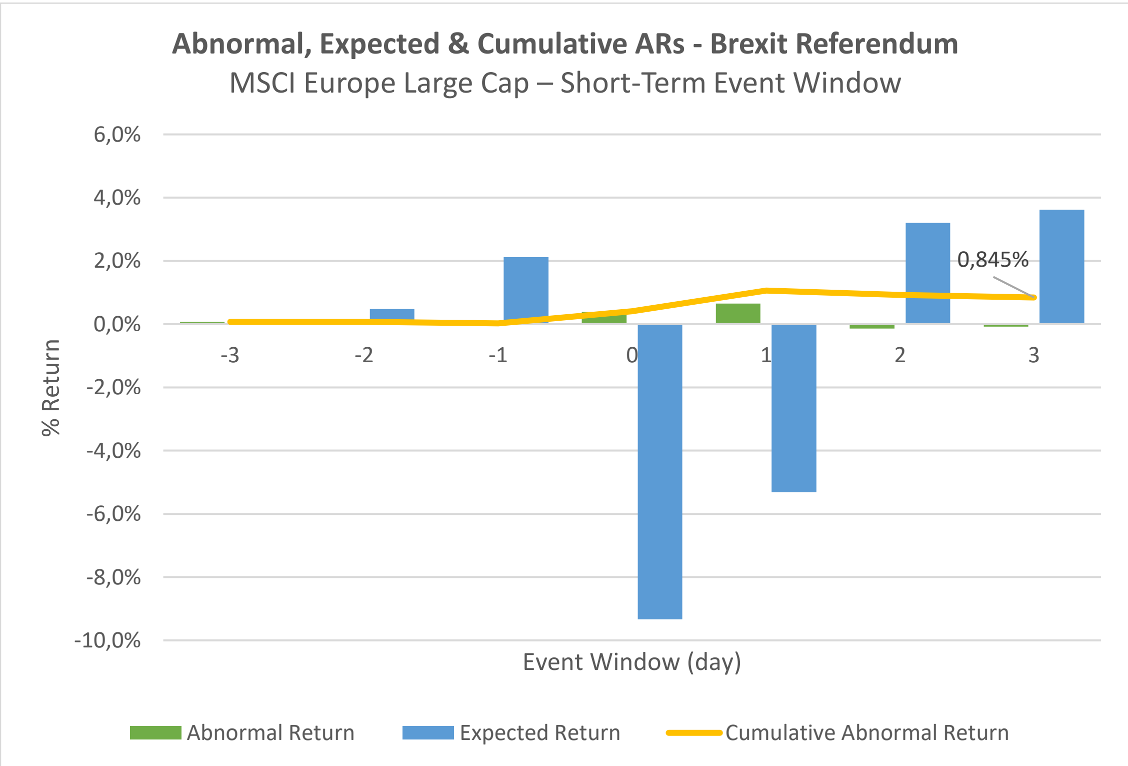

***Figure 17**. Abnormal, expected, and cumulative abnormal returns for MSCI Europe Large Cap during the short-term event window surrounding the Brexit referendum.*

Appendix B Robustness test: Brexit Referendum (Short-Term Event Window)

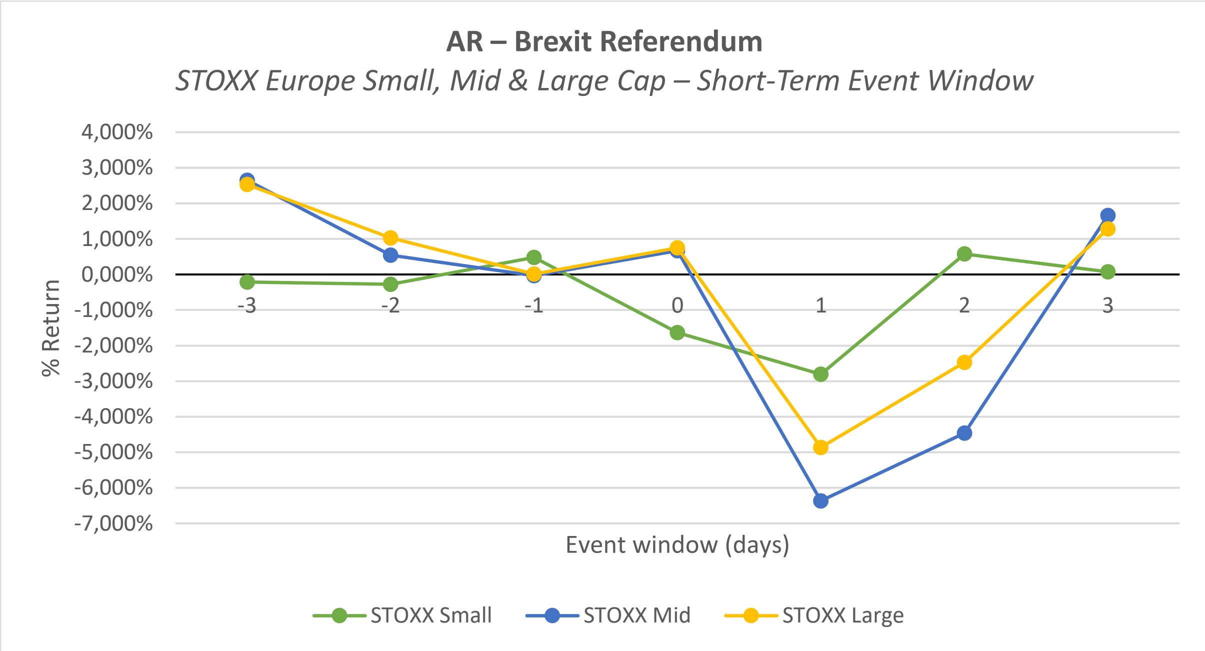

Figure 18. *Abnormal returns (AR) for STOXX Europe Small, Mid, and Large Cap indices during the short-term event window surrounding the Brexit referendum.*

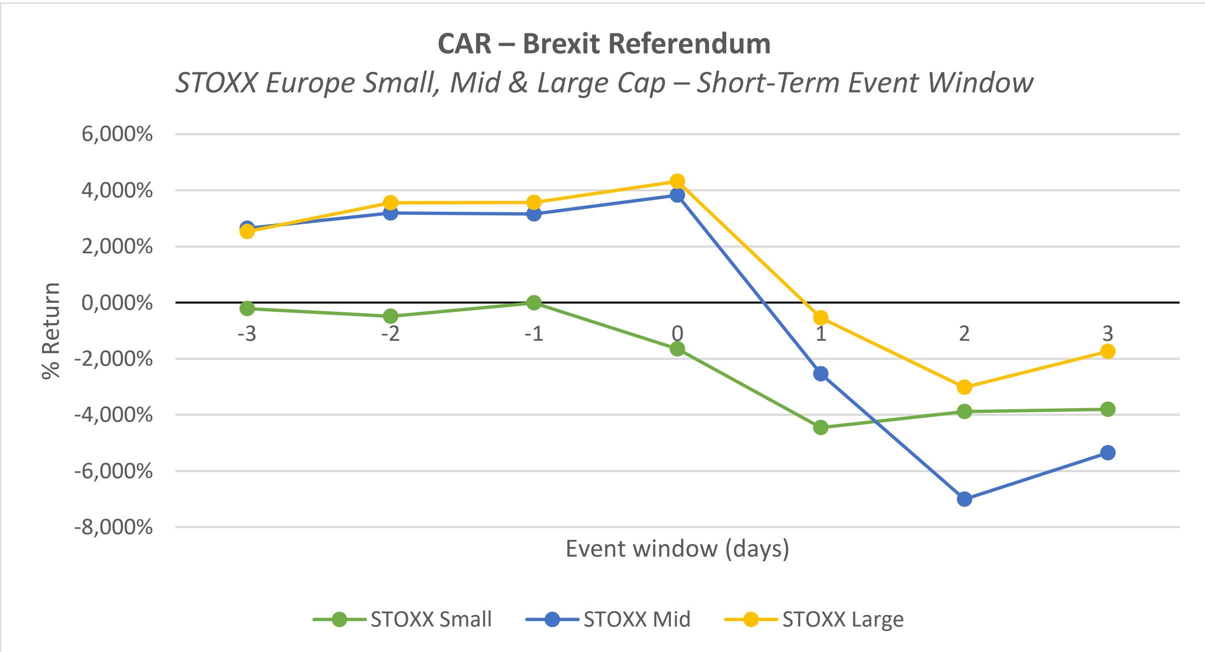

Figure 19. *Cumulative abnormal returns (CAR) for STOXX Europe Small, Mid, and Large Cap indices following the Brexit referendum.*

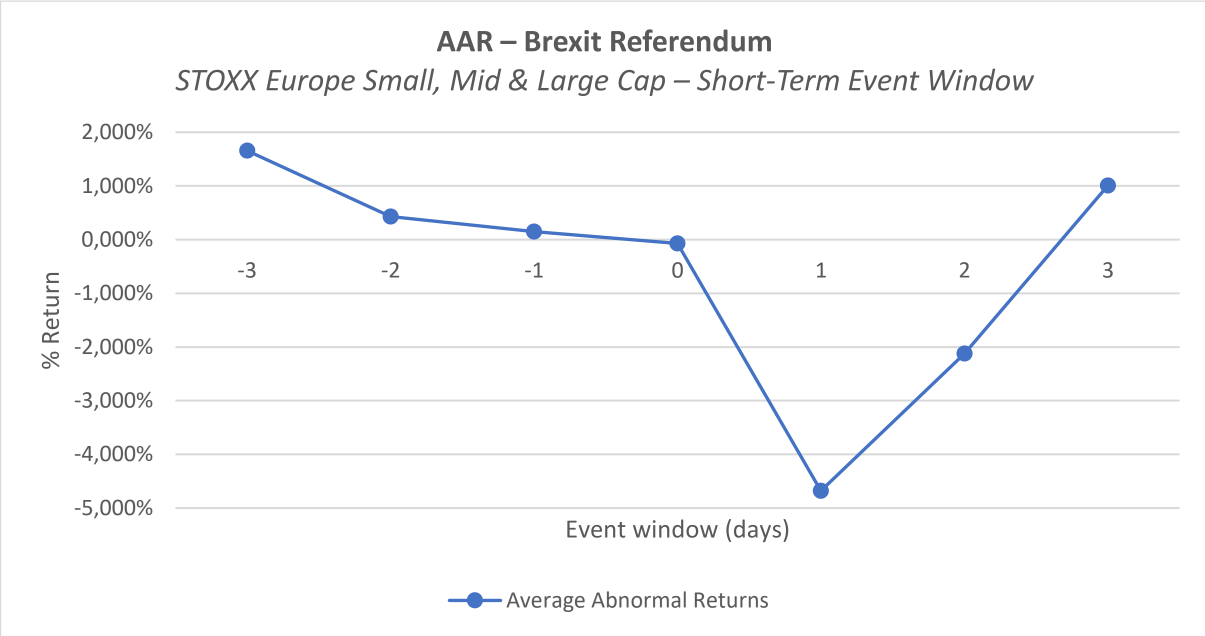

***Figure 20**. Average abnormal returns (AAR) across STOXX Europe Small, Mid, and Large Cap indices.*

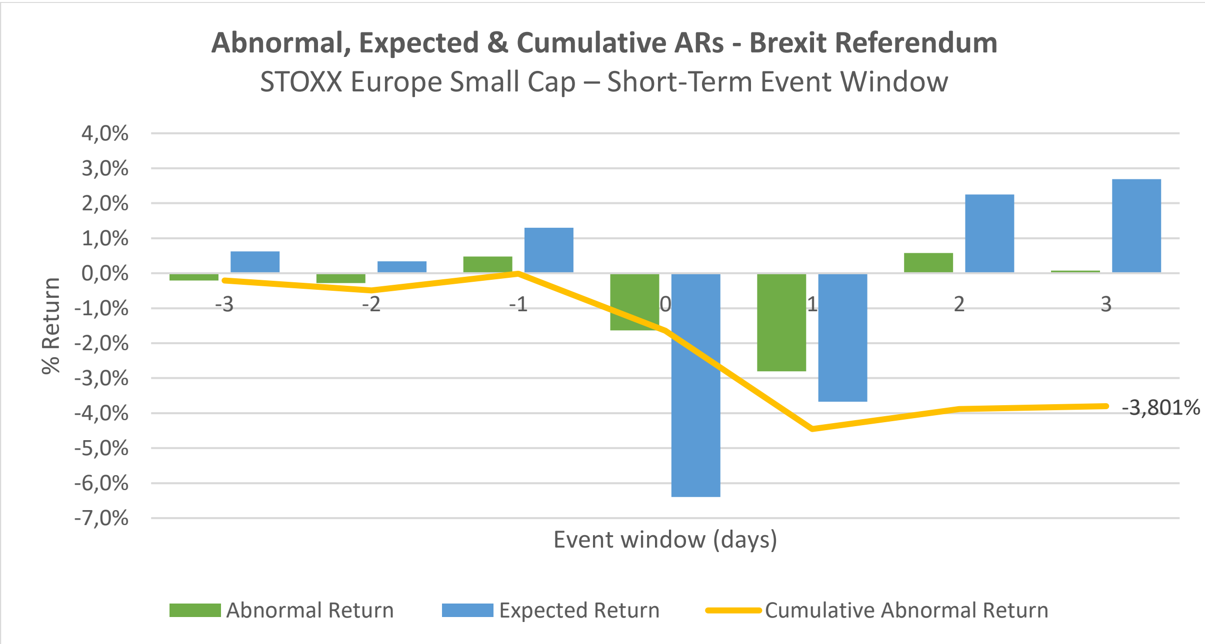

***Figure 21**. Abnormal, expected, and cumulative abnormal returns for STOXX Europe Small Cap during the short-term event window surrounding the Brexit referendum.*

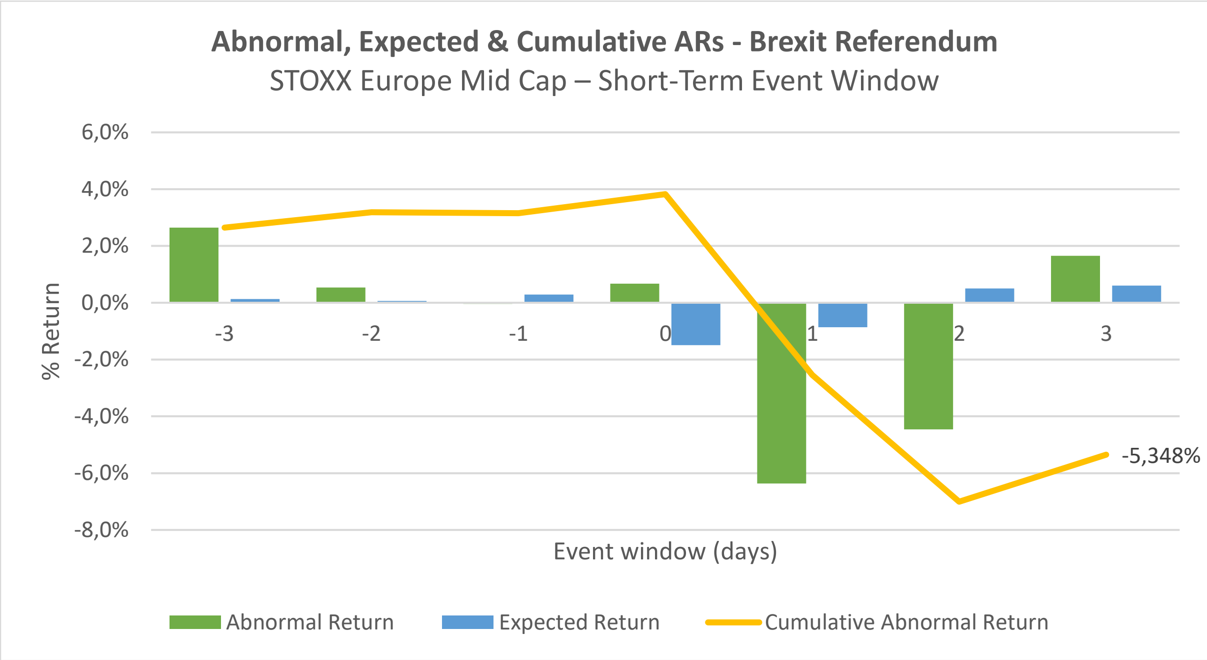

Figure 22. *Abnormal, expected, and cumulative abnormal returns for STOXX Europe Mid Cap during the short-term event window surrounding the Brexit referendum.*

