Sector-Level Return Dynamics and Event Sensitivity in the Qatar Stock Exchange (2014-2025)

A Dissertation submitted in part fulfilment of the requirements for the degree of Masters of Investment and Finance at Liverpool Business School, Liverpool John Moores University

By

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Declaration

I hereby declare that the work presented in this dissertation, entitled ***"Sector-Level Return Dynamics and Event Sensitivity in the Qatar Stock Exchange (2014-2025)"***, has been carried out solely by me under the supervision of Dr. Tripti Saha.

All sources of information and data derived from published materials have been properly acknowledged within the text and fully listed in the references section. No portion of this dissertation has been previously submitted, in whole or in part, in support of an application for any other degree, diploma, or qualification at this or any other university or institution of higher learning.

Moses B.

August, 2025.

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Dedication

This thesis is dedicated to my late father, whose life and values continue to guide me in quiet and steady ways. Though he is no longer here, the lessons he taught me remain part of how I think, work, and move forward. His influence has shaped my approach to learning and to life, and I carry it with gratitude and respect.

I also dedicate this work to my mother, who has always encouraged continuous intellectual growth and a commitment to learning. Her constant support, patience, and belief in education as a lifelong process have been a reliable source of motivation throughout my academic journey.

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Abstract

This study examines how efficiently the Qatar Stock Exchange processes information and how sectoral returns adjust to major macroeconomic and geopolitical shocks over the period 2014–2025. Using daily data for the QSE All Share Index and seven sectoral indices, the analysis combines weak-form market efficiency tests with a multi-event study framework to provide an integrated, sector-level assessment of return behaviour in a concentrated emerging market.

Weak-form efficiency is evaluated using complementary autocorrelation, runs, and variance-ratio diagnostics. The findings reveal pronounced sectoral heterogeneity. The market index and several core sectors, particularly Banking, Industrials, and Real Estate, exhibit short-run serial dependence and non-random behaviour, consistent with delayed information assimilation. Telecommunications displays return behaviour closest to random adjustment in short-horizon tests, while Consumer Goods also shows relatively weak dependence. In contrast, variance-ratio evidence indicates that all sectors exhibit mean-reverting dynamics over longer horizons, suggesting that inefficiencies are short-lived rather than persistent. Overall, the QSE is characterised by partial and time-varying weak-form efficiency shaped by sectoral liquidity, exposure, and structural frictions.

Event-study analysis examines sectoral responses to major macroeconomic and geopolitical shocks, including the oil price collapse, the GCC diplomatic blockade, the COVID-19 pandemic, the Russia-Ukraine conflict, the FIFA World Cup, and the Iran missile strike. The results show that shocks are transmitted primarily through sector-specific channels rather than uniform market repricing. Banking acts as a stabilising sector during systemic stress, benefiting from policy credibility and domestic anchoring. Consumer Goods and Transportation are most affected by trade, mobility, and demand disruptions, while Industrials respond strongly to commodity and investment-cycle shocks. Real Estate consistently amplifies macro-financial stress, reflecting leverage and liquidity sensitivity. Telecommunications initially serves as a short-term defensive hedge but underperforms as sentiment reverses, while Insurance emerges as a late-stage defensive allocation during heightened geopolitical shocks.

Taken together, the evidence portrays the QSE as a market in which information is absorbed unevenly across sectors, short-run inefficiencies emerge during periods of stress, and prices adjust over time through corrective sectoral reallocation rather than persistent mispricing. This integrated sector-level approach offers new insight into market efficiency and shock transmission in Qatar's equity market.

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List of Abbreviations

ADF - Augmented Dickey–Fuller (test for stationarity)

AAR - Average Abnormal Return

AR - Abnormal Return

AR_0 - Abnormal Return on the event day (t = 0)

CAAR - Cumulative Average Abnormal Return

CAR - Cumulative Abnormal Return

COVID-19 - Coronavirus Disease 2019

DMY - Day-Month-Year (date format)