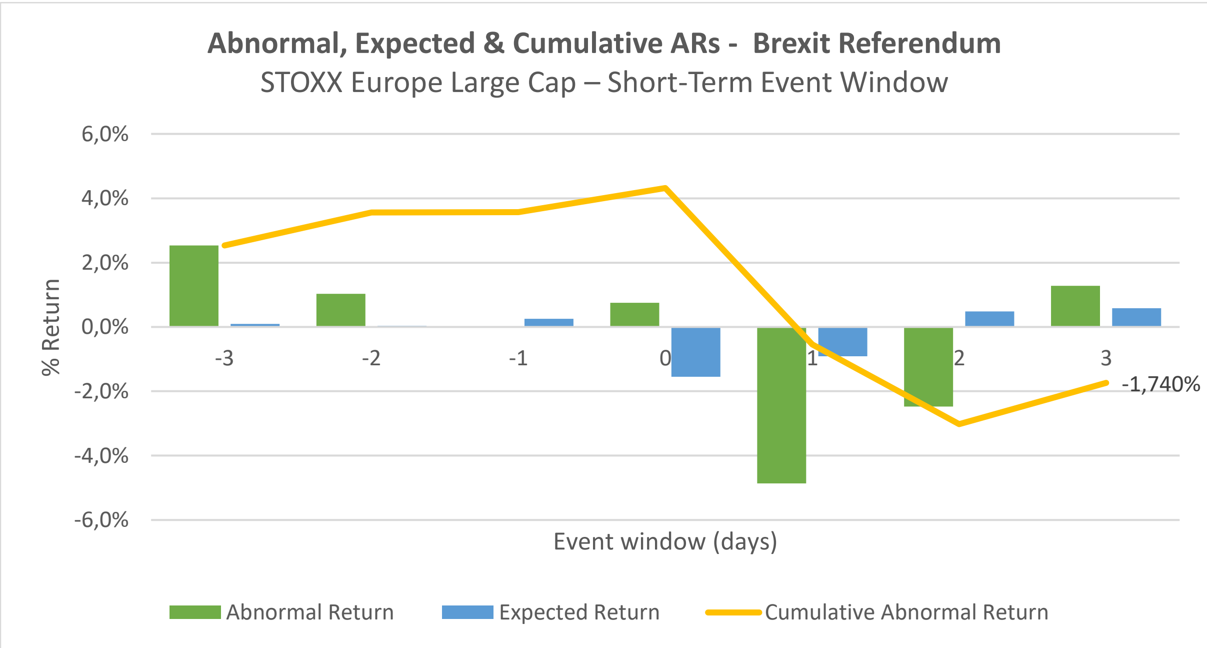

Figure 23. *Abnormal, expected, and cumulative abnormal returns for STOXX Europe Large Cap during the short-term event window surrounding the Brexit referendum.*

Appendix C Event Study Results: Brexit Referendum (Long-Term Event Window)

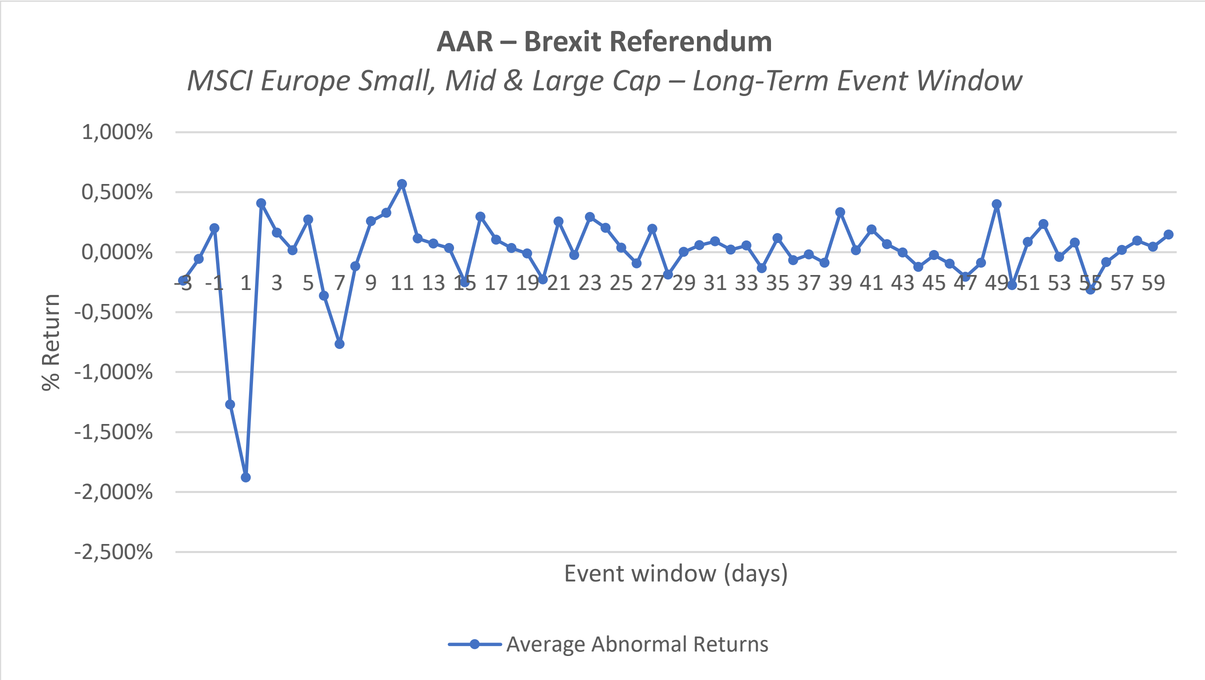

***Figure 24**. Average abnormal returns across MSCI Europe Small, Mid, and Large Cap indices.*

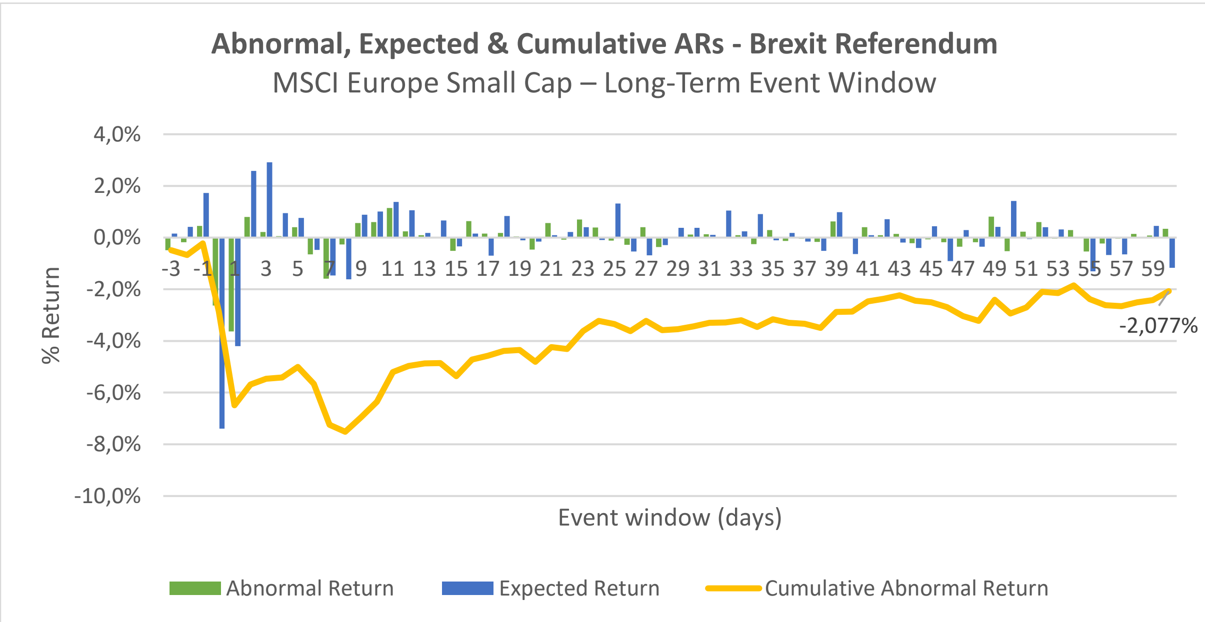

***Figure 25**. Abnormal, expected, and cumulative abnormal returns for MSCI Europe Small Cap during the long-term event window surrounding the Brexit referendum.*

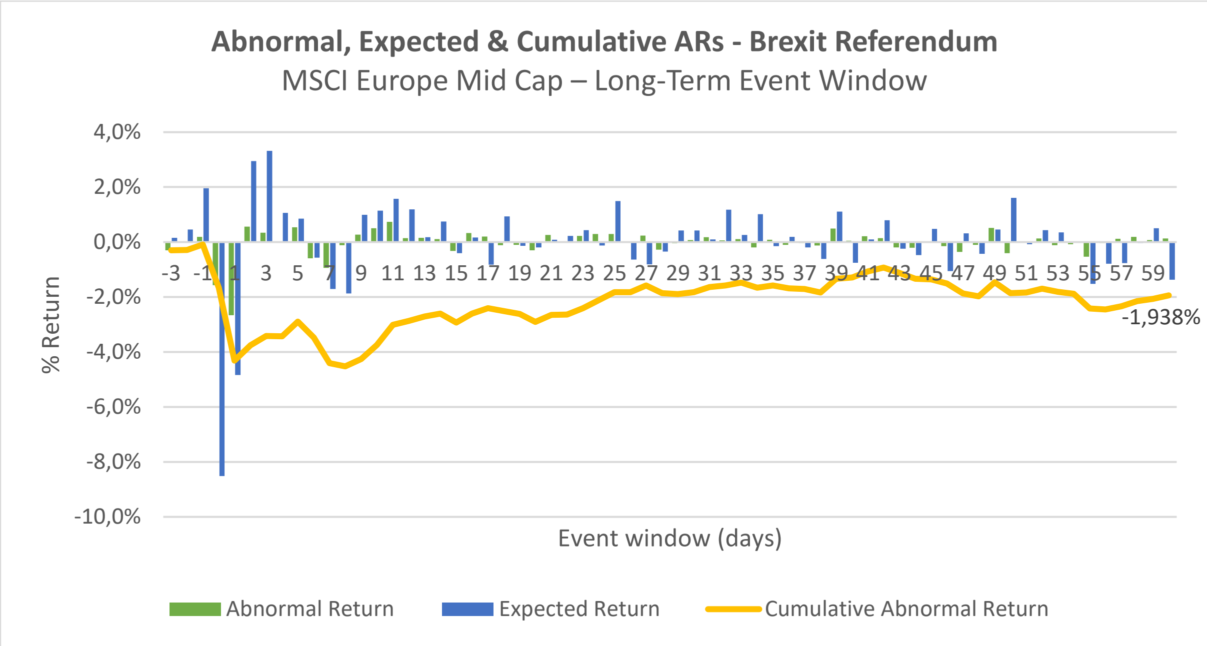

Figure 26. *Abnormal, expected, and cumulative abnormal returns for MSCI Europe Small Cap during the long-term event window surrounding the Brexit referendum.*

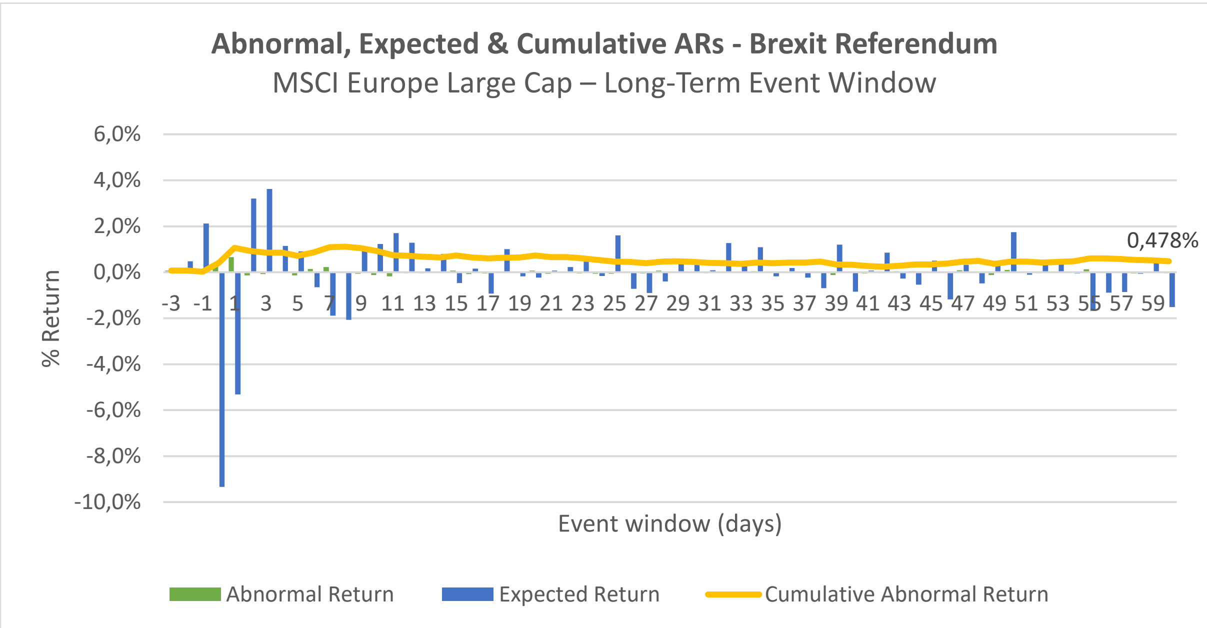

Figure 27. *Abnormal, expected, and cumulative abnormal returns for MSCI Europe Small Cap during the long-term event window surrounding the Brexit referendum..*

Appendix D Robustness test: Brexit Referendum (Long-Term Event Window)

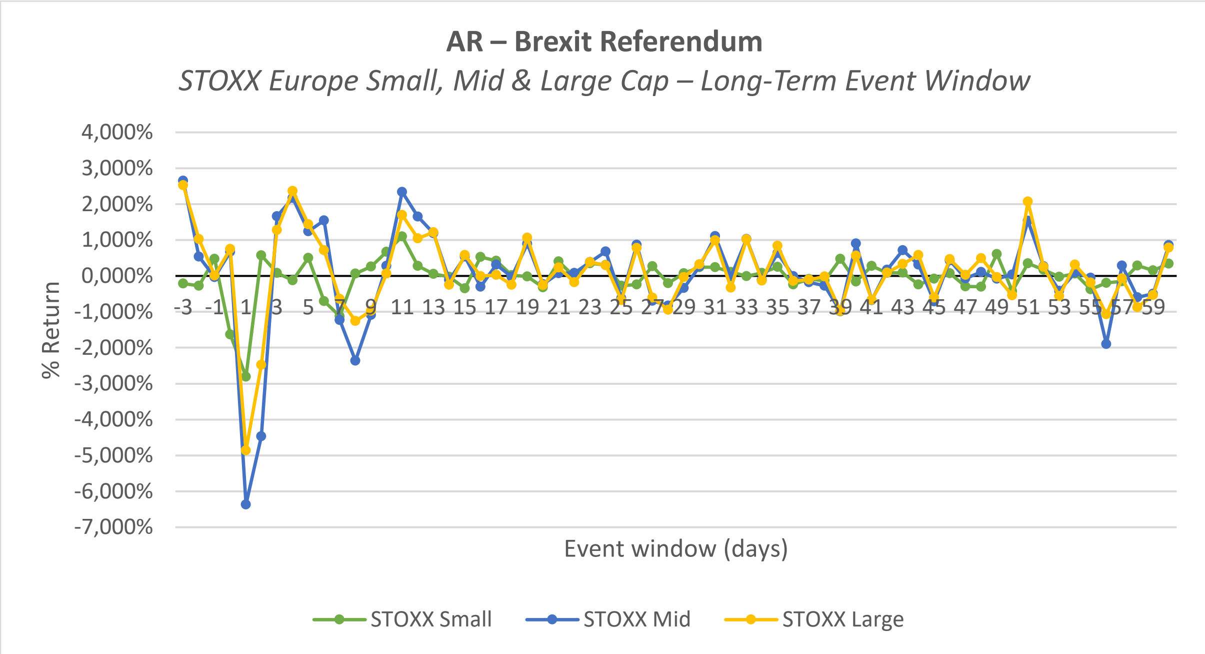

Figure 28. *Abnormal returns (AR) for STOXX Europe Small, Mid, and Large Cap indices during the Long-term event window surrounding the Brexit referendum.*

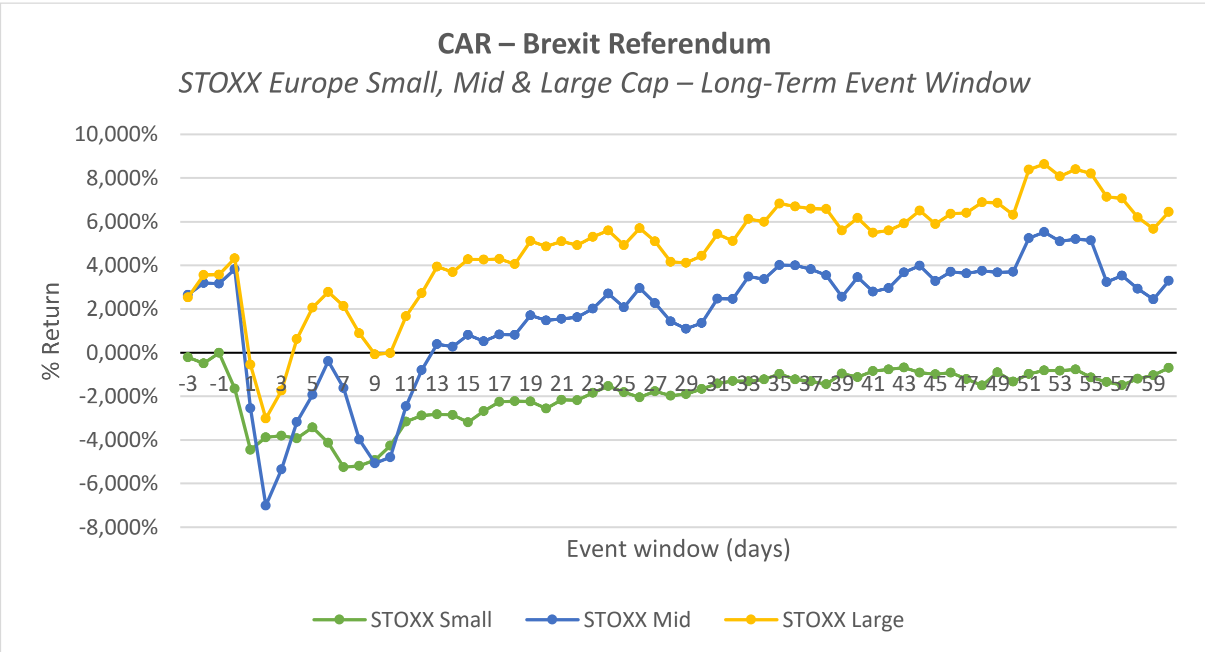

Figure 29. *Cumulative abnormal returns (CAR) for STOXX Europe Small, Mid, and Large Cap indices following the Brexit referendum.*

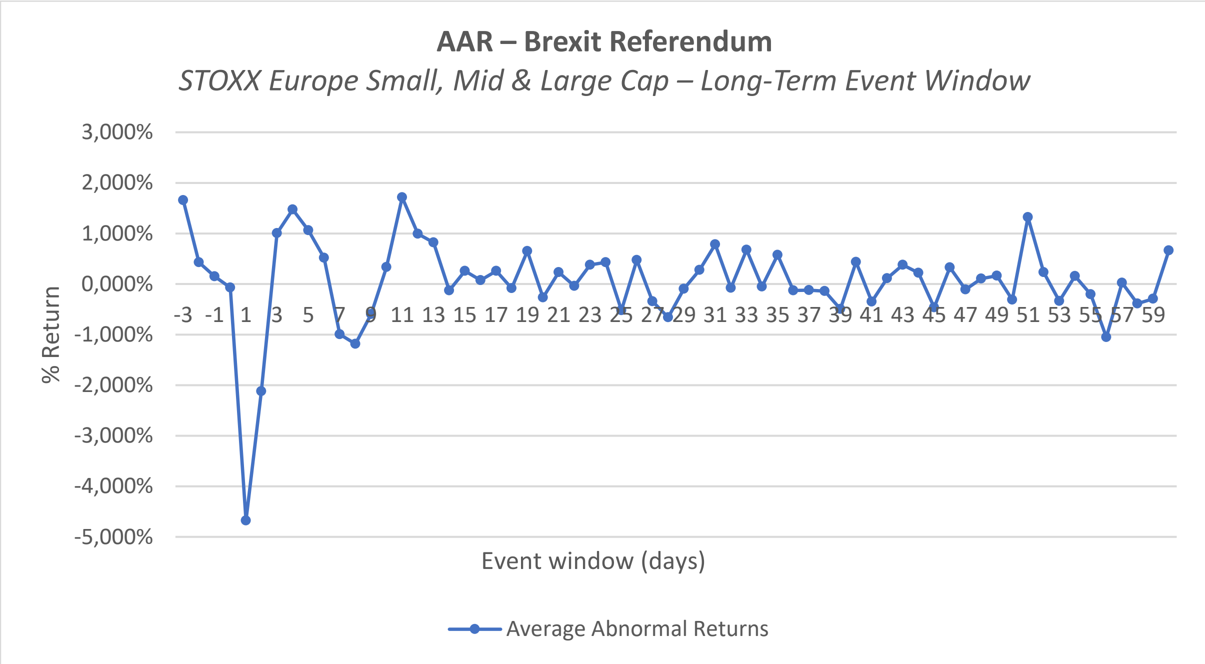

***Figure 30**. Average abnormal returns (AAR) across STOXX Europe Small, Mid, and Large Cap indices .*

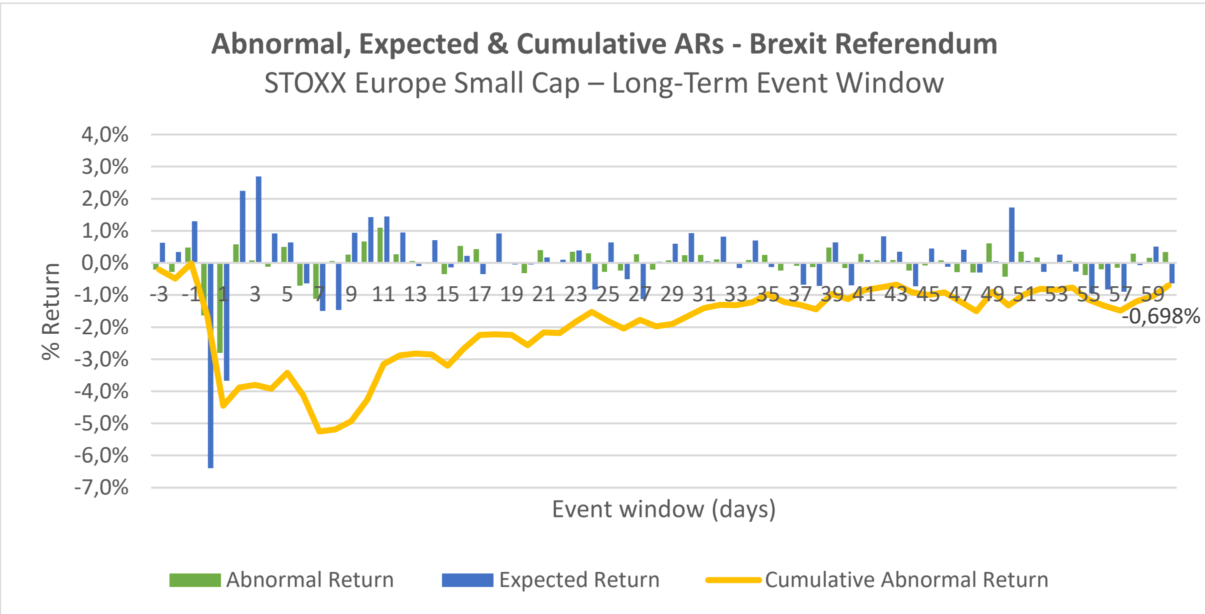

***Figure 31**. Abnormal, expected, and cumulative abnormal returns for STOXX Europe Small Cap during the long-term event window following the Brexit referendum.*

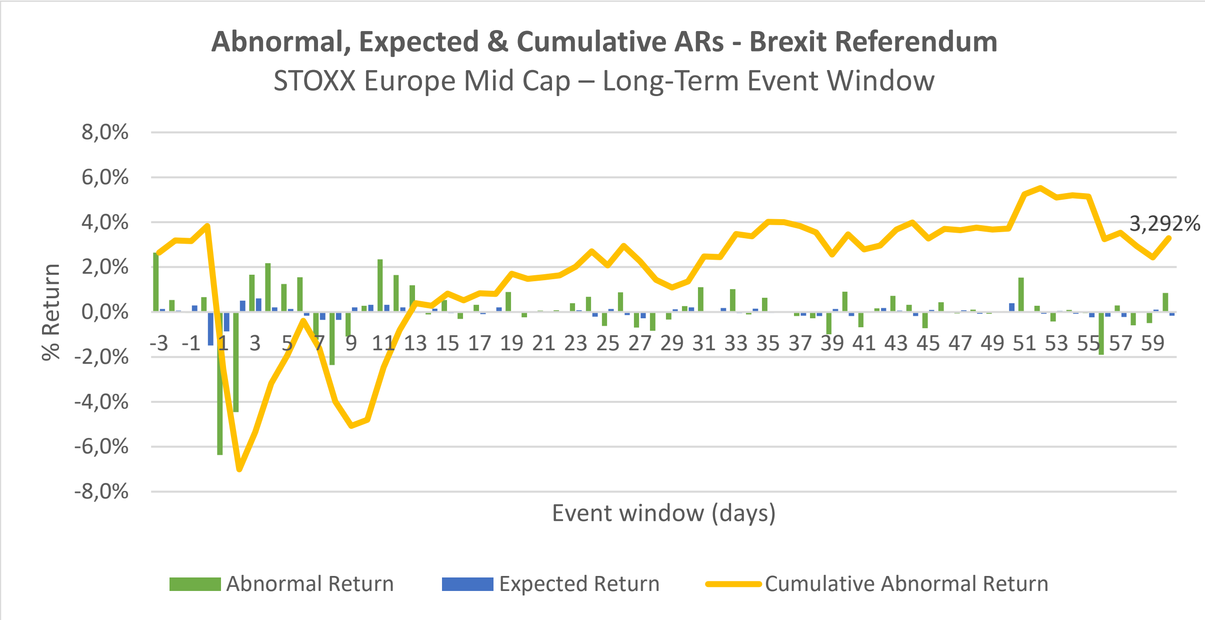

Figure 32. *Abnormal, expected, and cumulative abnormal returns for STOXX Europe Mid Cap during the long-term event window following the Brexit referendum.*

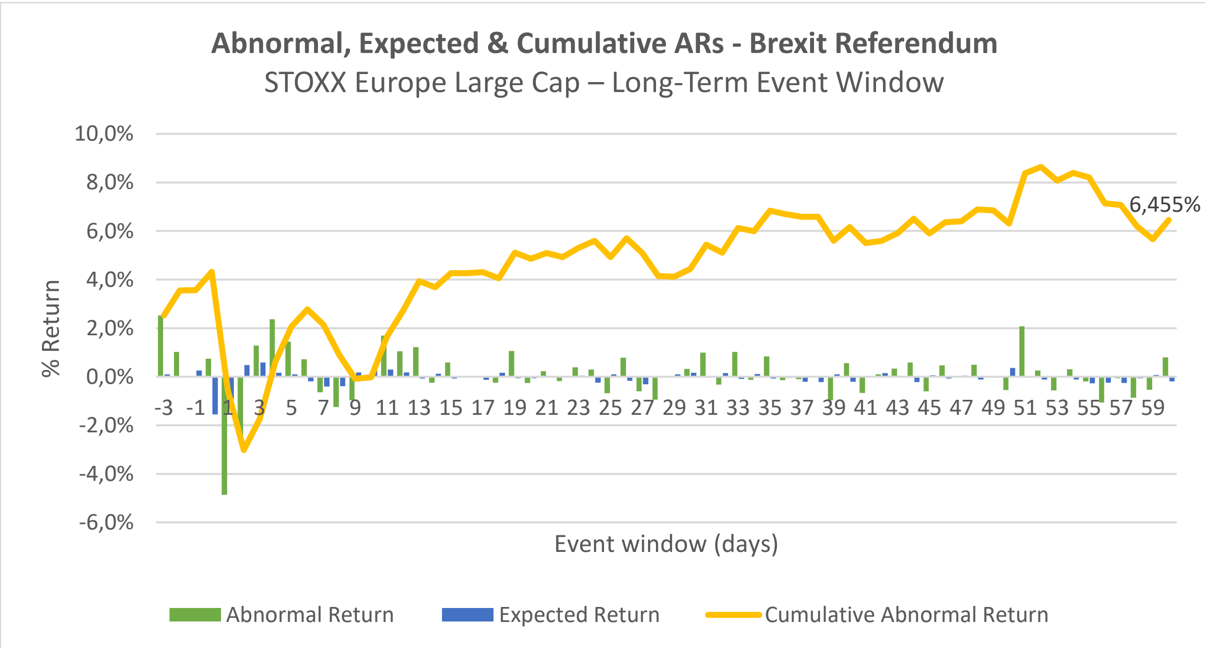

Figure 33. *Abnormal, expected, and cumulative abnormal returns for STOXX Europe Large Cap during the long-term event window following the Brexit referendum.*

Appendix E Event Study Results: 2022 Energy Crisis (Short-Term Event Window)