GCC - Gulf Cooperation Council

HMM - Historical Mean Model

IMF - International Monetary Fund

Lo-MacKinlay - Variance Ratio test for weak-form efficiency

MAM - Market Adjusted Model

MFM - Multi-Factor Model

OLS - Ordinary Least Squares

QEAS - Qatar Exchange All Share Index

QBNK - Qatar Exchange Banking and Financial Services Sector Index

QCON - Qatar Exchange Consumer Goods and Services Sector Index

QIND - Qatar Exchange Industrials Sector Index

QINS - Qatar Exchange Insurance Sector Index

QREA - Qatar Exchange Real Estate Sector Index

QTLC - Qatar Exchange Telecommunications Sector Index

QTRN - Qatar Exchange Transportation Sector Index

QSE - Qatar Stock Exchange

VR - Variance Ratio

Chapter 1: Introduction

1.1 Background of Research

The behaviour of sector-level equity returns in emerging and frontier markets has drawn sustained academic interest as these markets continue to evolve under the influence of financial liberalisation, technological advancement, and macroeconomic uncertainties. Unlike mature markets, where institutional depth and broad investor participation often dampen idiosyncratic fluctuations, emerging markets are characterised by structural frictions, concentrated ownership, and episodic liquidity constraints. These conditions amplify the sensitivity of prices to external shocks and create conditions where differences between sectors become especially important to understand (Ahmed, 2012; Alnatour, 2025). In such contexts, aggregate market indices obscure the diversity of industry-specific behaviours, thereby limiting the diagnostic power of market-wide analyses. Therefore, a sector-level analysis provides a more refined framework for understanding return dynamics, volatility regimes, and shock transmission mechanisms within a transitioning financial system (Caporale, Ali & Spagnolo, 2015; Amaglobeli et al., 2024).

This relevance is pronounced in the Gulf Cooperation Council (GCC) region, where economies are undergoing structural transformation to reduce dependence on hydrocarbons. In this regional context, the Qatari economy offers a compelling case as outlined through the Qatar National Vision 2030 (QNV), which prioritise diversification into finance, real estate, logistics, education, and tourism (OBG, 2025; QNDCC, 2023). As noted by Almujamed (2018), these reforms are reflected in the evolution of the Qatar Stock Exchange (QSE), which has expanded from a small domestic exchange into one of the region's leading frontier markets. It ranks fourth by market capitalisation alongside the Saudi Exchange (Tadāwul), Abu Dhabi Securities Exchange (ADX), and Dubai Financial Market (DFM). The QSE provides sector indices suite that allow a disaggregated view of market behaviour as follows:

1. Banking & Financial Services (QBNK),
2. Consumer Goods (QCON),
3. Industrials (QIND),
4. Insurance (QINS),
5. Real Estate (QREA),
6. Telecommunications (QTLC),
7. Transportation (QTRN), and

8. Qatar Exchange All Share Index (QEAS)

Qatar's diversification push unfolded during a period of pronounced macroeconomic and geopolitical turbulence that includes shocks such as the global oil price collapse (2014-2016), the 2017 diplomatic blockade, the COVID-19 pandemic (2020-2021), the 2022 FIFA World Cup, the post-2022 monetary tightening following the Russia-Ukraine conflict, and the 2025 missile strike. Each event influenced QSE sectors differently. The oil price collapse dampened returns in energy-linked and industrial sectors (Nusair & Al-Khasawneh, 2018; Mensi et al., 2021); the blockade disrupted supply chains while accelerating domestic production (Kapar & Buigut, 2020); and the COVID-19 pandemic generated steep losses in consumer and industrial sectors, whereas telecommunications and banking showed relative resilience due to digital adoption and liquidity measures from the Qatar Central Bank (Al Samman & Akkas, 2021; PwC, 2021, Abidi, El Herradi & Sakha, 2023). The 2022 World Cup further boosted real estate and transportation through infrastructure investment (PwC, 2023). These uneven effects show that shocks in Qatar affect sectors differently, highlighting the need for a detailed, sector-focused approach to studying returns.

These observations also raise an important theoretical question about how efficiently markets like Qatar's process information. While the Efficient Market Hypothesis (EMH) posits that prices incorporate available information rapidly and fully (Fama, 1970), empirical evidence from emerging markets suggests that information processing may be slower or incomplete, particularly during periods of heightened uncertainty (Neaime, 2016; Piccoli, Chaudhury & Souza, 2017; Malkiel, 2019). Shocks can cause temporary mispricing or delayed adjustments, and event-study analysis offers a robust framework to detect such deviations by isolating abnormal returns (ARs) and cumulative abnormal returns (CARs), which is particularly useful in markets where structural frictions create conditions for delayed price adjustment.

Despite its suitability, studies focusing specifically on Qatar's sectors remain limited. Much of the existing research on the QSE uses market-wide indices, which mask sectoral differences between industries (Charfeddine & Barkat, 2020a; Alqahtani, Bouri & Vo, 2020). Only a few papers assess weak-form efficiency at the sector level, and even fewer examine how different QSE sectors respond across multiple shocks over time. There is also little evidence distinguishing between reactions that occur only because of specific events and those that reflect longer-term market structure (Almujamed, 2018; Buigut & Kapar, 2020).

This study analyses daily QSE sector data from 2014 to 2025 to examine return patterns, test weak-form efficiency, and assess sector responses to major economic and geopolitical events. A placebo test ensures abnormal movements occur only around actual events. Together, these methods provide a clear view of how Qatar's sectors absorb shocks, incorporate new information, and behave across stable and turbulent periods.

1.2 Research Problem Statement

Despite growing academic interest in GCC equity markets, empirical research on the Qatar Stock Exchange remains limited in its treatment of sectoral behaviour. Much of the existing literature relies on aggregate market indices or selected firm samples, which obscures how different sectors respond to changing economic conditions and major shocks (Benjelloun & Squalli, 2008; Buigut & Kapar, 2020; Alrabadi & Al-Qadi, 2024).Evidence from emerging and frontier markets suggests that sectoral responses to macroeconomic and geopolitical developments can differ substantially due to variations in liquidity, investor composition, and industry-specific exposure (Chowdhury, 2020; Erer, Erer & Güngör, 2023; Dang et al., 2024). However, such sector-specific dynamics remain underexplored in the QSE context.

The need for sector-focused analysis becomes more evident given Qatar's unique mix of structural reforms and exposure to multiple shocks over the past decade. As discussed, these events did not affect sectors uniformly, suggesting that a simple market-level view may mask important differences in resilience, volatility, and adjustment behaviour. However, existing studies do not fully examine and call for testing on whether sectors follow identifiable return cycles, display short-term predictability, or whether their reactions to shocks vary in timing or intensity (Al-Alawnh et al. 2025). A further limitation is the lack of an integrated analytical approach. Current research tends to examine market efficiency, event reactions, or general price behaviour separately. No study has combined sectoral return cycles, weak-form efficiency tests, and event-driven responses within a single framework. Without such integration, it is difficult to distinguish routine market patterns from event-specific movements or to determine whether observed behaviours reflect efficient adjustment, temporary mispricing, or deeper structural features of the market.

This gap carries both theoretical and practical implications. Academically, the lack of sector-level evidence constrains efforts to understand how information is assimilated during periods of uncertainty, an issue widely discussed in the literature on emerging-market efficiency (Meero, 2018; Alrabadi & Al-Qadi, 2024). Practically, limited insight reduces the ability of policymakers, regulators, and investors to identify vulnerable or stabilising sectors, manage risk, and track the progress of economic diversification initiatives under the QNV 2030.

Accordingly, the study addresses this gap by systematically analysing sector-level return cycles and efficiency dynamics, thereby assessing how market shocks/ events shape short-term and cyclical performance to reveal whether observed sectoral patterns reflect efficient adjustment, and structural fragility within Qatar's equity market.

1.3 Aim and Objectives

1.3.1 Aim

The aim of this study is to examine how sector-level returns in the QSE behave during periods of stability and during major macroeconomic and geopolitical events between 2014 and 2025. Specifically, the study seeks to understand whether sectoral point movements follow identifiable cycles, incorporate information efficiently, and how they respond to major shocks within Qatar's evolving economic environment.

1.3.2 Objectives

To achieve this aim, the study will pursue the following interrelated objectives:

1. To identify and characterise cyclical patterns in sectoral returns within the QSE.
2. To evaluate weak-form market efficiency at the sector level and determine how efficiently information is incorporated into prices.
3. To examine the sensitivity and robustness of sectoral returns to major macroeconomic and geopolitical events, with placebo tests used to validate event identification.

1.4 Research Question

In line with the above objectives, the study is guided by the following research questions:

- What cyclical patterns of highs and lows are observable on the QSE sectoral returns, and how do they differ across industries?
- Do sector indices exhibit weak-form efficiency, or does serial dependence emerge?
- How do QSE sectors respond to major macroeconomic and geopolitical events, and are these responses symmetric across sectors?
- Are observed sectoral sensitivities genuinely event-driven, as opposed to arising from structural volatility patterns (placebo comparison)?

- What are the implications for sector risk management, market monitoring, and event-sensitive portfolio positioning in Qatar?

1.5 Hypotheses

The study tests the following hypotheses, derived from its objectives and grounded in financial market theory:

- **H1:** Sectoral returns in the QSE exhibit identifiable cyclical highs and lows that correspond with major macroeconomic and geopolitical events.
- **H2:** QSE sectoral indices do not fully conform to weak-form market efficiency and short-horizon serial dependence is expected to emerge, particularly during periods of turbulence.
- **H3:** The sensitivity of sectoral returns to macroeconomic and geopolitical events varies significantly across sectors, reflecting asymmetric reactions and differential resilience.
- **H4:** Event-study abnormal returns will be significant around actual event dates but insignificant around placebo dates, demonstrating that sectoral responses are event-driven rather than due to underlying structural factors.