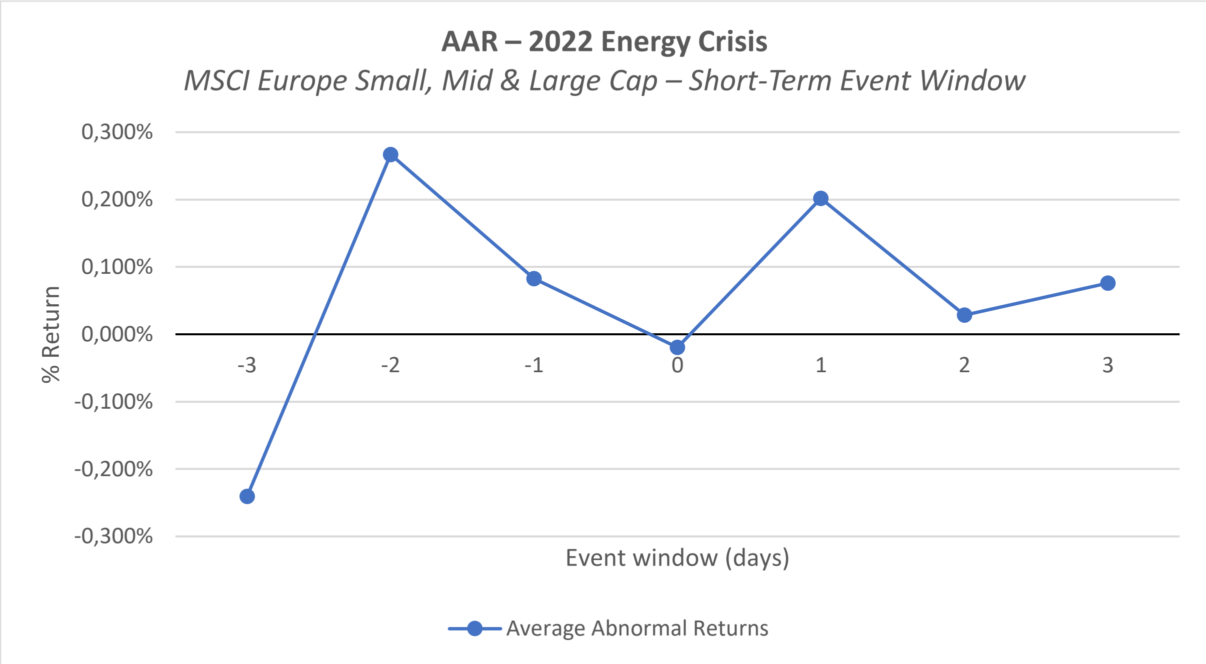

Figure 34*. Average abnormal returns across MSCI Europe Small, Mid, and Large Cap indices.*

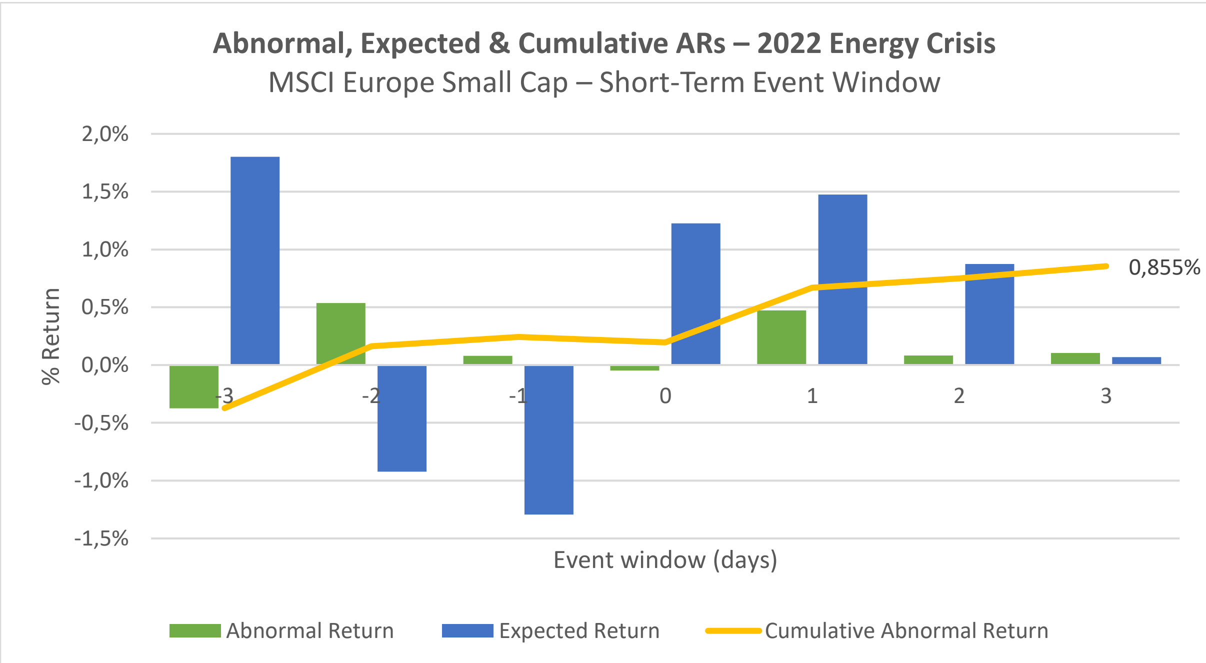

Figure 35*. Abnormal, expected, and cumulative abnormal returns for MSCI Europe Small Cap during the short-term event window surrounding the 2022 Energy crisis.*

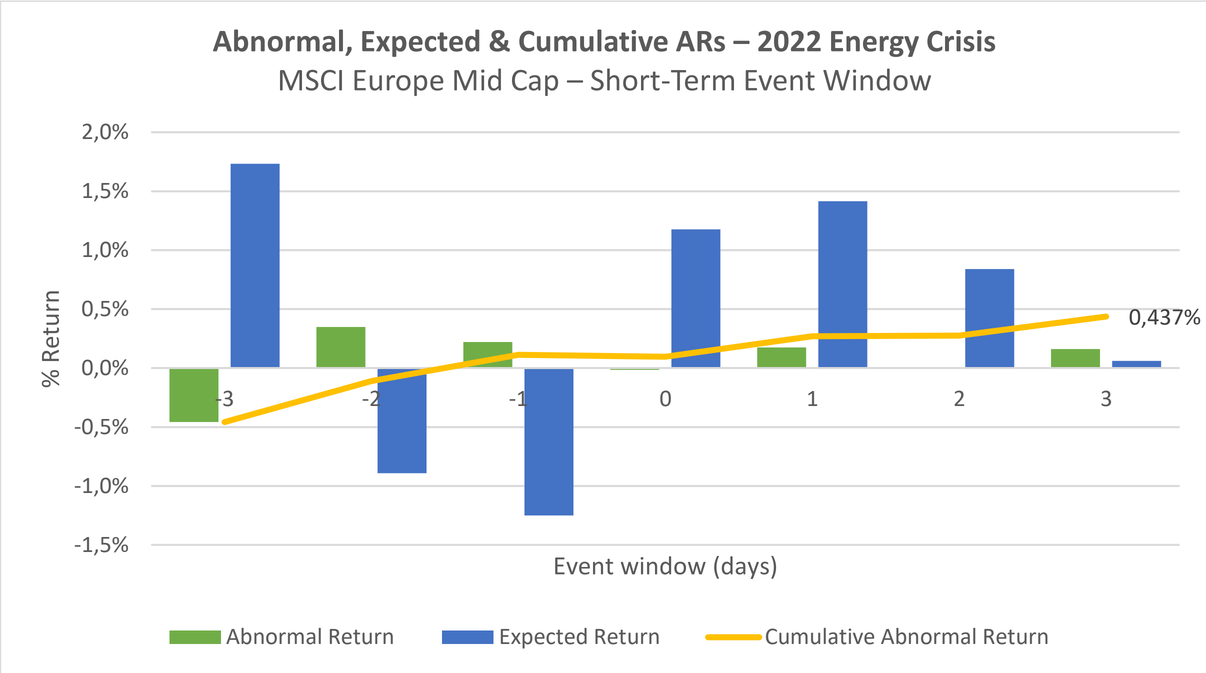

Figure 36. *Abnormal, expected, and cumulative abnormal returns for MSCI Europe Mid Cap during the short-term event window surrounding the 2022 Energy crisis.*

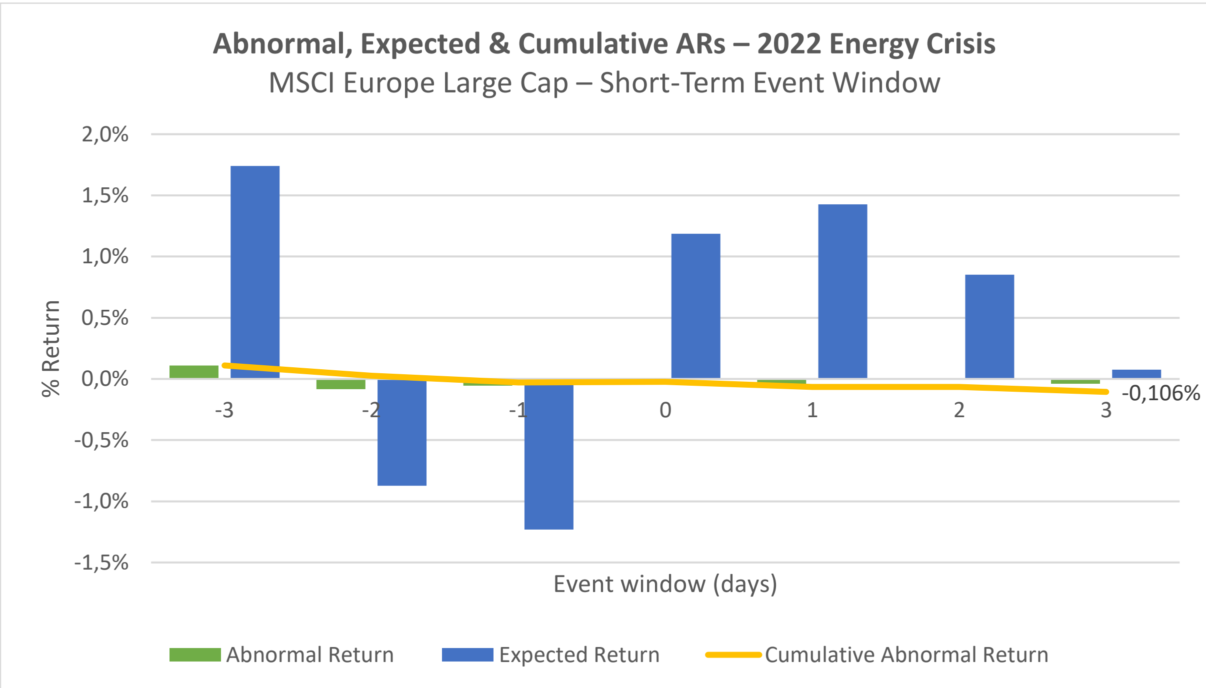

Figure 37. *Abnormal, expected, and cumulative abnormal returns for MSCI Europe Large Cap during the short-term event window surrounding the 2022 Energy crisis.*

Appendix F Robustness test: 2022 Energy Crisis (Short-Term Event Window)

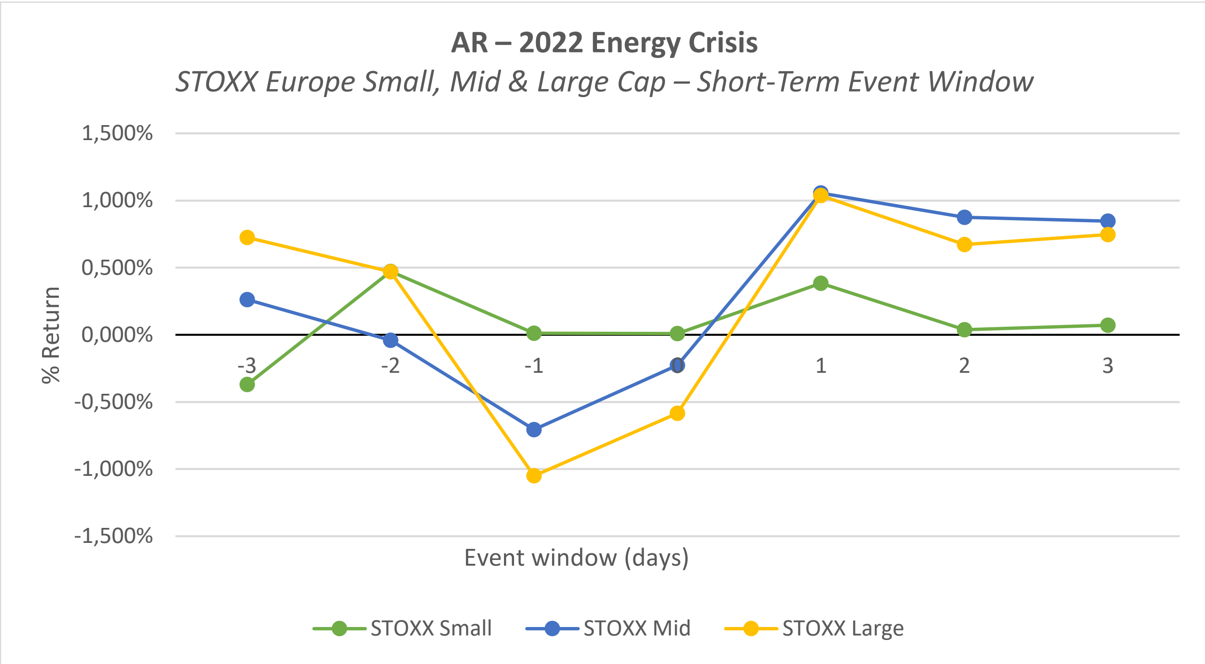

Figure 38. *Abnormal returns (AR) for STOXX Europe Small, Mid, and Large Cap indices during the short-term event window surrounding the 2022 Energy crisis.*

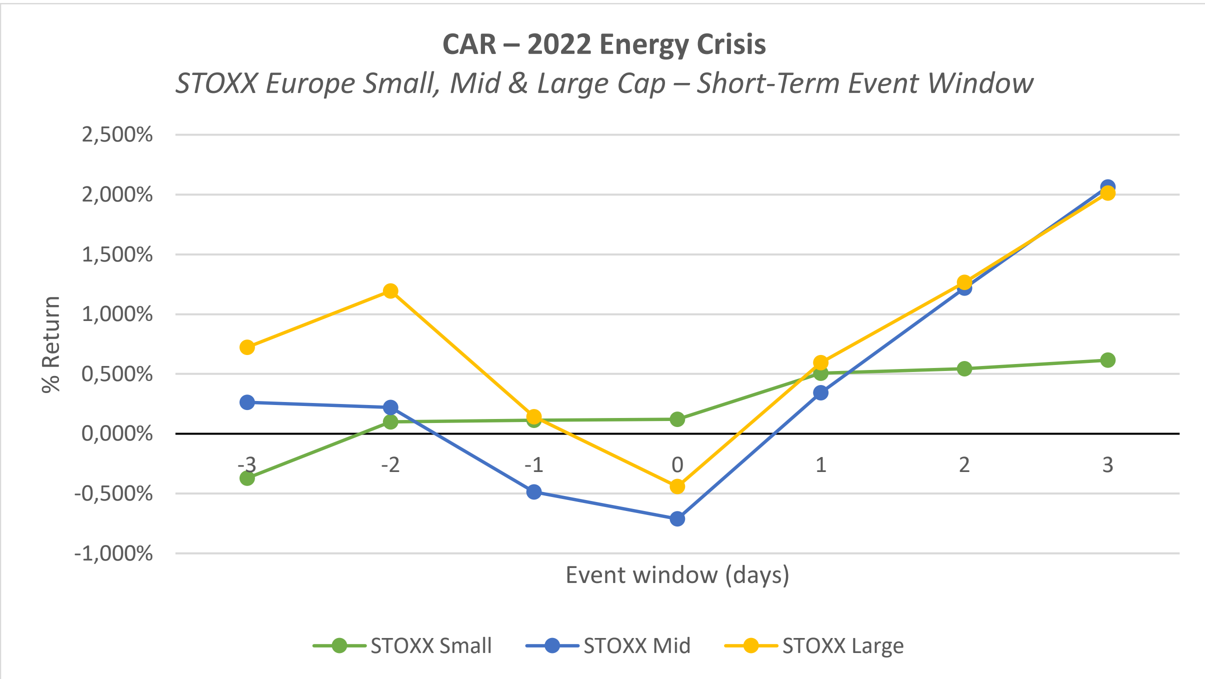

Figure 39. *Cumulative abnormal returns (CAR) for STOXX Europe Small, Mid, and Large Cap indices following the 2022 Energy crisis.*