1.6 Scope of the Study

This study focuses on the QSE sector indices and the overall market index as the primary units of analysis, rather than individual firms, thereby mitigating potential biases such as survivorship effects and microstructure noise including thin trading and price discreteness. The analysis spans the period from July 2014 to June 2025, encompassing the full timeframe for which these indices are available on the exchange's portal.

Expected returns are estimated using the QEAS as the market benchmark owing to its comprehensive coverage of all listings thereby providing a balanced and representative measure of aggregate market performance, making it more appropriate for a sector-level study than the QE 20. Although widely followed, the QE 20 Index is a concentrated blue-chip index dominated by banking and industrial stocks; using it as the benchmark would risk introducing sectoral weighting bias, particularly when evaluating QBNK and QIND. The QEAS therefore offers a more neutral and representative basis for estimating expected returns across sectors. The analysis is event-driven and does not introduce exogenous macro variables, as shocks are defined through dated event windows. Methods proceed as follows:

i. Descriptive identification of highs/lows;
ii. Weak-form efficiency tests;
iii. Event-study estimation of ARs and CARs;
iv. Robustness check using placebo windows in non-event periods.

In summary, although findings will be geographically specific, they may hold relevance for other GCC markets with similar structures and shock exposures.

1.7 Significance of the Study

This study contributes to both theoretical and applied finance. Theoretically, it adds to the growing sector-level literature on market efficiency and sectoral return behaviour to the QSE. By integrating weak-form efficiency testing with event-sensitivity analysis to major events, the study offers fresh evidence on how markets in small, hydrocarbon-dependent economies adjust to shocks.

Practically, the results support investors, portfolio managers, and policymakers by identifying which sectors are most sensitive to systemic events and how quickly they adjust. These insights inform sector-rotation strategies, risk management, and macroprudential planning, aligning with broader goals under the QNV by informing strategies aimed at strengthening financial resilience and broadening the non-hydrocarbon base of the economy (IMF, 2023; National Planning Council (NPC), 2024).

Overall, the study's contribution lies in advancing both the empirical understanding and policy relevance of sectoral market behaviour in an emerging economy, offering a robust framework for analysing how financial markets adapt to systemic shocks and supporting the development of more informed, evidence-based investment and regulatory decisions in Qatar and comparable GCC markets.

1.8 Justification of the Research

This study is motivated by an empirical gap in the existing literature and by the sequence of shocks experienced by the QSE between 2014 and 2025, including the global oil price collapse, the 2017 GCC diplomatic blockade, the COVID-19 pandemic, the FIFA World Cup investment cycle, and the post-2022 global monetary tightening phase. Although this sequence of disruptions creates a rich setting for analysing market behaviour, empirical evidence on market efficiency and price adjustment in Qatar remains limited and fragmented, with most studies focusing on aggregate market indices. Consequently, there is still limited understanding of how different QSE sectors process information during periods of stress and recovery.

A renewed investigation is necessary because weak-form market efficiency is not time-invariant, particularly in emerging and frontier markets. Recent post-pandemic evidence from Arab and MENA exchanges shows that return predictability and random-walk behaviour can shift following major crises, with outcomes shaped by volatility conditions, liquidity, and policy responses (Alrabadi & Al-Qadi, 2024; Asaad & Omer, 2024). These findings call into question the continued validity of conclusions drawn from pre-crisis periods and are especially relevant given the limited and dated nature of direct evidence for the QSE. Earlier studies document statistically significant return predictability and departures from weak-form efficiency using daily data up to around 2017, while also identifying differences across market segments (Almujamed, 2018). However, these results predate several shocks that now define the QSE, including the COVID-19 pandemic, the World Cup-related investment surge, and the subsequent global tightening cycle. Consequently, existing evidence provides only partial insight into current sector-level efficiency dynamics.

This limitation is particularly important given the structural heterogeneity of the QSE. The market is highly concentrated in a small number of sectors, while others remain thinner and more volatile. Evidence from regional markets suggests that aggregate indices can mask meaningful sector-level differences in efficiency, with some sectors exhibiting near random-walk behaviour and others displaying persistent serial dependence (Benjelloun & Squalli, 2008). In such settings, sector-level analysis is essential to avoid overstating market-wide efficiency or overlooking sector-specific vulnerabilities.

Accordingly, this study adopts a sector-level framework that combines weak-form efficiency testing with event-study analysis. Weak-form tests assess whether historical returns contain exploitable patterns during normal trading conditions, while event studies evaluate the speed and completeness of price adjustment around major shocks. Although existing Qatar-focused event studies document significant market reactions to key events, they do not link these reactions to underlying efficiency dynamics across sectors (Al Refai, & Eissa, 2017; Buigut & Kapar, 2020; El-Abiad, Malak & Rifi, 2021). By integrating these approaches over the 2014-2025 period, the study provides a more comprehensive assessment of how sectoral information processing has evolved within Qatar's equity market.

1.9 Structure of Research

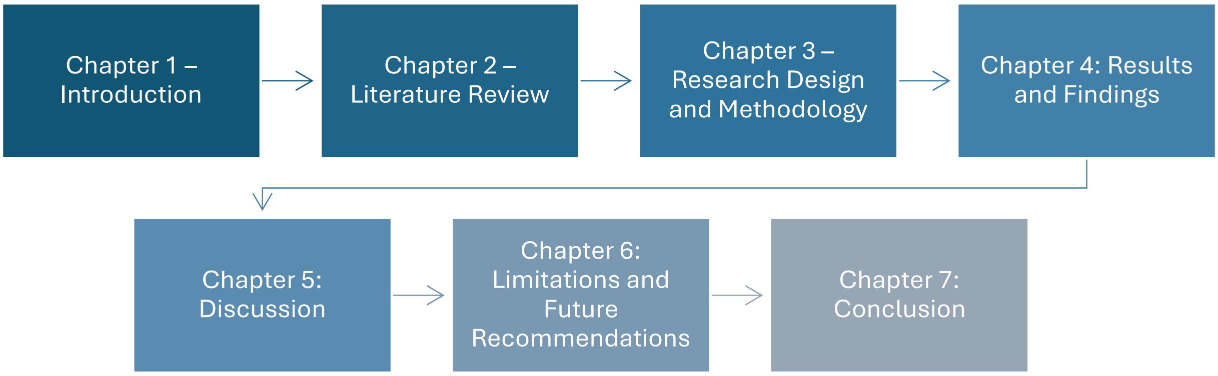

Figure 1: *Structure of Research*

Source: Developed for this Research

Figure 1 summarises the organisation of this dissertation. Chapter 1 introduces the study by outlining the background, research problem, aims and objectives, research questions, justification, scope, and methodological overview. Chapter 2 provides a literature review on sectoral market behaviour, market efficiency, and responses to shocks, engaging with theoretical frameworks and synthesising empirical evidence from global and GCC markets. Chapter 3 outlines the methodological framework, including the research design, data scope, and econometric techniques.

Chapter 4 presents empirical findings, including sectoral responsiveness to shocks, evidence of efficiency, and the behaviour of cyclical patterns across sectors. Chapter 5 interprets these results in relation to research questions, existing literature, and theoretical frameworks. Chapter 6 outlines the limitations encountered during the study and offers directions for future research within the context of Qatar's evolving financial landscape.

Finally, Chapter 7 summarizes the key insights of the research and reiterates its contributions to investment strategy, policy development and academic discourse of sectoral dynamics.

1.10 Summary

This chapter has positioned the QSE as a significant case for analysing sectoral return cycles, efficiency, and event sensitivity in an emerging market. It stated the problem, aim, objectives, research questions, hypotheses, scope, and justification for the study.

Chapter two: Literature Review

2.1 Introduction

This chapter reviews the theoretical and empirical literature relevant to sector-level behaviour in the QSE. It first outlines its structural features and sectoral composition, then examines evidence on sectoral return patterns in emerging and GCC markets. The discussion then turns to market efficiency and studies assessing how quickly prices incorporate information, followed by literature on event-driven market reactions to shocks such as oil price movements, political disruptions, and global crises. Together, these strands establish the conceptual basis for subsequent analysis and inform the methodological framework applied in the next chapter.

2.2 Evolution of the Qatar Stock Exchange (QSE)

2.2.1 Institutional Development and Market Structure

Established in 1995 as the Doha Securities Market (DSM) and launched trading in 1997 with 17 listed firms and a market-capitalisation of around 6 billion QAR (~1.65 billion USD), has since developed into one of the Gulf region's most significant equity markets with market-capitalisation reaching ~668.30 billion QAR as of July 2025 (QNBFS, 2025). Its establishment aimed to support capital raising for domestic firms and to provide a transparent platform for securities trading within Qatar's growing economy. Initially, market participation was restricted to Qatari nationals, but access expanded to GCC nationals and later foreign investors, promoting financial openness and capital-market integration (QSE, n.d.a).