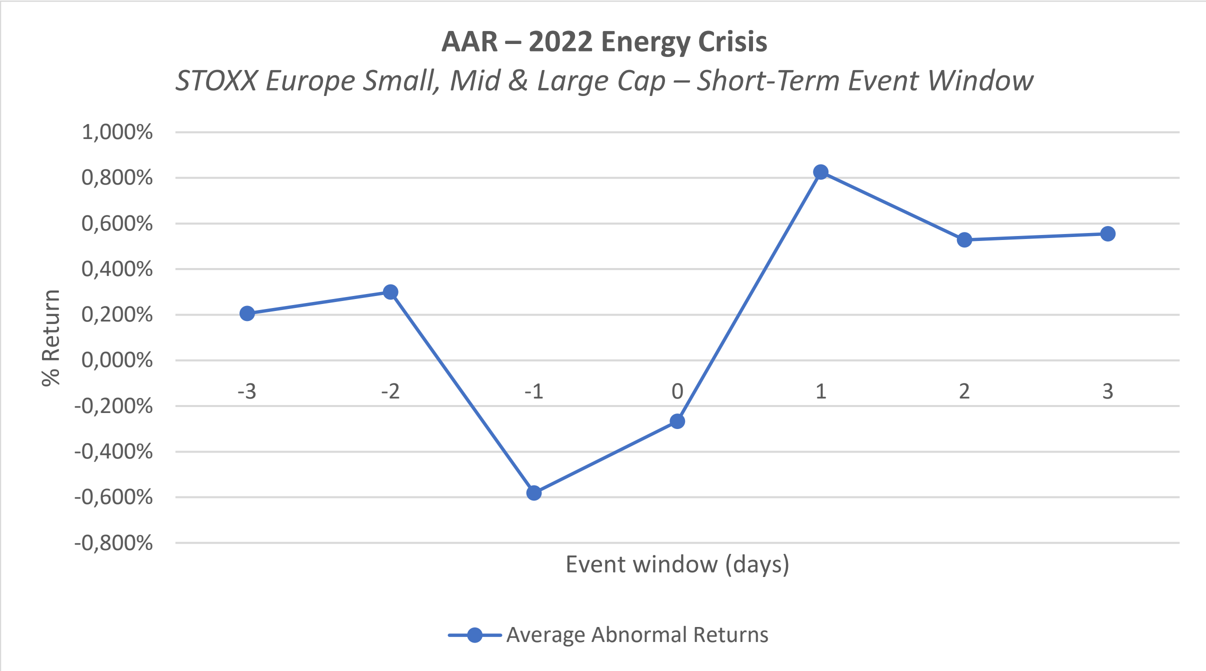

***Figure 40**. Average abnormal returns (AAR) across STOXX Europe Small, Mid, and Large Cap indices.*

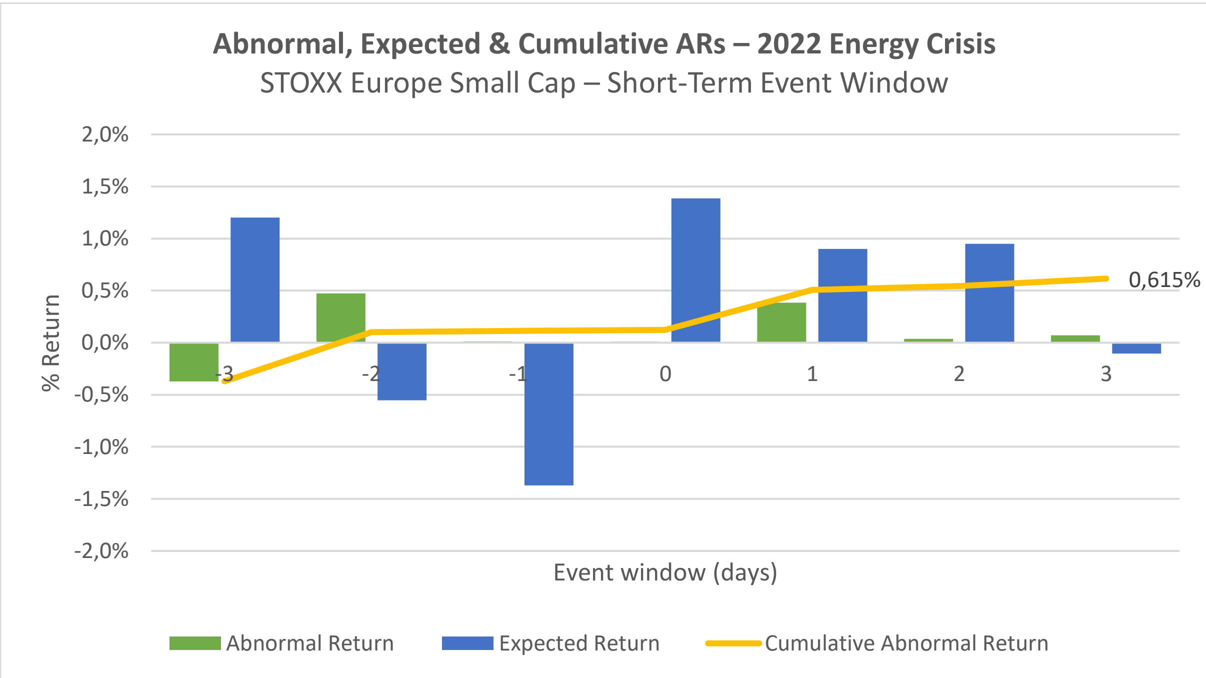

***Figure 41**. Abnormal, expected, and cumulative abnormal returns for STOXX Europe Small Cap during the short-term event window surrounding the 2022 Energy crisis.*

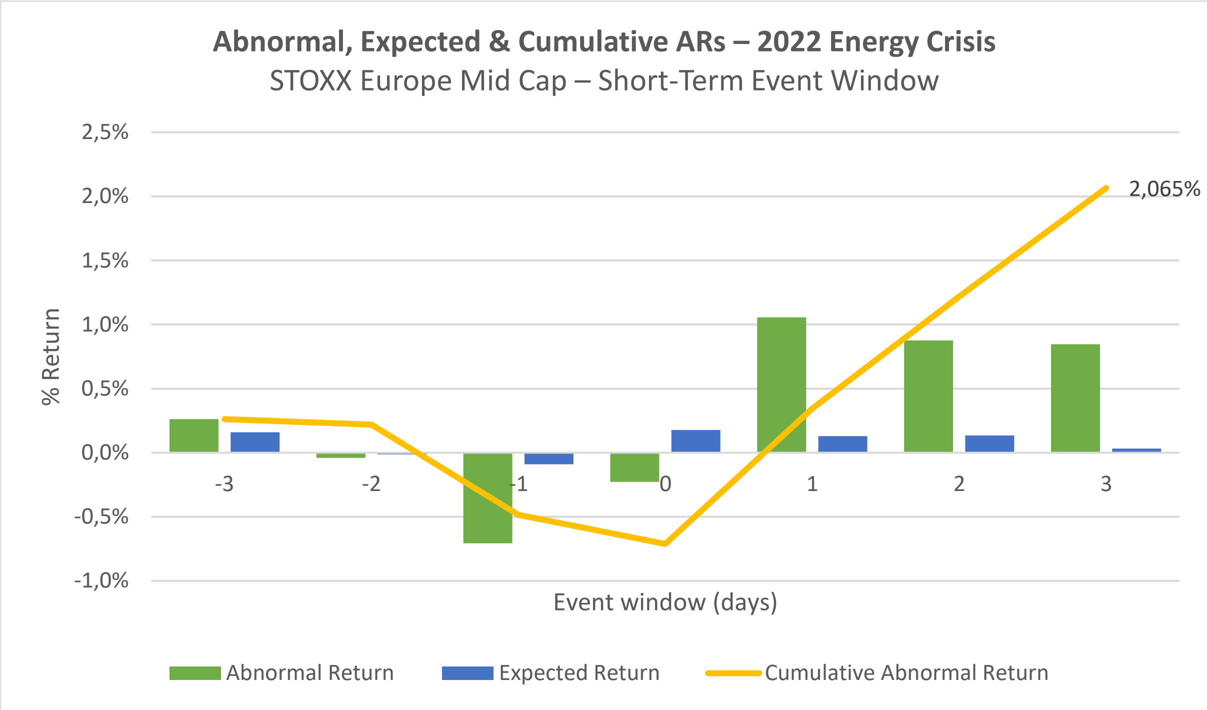

Figure 42. *Abnormal, expected, and cumulative abnormal returns for STOXX Europe Mid Cap during the short-term event window surrounding the 2022 Energy crisis.*

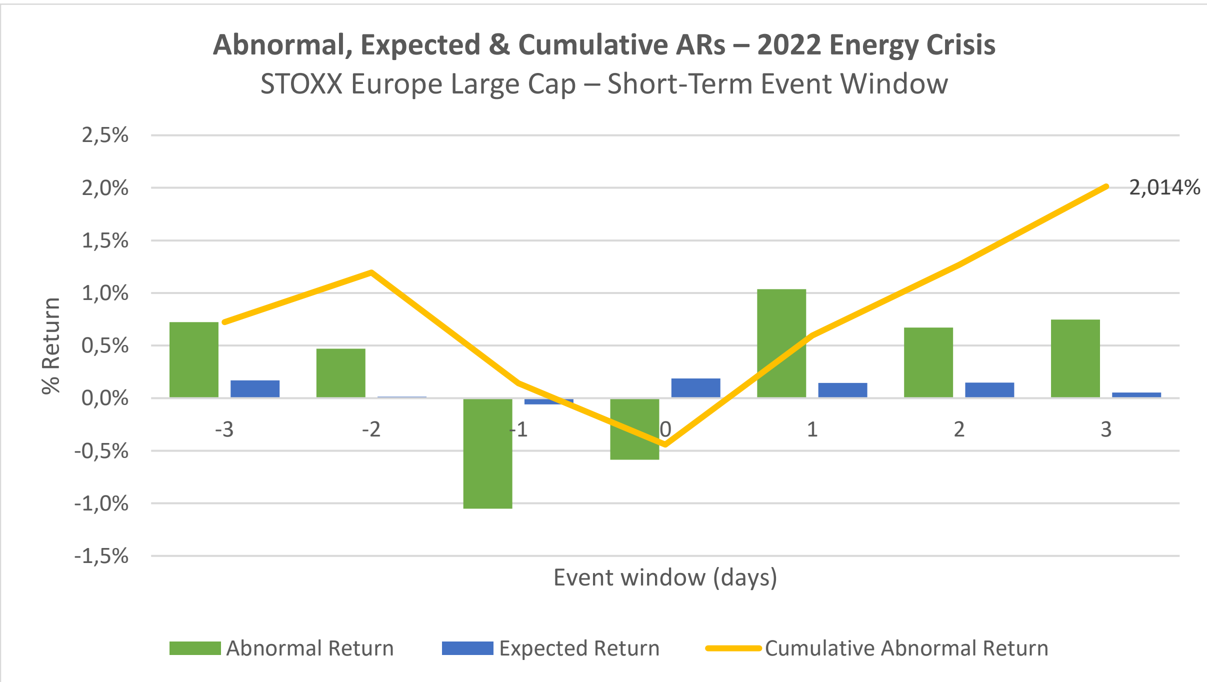

Figure 43. *Abnormal, expected, and cumulative abnormal returns for STOXX Europe Large Cap during the short-term event window surrounding the 2022 Energy crisis.*

Appendix G Event Study Results: 2022 Energy Crisis (Long-Term Event Window)

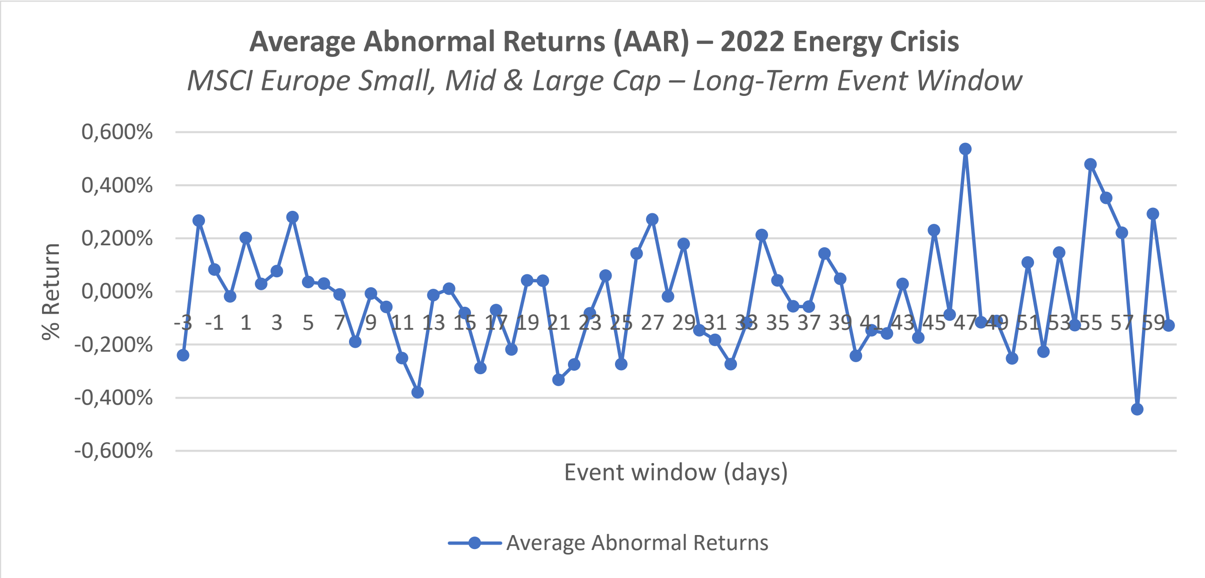

Figure 44*. Average abnormal returns across MSCI Europe Small, Mid, and Large Cap indices.*

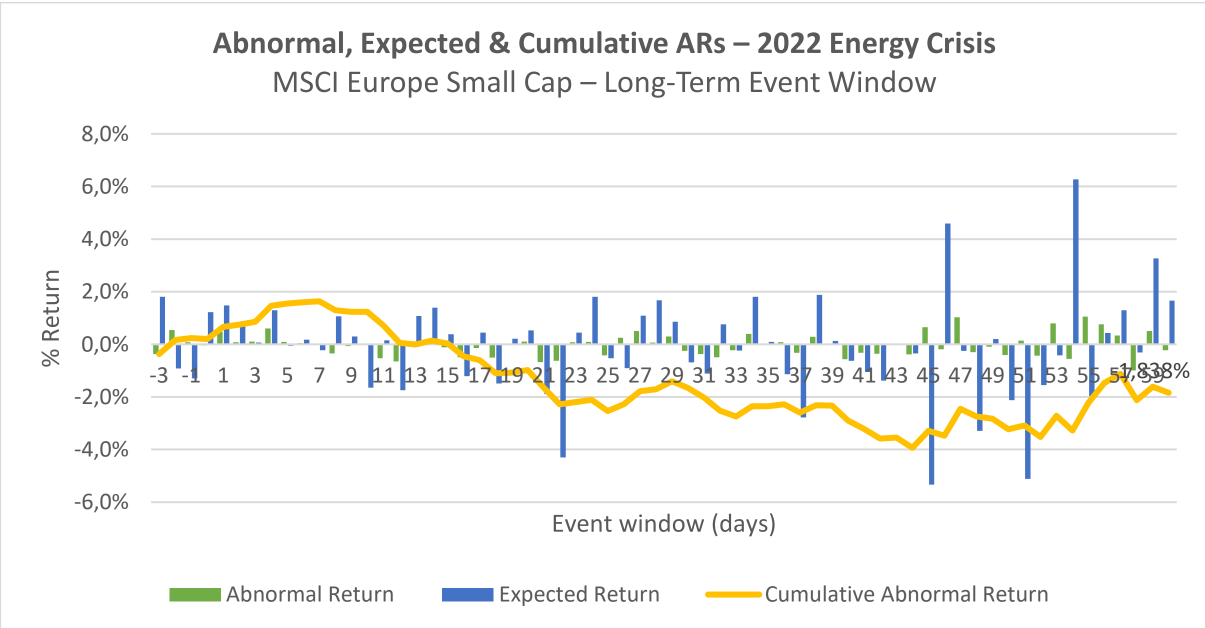

Figure 45*. Abnormal, expected, and cumulative abnormal returns for MSCI Europe Small Cap during the long-term event window surrounding the 2022 Energy crisis.*

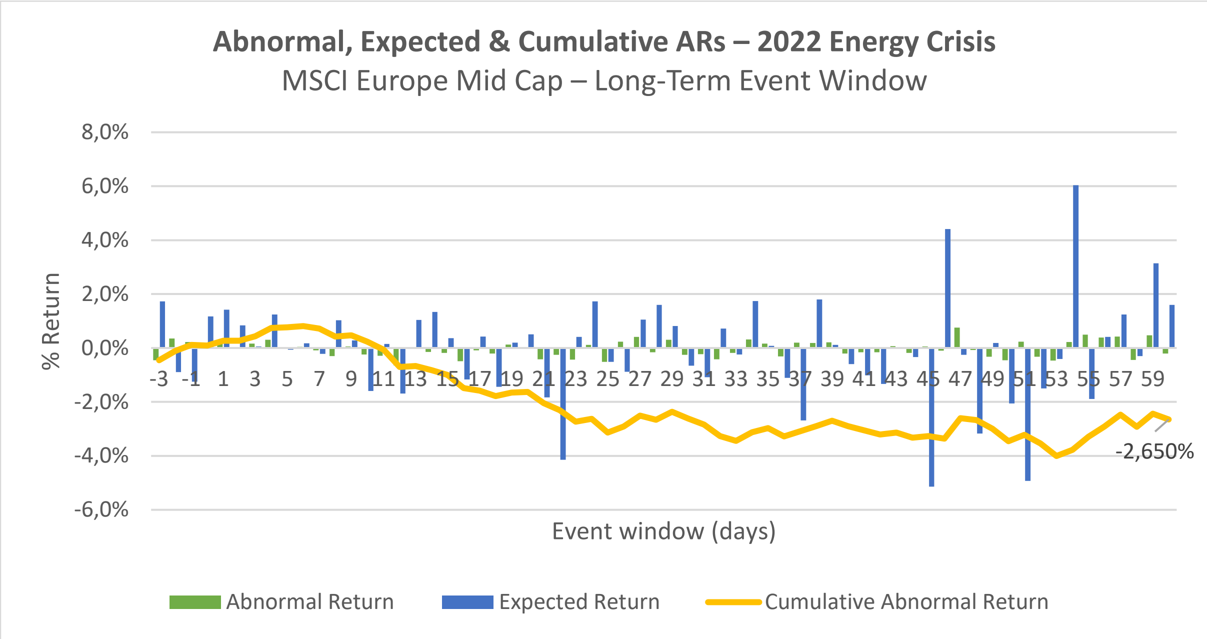

***Figure 46**. Abnormal, expected, and cumulative abnormal returns for MSCI Europe Mid Cap during the long-term event window surrounding the 2022 Energy crisis.*

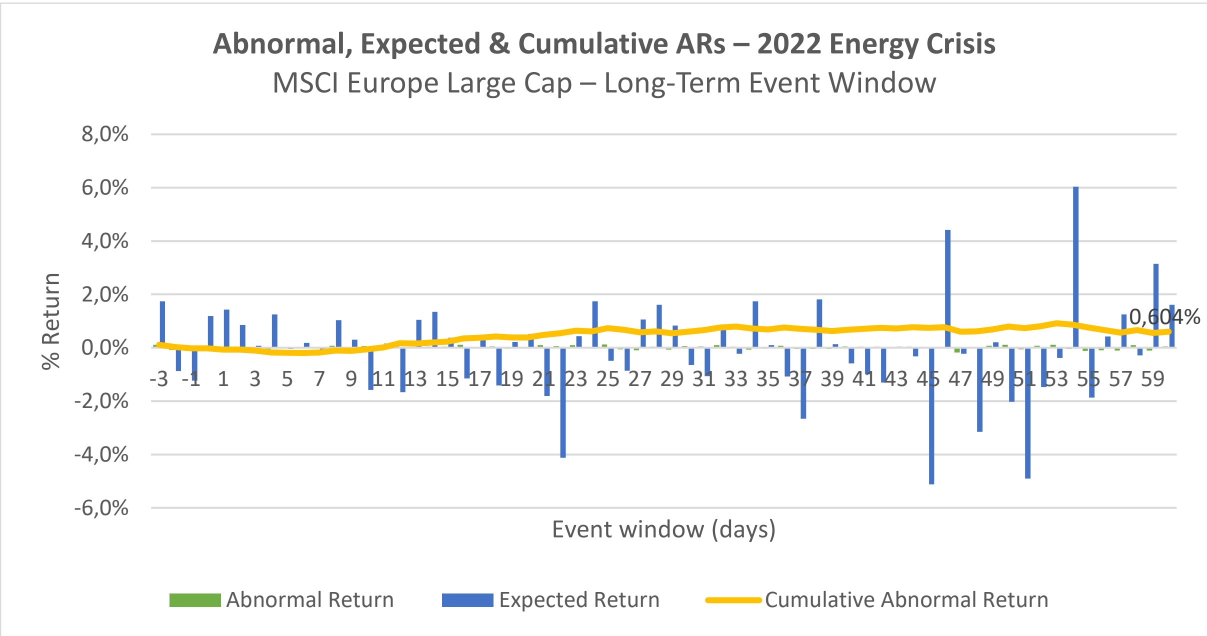

***Figure 47**. Abnormal, expected, and cumulative abnormal returns for MSCI Europe Large Cap during the long-term event window surrounding the 2022 Energy crisis.*

Appendix H Robustness test: 2022 Energy Crisis (Long-Term Event Window)

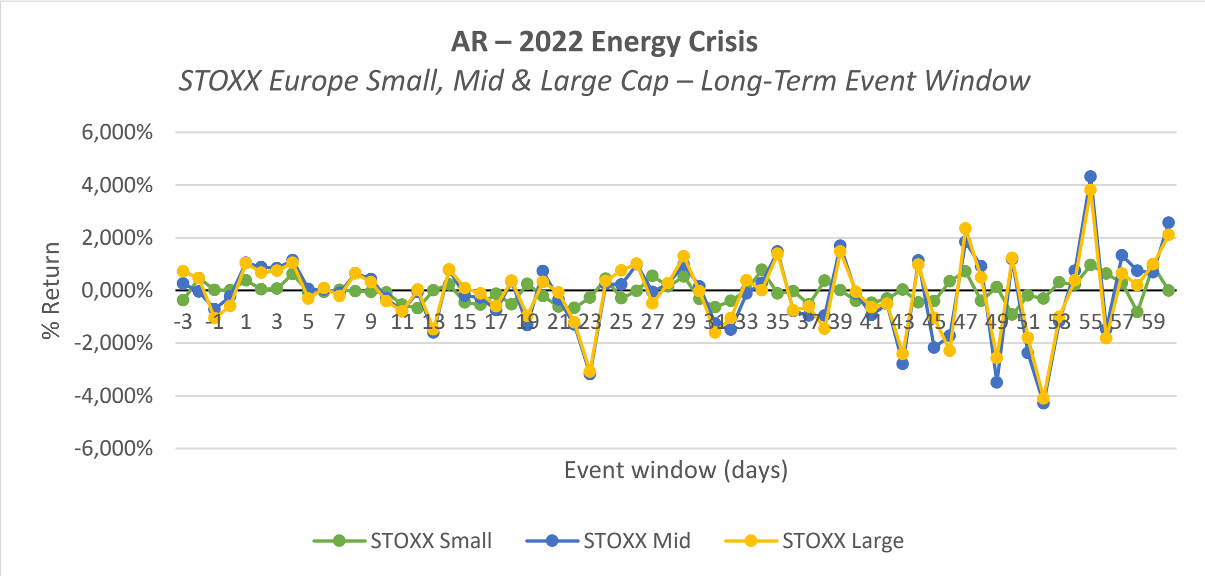

Figure 48. *Abnormal returns (AR) for STOXX Europe Small, Mid, and Large Cap indices during the Long-term event window surrounding the 2022 Energy crisis.*

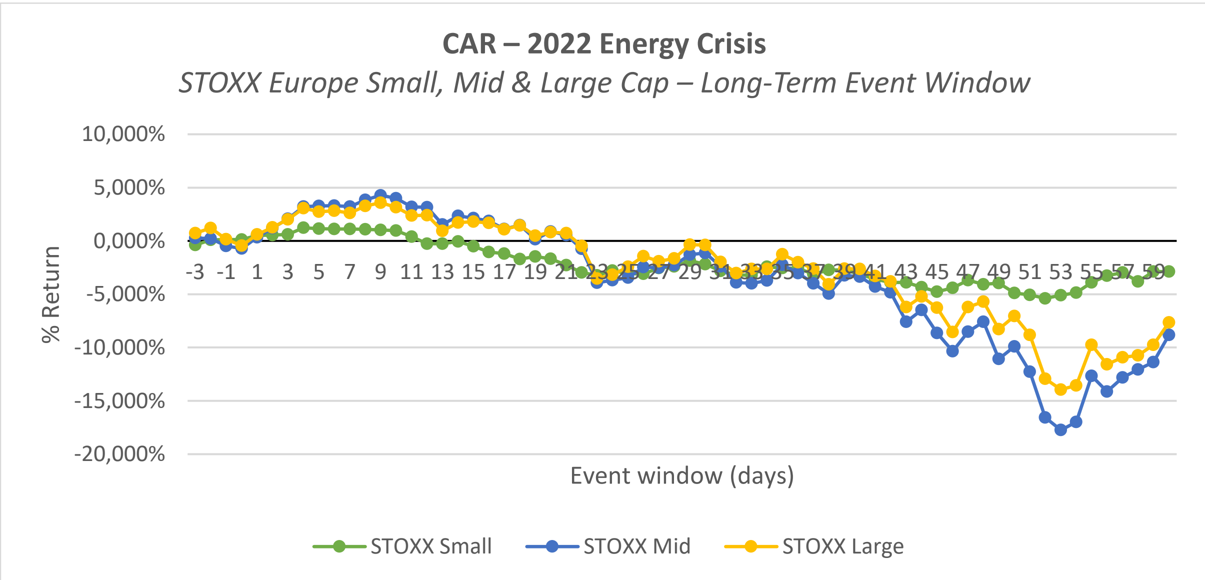

Figure 49. *Cumulative abnormal returns (CAR) for STOXX Europe Small, Mid, and Large Cap indices following the 2022 Energy crisis.*

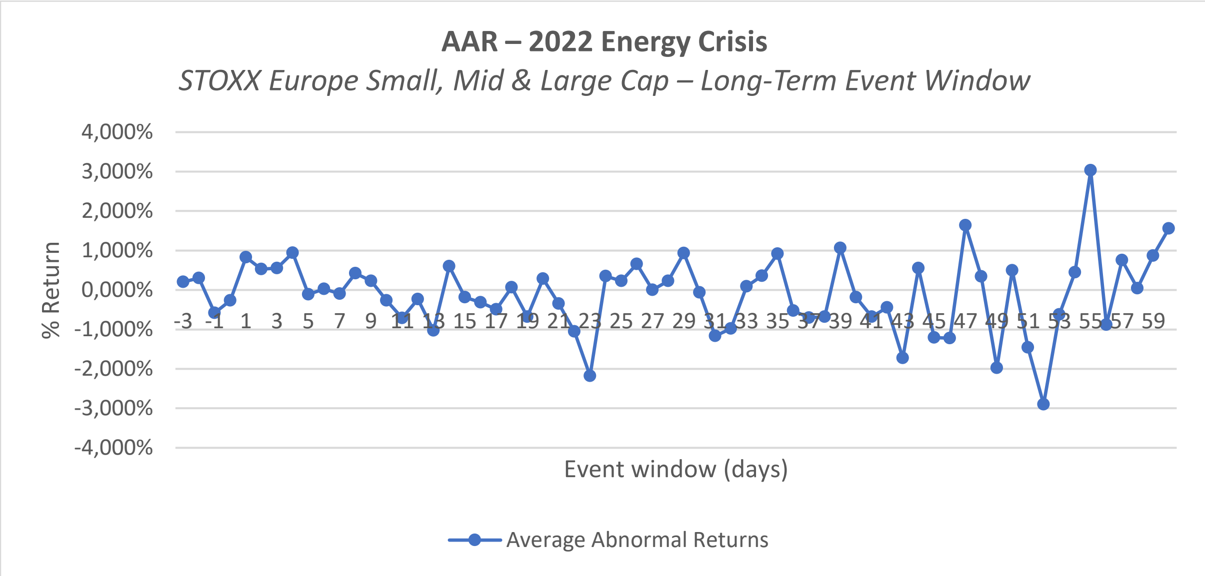

Figure 50. *Average abnormal returns (AAR) across STOXX Europe Small, Mid, and Large Cap indices.*