It was rebranded as the "*QSE*" in 2009 following a strategic partnership between Qatar Holding (88%) and NYSE Euronext (12%), with Qatar Holding acquiring full ownership in 2013. A further milestone occurred in June 2023 with the adoption of the Millennium trading platform through partnership with the London Stock Exchange Group (LSEG), aligning its trading infrastructure with international standards thereby attaining a secondary emerging market status, that reflects advances in liquidity, regulatory quality, and institutional development. Clearing, settlement, and custody functions are undertaken by EDAA (Qatar Central Securities Depository) under the supervision of the Qatar Financial Markets Authority (QFMA) (Marhaba, 2025; QSE, n.d.b; n.d.c).

These developments are significant for the present study because institutional maturity directly influences how efficiently markets incorporate information and how sensitively sectors respond to macroeconomic and geopolitical events. Empirical work on Qatar indicates that valuation shocks in large firms generate spillovers across the exchange, reflecting rising integration and systemic interconnectedness within the financial ecosystem (Gharaibeh, 2016; Fernandez & Joseph, 2016).

2.2.2 Sectoral Structure, Concentration, and Performance Dynamics

The sectoral organisation of the QSE provides an essential foundation for understanding return behaviour in a concentrated emerging market. The introduction of sectoral indices (constructed with free-float market-capitalisation methodology) into the QSE's index suite in April 2012 marked a key development in providing disaggregated visibility into the industry structure and broadly reflects international standards like the Global Industry Classification Standard (GICS), improving comparability with global benchmarks and enhancing transparency for both domestic and foreign investors (QSE, n.d.c; FTSE, 2024). This granularity is essential as capitalisation is concentrated in a few dominant firms, causing substantial divergence that broad indices often obscure (Ahmed, 2012; MSCI, 2014).

Table 1: Comparative Overview - Sectoral Performance and Divergence

	Constituents (Nos.)			Trading Volume (QAR)			Trading value (QAR)			Transactions (Nos.)		
Sector	No. of Listings		% Change	Number of Shares (Bn)		% Change	Value (Billion)		% Change	Transactions (Mn)		% Change
	2014	2024		2014	2024		2014	2024		2014	2024	
QBNK	12	13	8.33	1.09	10.66	875.20	69.65	44.87	(35.58)	0.59	1.39	134.61
QCON	8	13	62.50	0.41	6.41	1,482.04	19.31	13.09	(32.22)	0.20	0.52	163.80
QIND	9	10	11.11	0.56	9.88	1,648.82	43.39	25.29	(41.72)	0.55	0.89	63.20
QREA	5	7	40.00	0.10	0.90	815.68	5.40	2.34	(56.60)	0.06	0.09	49.29
QTLC	4	4	0.00	1.48	7.16	385.13	39.01	7.57	(80.60)	0.42	0.29	(30.91)
QTRN	2	2	0.00	0.56	1.61	189.42	14.07	5.82	(58.64)	0.15	0.23	51.37
QINS	3	3	0.00	0.25	1.55	529.96	8.46	7.62	(9.93)	0.09	0.26	177.60
Total	**43**	**52**	**20.93**	**4.44**	**38.17**	**759.75**	**199.29**	**106.60**	**(46.51)**	**2.06**	**3.67**	**78.33**

Source: QSE Annual Reports (2015 to 2024)