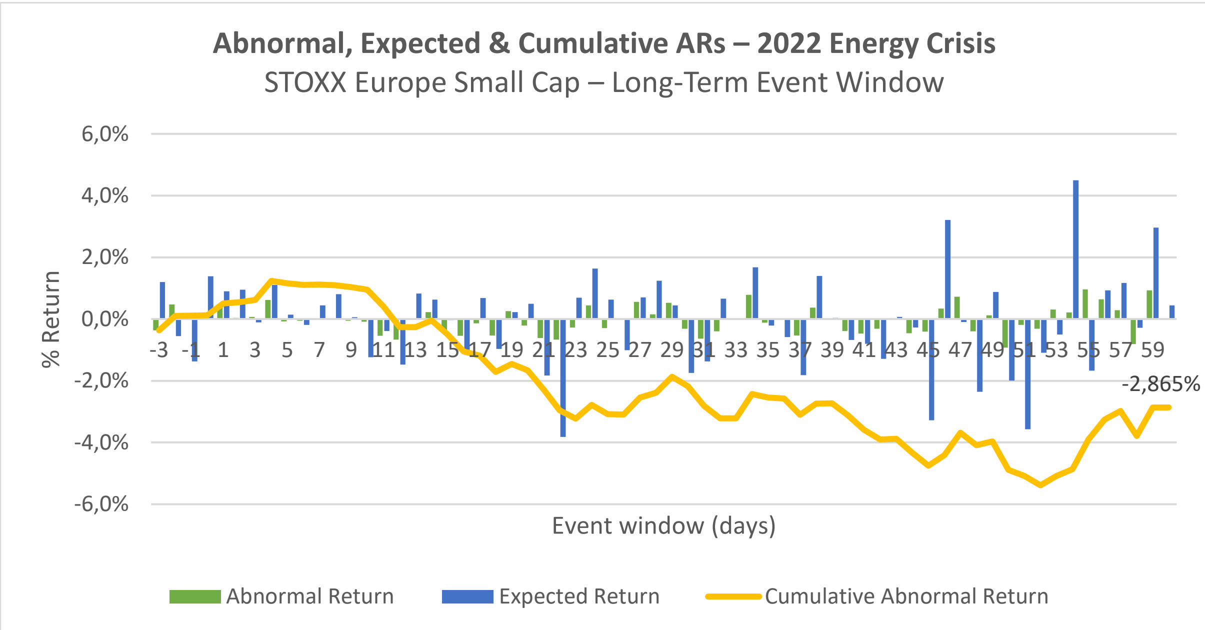

Figure 51. *Abnormal, expected, and cumulative abnormal returns for STOXX Europe Small Cap during the long-term event window following the 2022 Energy crisis.*

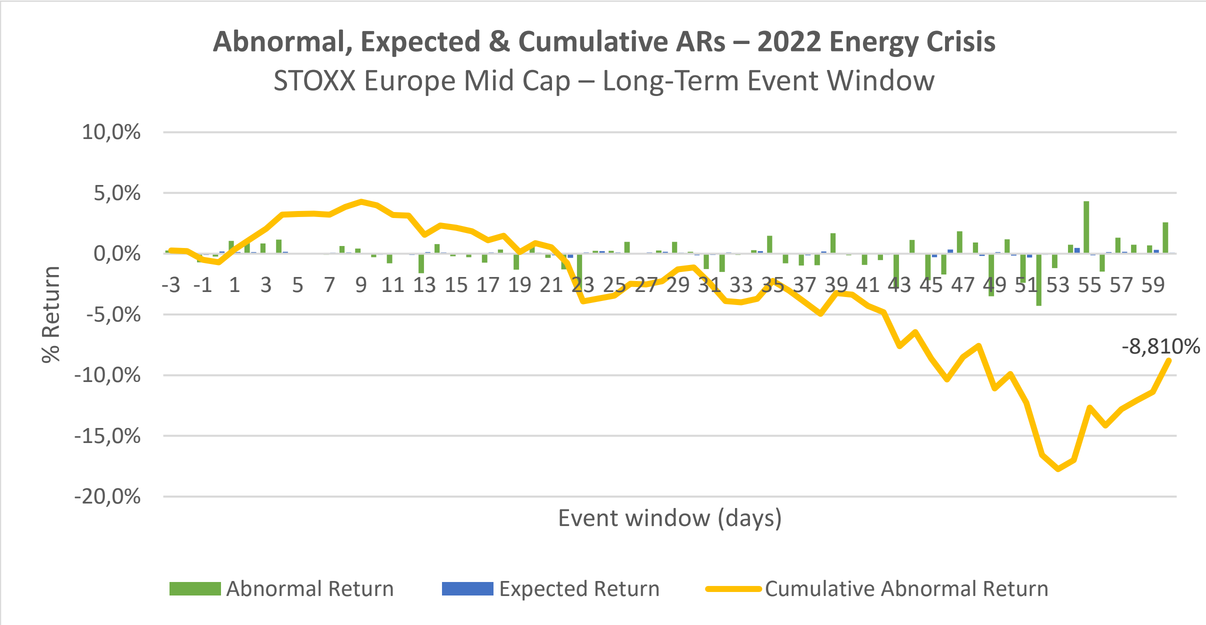

Figure 52. *Abnormal, expected, and cumulative abnormal returns for STOXX Europe Mid Cap during the long-term event window following the 2022 Energy crisis.*

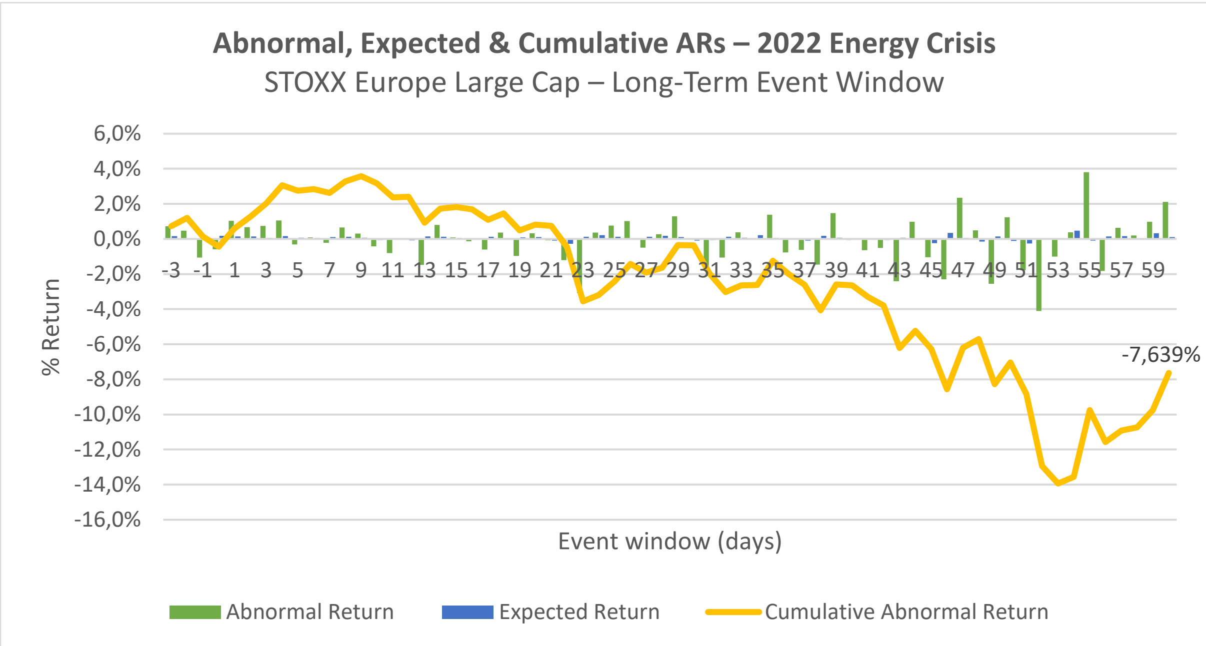

Figure 53. *Abnormal, expected, and cumulative abnormal returns for STOXX Europe Large Cap during the long-term event window following the 2022 Energy crisis.*

Appendix I Statistical test: Brexit Referendum

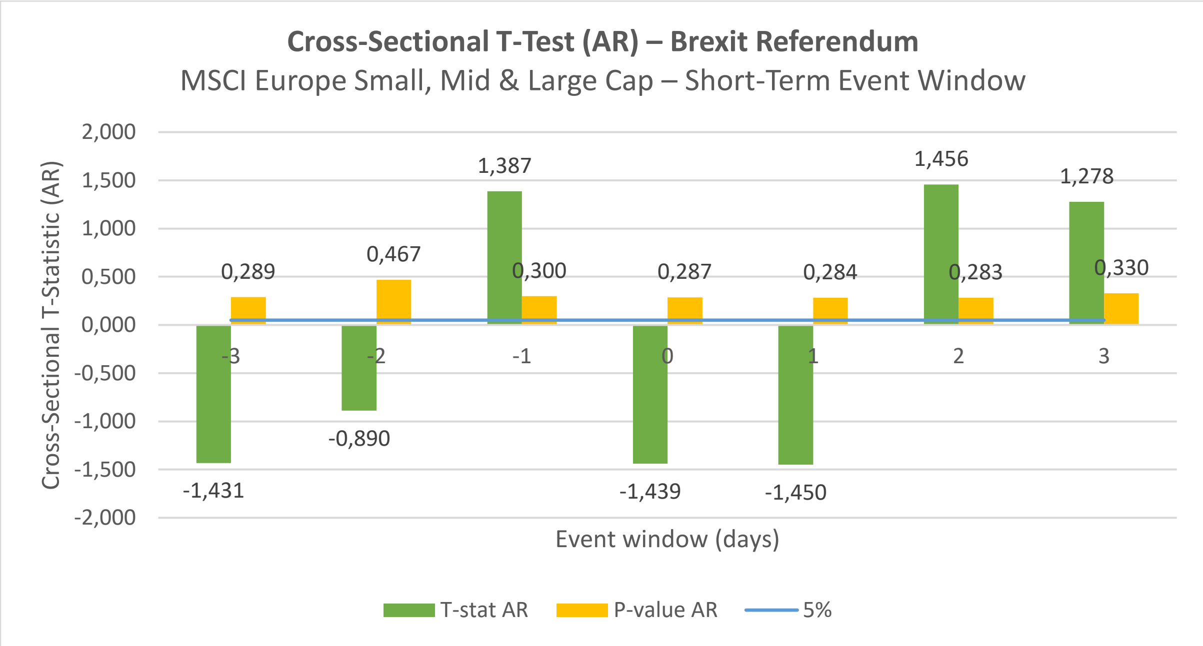

***Figure 54**: T-statistics of daily abnormal returns (ARs) for MSCI Europe Small, Mid, and Large Cap indices from the short-term study of the 2016 Brexit referendum, based on cross-sectional testing.*

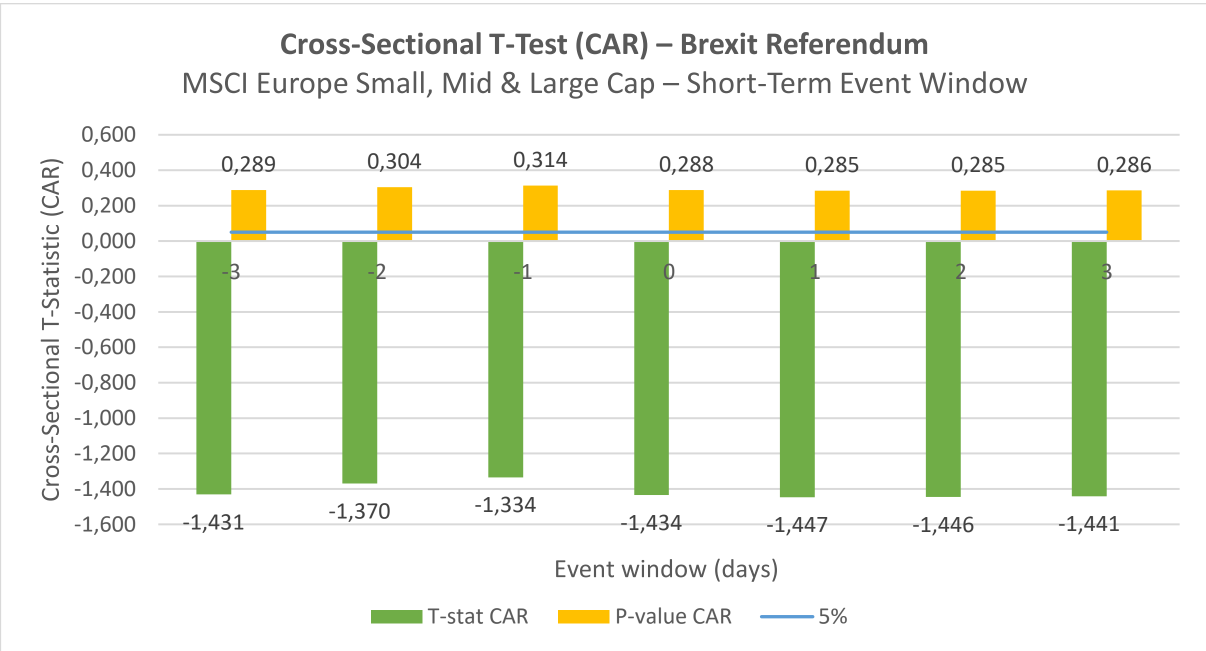

***Figure 55**: T-statistics of daily abnormal returns (CARs) for MSCI Europe Small, Mid, and Large Cap indices from the short-term study of the 2016 Brexit referendum, based on cross-sectional testing.*

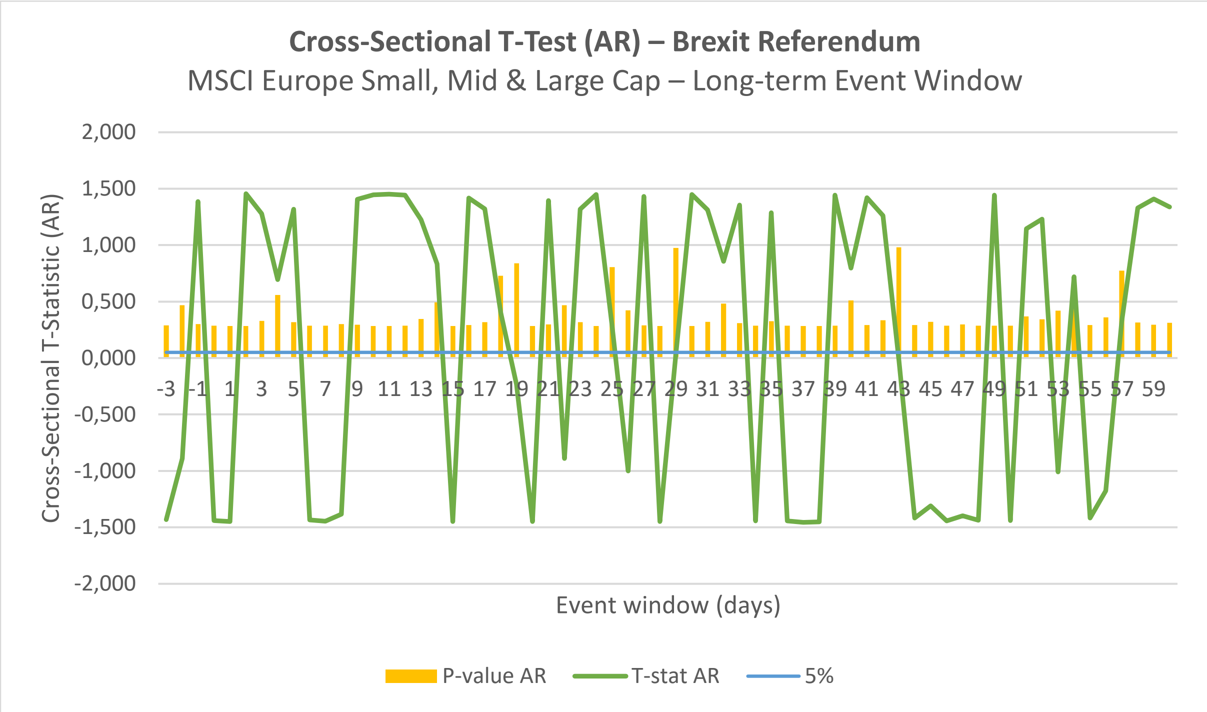

***Figure 56**: T-statistics of daily abnormal returns (ARs) for MSCI Europe Small, Mid, and Large Cap indices from the long-term study of the 2016 Brexit referendum, based on cross-sectional testing.*

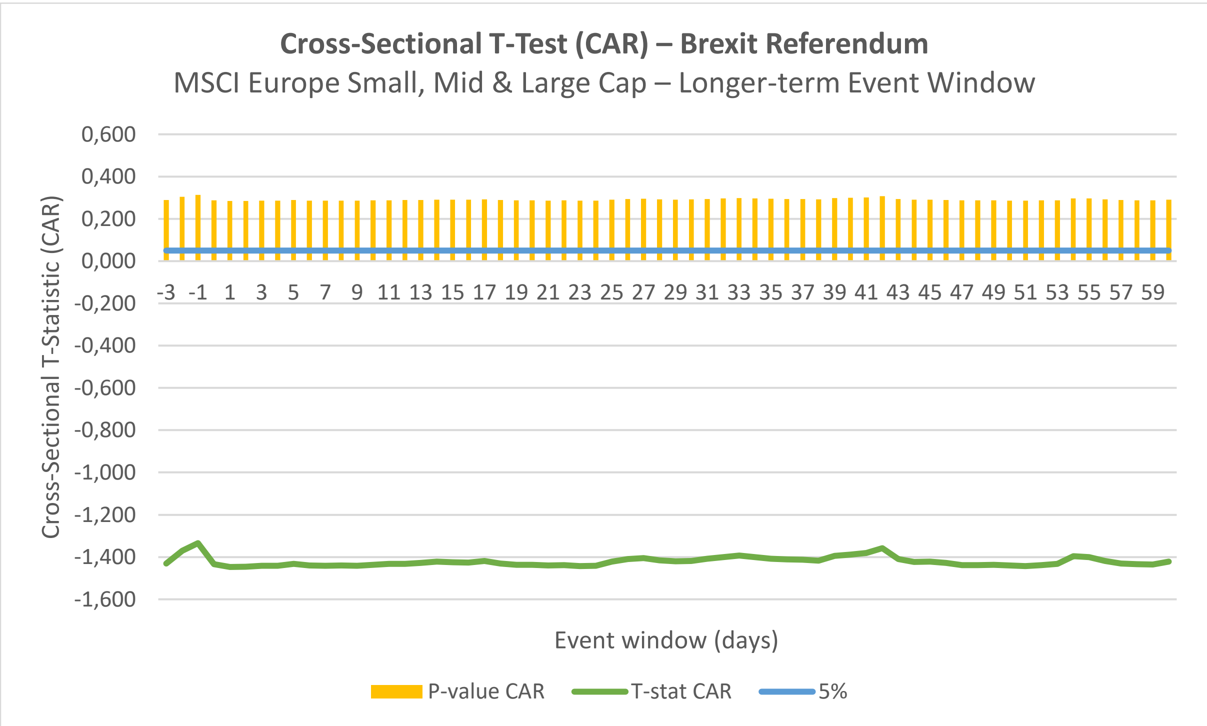

***Figure 57**: T-statistics of daily abnormal returns (CARs) for MSCI Europe Small, Mid, and Large Cap indices from the long-term study of the 2016 Brexit referendum, based on cross-sectional testing.*

Appendix J Statistical test: 2022 Energy Crisis

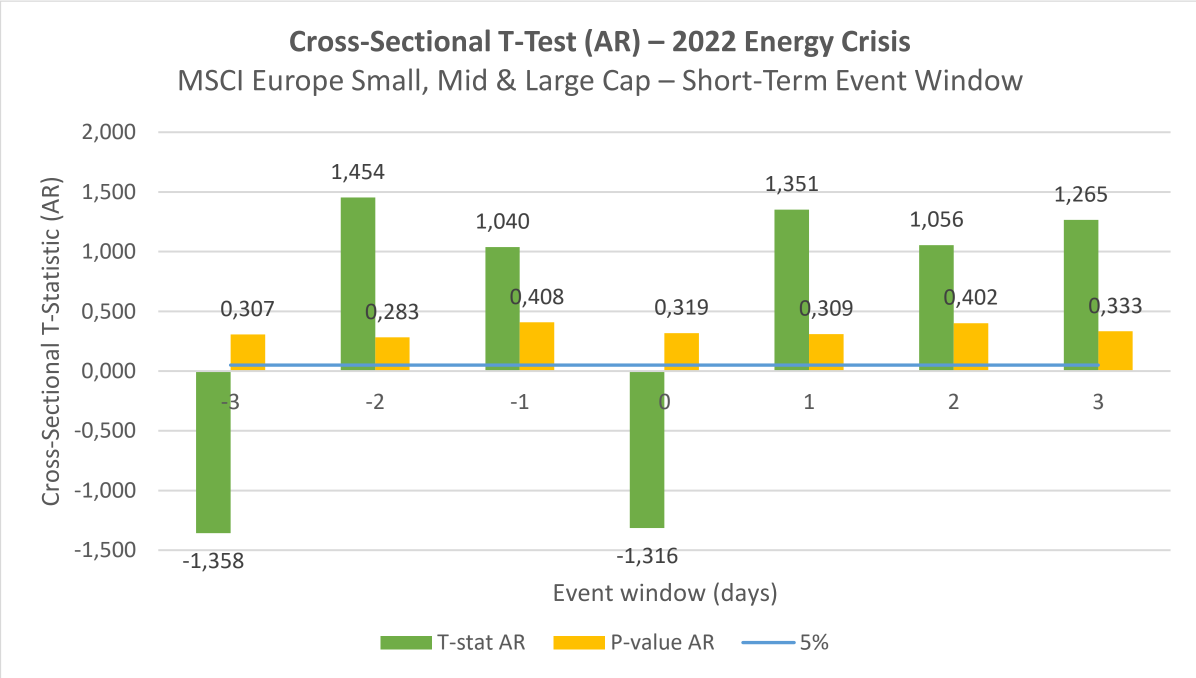

Figure 58*: T-statistics of daily abnormal returns (ARs) for MSCI Europe Small, Mid, and Large Cap indices from the short-term study of the 2022 Energy crisis, based on cross-sectional testing.*

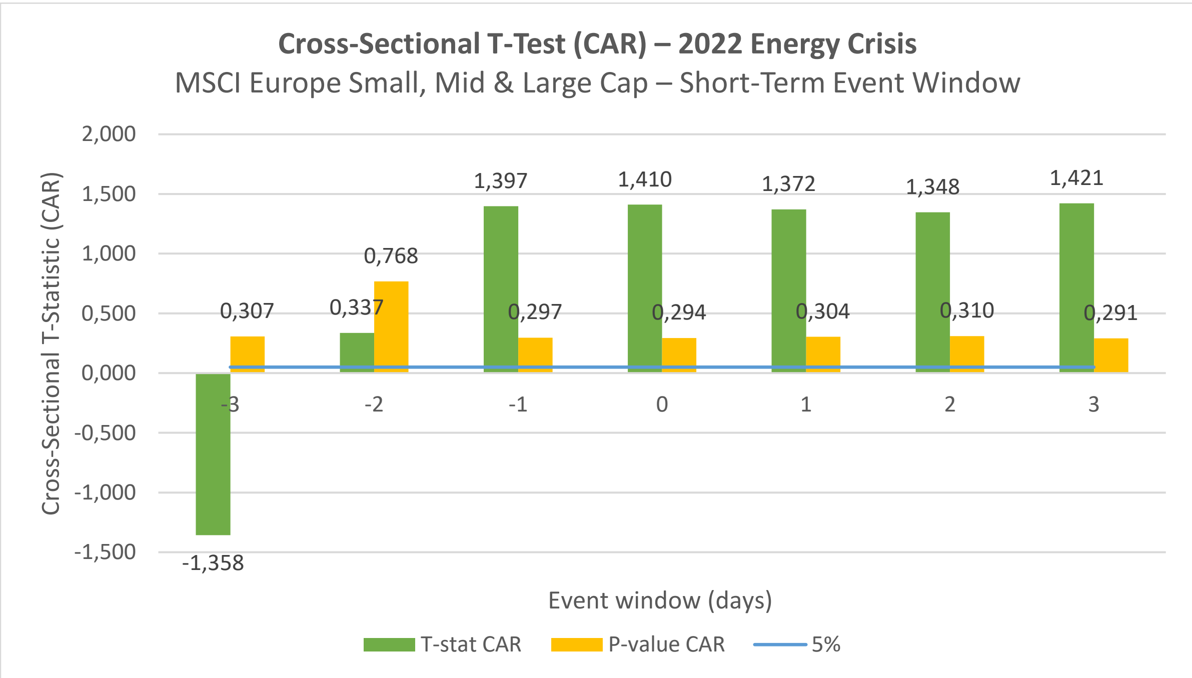

Figure 59*: T-statistics of daily abnormal returns (CARs) for MSCI Europe Small, Mid, and Large Cap indices from the short-term study of the 2022 Energy crisis, based on cross-sectional testing.*

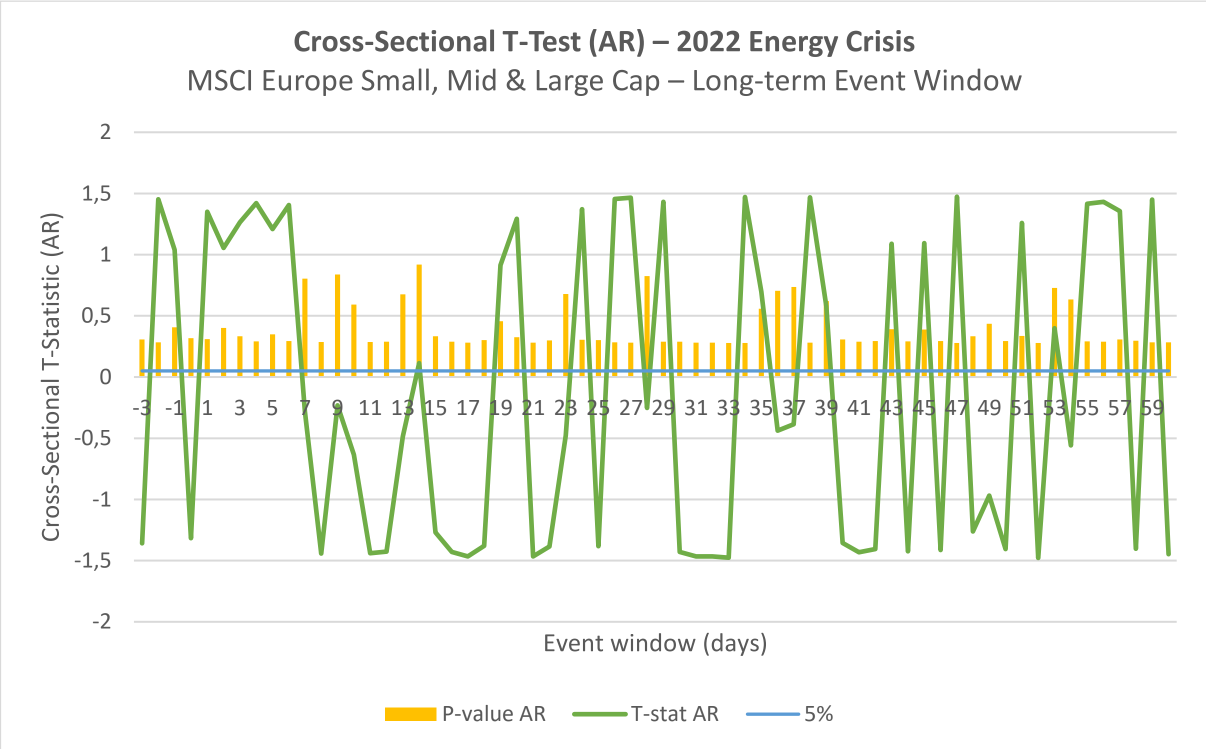

***Figure 60**: T-statistics of daily abnormal returns (ARs) for MSCI Europe Small, Mid, and Large Cap indices from the long-term study of the 2022 Energy crisis, based on cross-sectional testing.*

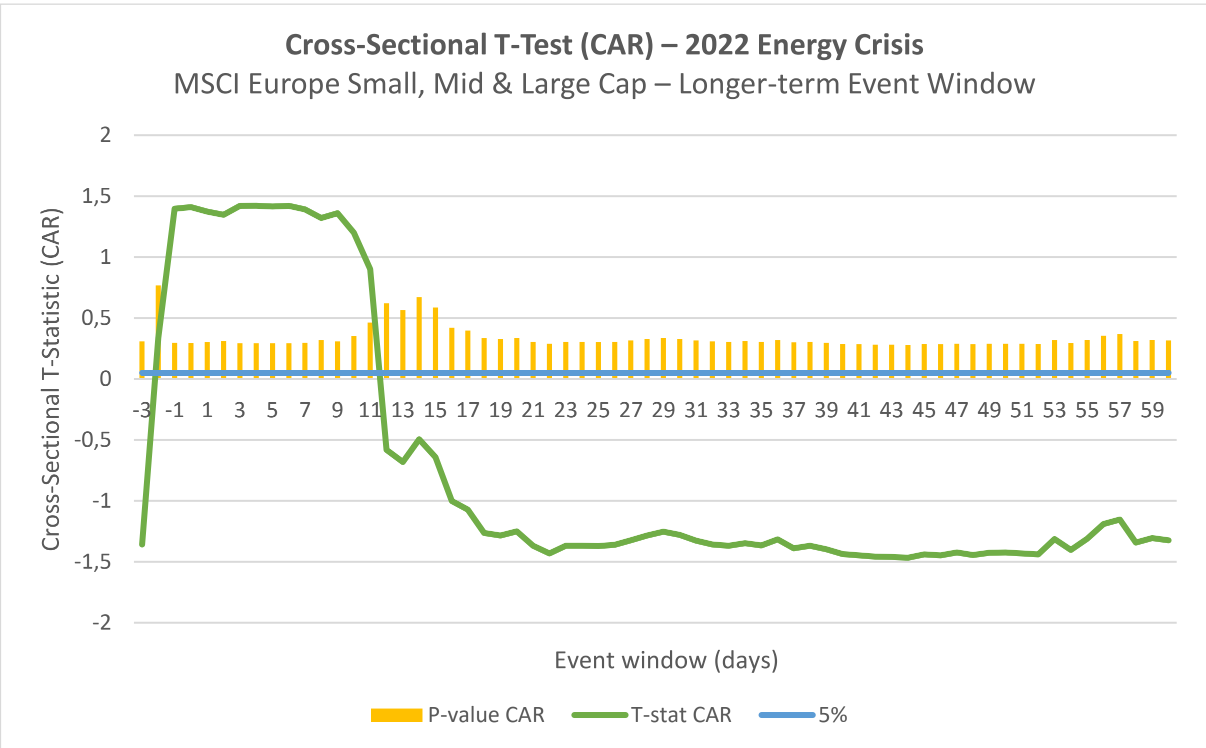

***Figure 61**: T-statistics of daily abnormal returns (CARs) for MSCI Europe Small, Mid, and Large Cap indices from the long-term study of the 2022 Energy crisis, based on cross-sectional testing.*