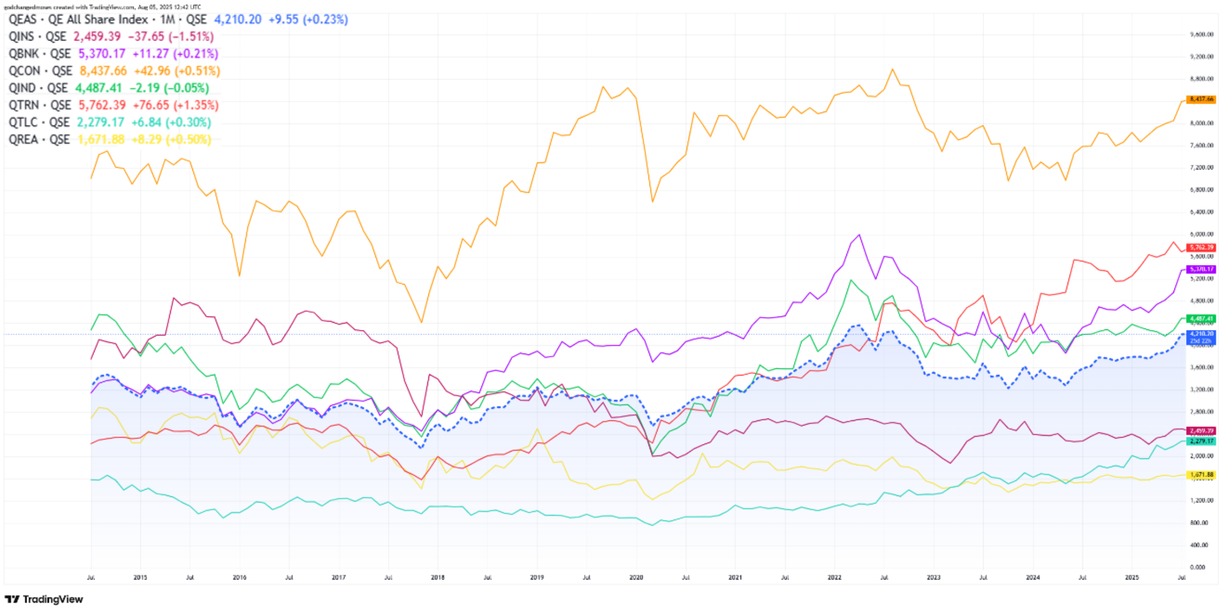

Figure 2: *Sectoral Performance on the Qatar Stock Exchange (2014–2025).*

Source: Trading View

Across 2014 to 2025 period, sectoral patterns reveal substantial divergence in liquidity, volatility, and long-term performance. These developments reflect the combined influence of Qatar's diversification agenda, macroeconomic cycles, and major regional events. QSE Annual Reports (2014; 2024) show that while listings increased from 43 to 53 (a rise of 20.9%), trading activity and investor attention became increasingly uneven across sectors. The comparative data in Table 2 and Figure 2, highlights four key trends:

- Banking sector strengthened its position as the market's core anchor. It accounted for the largest share of traded value and displayed consistently strong liquidity. This dominance reflects deep institutional demand and the sector's systemic importance (Kamco Invest, 2020; 2025).
- Industrials and Consumer Goods sectors emerged as secondary hubs of activity. Industrials exhibited pronounced cyclical swings linked to global commodity markets and investment cycles (Nusair and Al-Khasawneh, 2018; Mensi et al., 2021), while Consumer Goods expanded in both listings and turnover as domestic demand increased and investor interest broadened (Nusair and Al-Khasawneh, 2018; Mensi et al., 2021).
- In contrast, Real Estate and Telecommunications show declining market presence. Real Estate remains volatile due to financial tightening and oversupply pressures (PwC, 2023), whereas Telecoms exhibits subdued turnover and limited growth. Both indicate weaker investor expectations and reduced sectoral momentum.

- Smaller sectors displayed mixed patterns. Insurance remained thinly traded, reflecting structural constraints and limited institutional participation. Transportation showed short, event-driven spikes during the 2017 blockade, the COVID-19 period, and the World Cup infrastructure phase (Kapar and Buigut, 2020; Al Samman and Akkas, 2021).

Overall, these divergences underscore the QSE's transition from a market once led by Real Estate and Telecoms to one increasingly driven by Banking, Industrials, and Consumer Goods. This evolving structure highlights the importance of sector-level analysis, as aggregate indices mask the distinct volatility patterns, return cycles, and shock sensitivities that define Qatar's equity market.

2.3 Theoretical Foundations

Understanding sector-level return behaviour requires a framework explaining how information is incorporated into prices and why adjustment may differ across assets and market conditions. Two strands of theory are central to this study. Firstly, the Efficient Market Hypothesis (EMH), which provides expectations about predictability and information assimilation. Secondly, the event-study methodology, which offers a structured approach for measuring market reactions to identifiable shocks. Together, these frameworks guide the interpretation of sectoral return dynamics and inform the empirical design adopted in this dissertation.

2.3.1 Efficient Market Hypothesis (EMH)

The EMH is a cornerstone of modern financial economics, asserting that security prices fully reflect all available information and thus embody intrinsic value. Formally proposed by Fama (1970), it implies that investors cannot consistently earn abnormal returns beyond chance. This concept builds on earlier random walk theory (Kendall & Hill, 1953; Fama, 1965a), which posited that successive price changes are independent and identically distributed, making future prices unpredictable from past movements.

The EMH is expressed through three levels of informational efficiency:

- **Weak-form efficiency**: asserts that current prices reflect all past price and return data. Because price changes between t and $t + 1$are assumed to be random, returns are statistically independent over time. Consequently, historical information cannot be used to predict future price movements, rendering technical or chart-based analysis ineffective.

- **Semi-strong form efficiency:** assumes that prices incorporate not only historical data but all publicly available information, including corporate disclosures (annual reports, earnings forecasts, dividends), management quality assessments, accounting information, and media coverage. Under this form, neither technical nor fundamental analysis can systematically generate abnormal returns.
- **Strong-form efficiency:** assumes that security prices incorporate all information including historical, public, and private. Even insiders with privileged access would be unable to earn excess returns under this condition. While conceptually comprehensive, strong-form efficiency is rarely observed in practice, especially in emerging markets with evolving regulatory and governance structures.

Subsequent theoretical refinements emphasise that efficiency must be understood as conditional rather than absolute. Beaver (1981) and Latham (1986) argue that efficiency is always defined relative to a particular information set, while Grossman and Stiglitz (1980) highlight that information acquisition is costly, implying that perfectly efficient markets are theoretically inconsistent with rational incentives to gather information. Malkiel (2003) further stresses that markets may appear efficient on average yet display episodic inefficiencies during periods of uncertainty or stress. These insights are especially relevant for emerging markets, where information asymmetry, ownership concentration, and episodic liquidity constraints are more pronounced.

2.3.1.1 Historical and Empirical Tests of Informational Efficiency

Empirical tests of weak-form efficiency traditionally focus on whether return series exhibit statistical independence. Early foundational studies in developed markets employed serial correlation tests, runs tests, and unit-root procedures to assess the random walk hypothesis, finding broad support for weak-form efficiency in mature markets (Cowles, 1933; Working, 1934; Kendall, 1953; Fama, 1965). Subsequent methodological advances introduced variance-ratio tests, most notably by Lo and MacKinlay (1988), which provided more powerful diagnostics for detecting short-term predictability and became a standard tool in efficiency testing.

International evidence, however, reveals substantial heterogeneity. Solnik (1973) and French and Roll (1986) document weak but significant autocorrelation in several European markets, while later studies show that predictability tends to be higher in markets characterised by lower liquidity, higher transaction costs, and weaker institutional frameworks. Behavioural finance contributions further challenge the universality of EMH, demonstrating that investor sentiment, overreaction, and information diffusion can generate temporary deviations from random walk behaviour (De Bondt & Thaler, 1985; Shiller, 1989). As a result, efficiency is increasingly viewed as time-varying, influenced by market maturity and external shocks rather than as a fixed structural property. These insights are pertinent to sectoral analysis within the QSE, where liquidity and free float vary significantly across industries.

2.3.1.2 Market Efficiency on the QSE

Empirical research on weak-form market efficiency in the MENA region has grown substantially over the past two decades. However, evidence specific to the QSE remains limited, as most studies treat Qatar as part of regional panels or focus on the aggregate index, leaving sectoral efficiency largely unexplored. This gap is important as its financial integration has accelerated shock transmission, increasing short-run inefficiencies and uneven adjustment across markets and industries (Arab Monetary Fund (AMF), 2023). In Qatar's concentrated market, aggregate indices may thus obscure heterogeneous sectoral responses to regional and global shocks.

Early studies on weak-form efficiency in Qatar markets largely rejects the random walk hypothesis. Using serial correlation, runs, and variance-ratio tests, Al-Khazali, Ding and Pyun (2007) and Elango and Hussein (2008) document persistent and uneven return predictability, particularly in smaller and less liquid exchanges, attributing inefficiencies to thin trading and institutional frictions. Benjelloun and Squalli (2008) extend this evidence by showing that aggregate indices can mask substantial sector-level differences in efficiency, including in Qatar. Collectively, these studies indicate that informational efficiency in MENA markets is conditional, heterogeneous, and shaped by market structure rather than uniform across markets or sectors.

Subsequent regional studies reinforce the view that weak-form efficiency is partial and time-varying. Employing unit-root tests, autocorrelation diagnostics, variance-ratio procedures, and nonlinear dependence tests, Elhami and Hefnaoui (2018) and Hkiri et al. (2021) find persistent serial dependence across MENA and GCC markets, including Qatar, with inefficiencies intensifying during periods of stress and volatility. These findings suggest that efficiency evolves with liquidity conditions and external shocks rather than converging smoothly toward a random walk.

Qatar-specific evidence remains limited and mixed. Using daily data from 2005-2015, Almujamed (2018) finds that moving-average and filter trading strategies generate AR, rejecting weak-form efficiency and revealing uneven sectoral performance, with consumer goods and industrials closer to random walk behaviour. In contrast, Olubiyi and Olopade (2018), relying on monthly data and Wright-type variance-ratio tests, find that Qatar's market broadly satisfies weak-form efficiency, highlighting the sensitivity of results to data frequency.

More recent contributions embed Qatar within broader MENA or GCC samples, particularly around major shocks. Dalili and Boussedra (2023) and Nawaz et al. (2025) document time-varying efficiency and significant serial dependence in Qatar and other GCC markets, with inefficiencies intensifying during episodes such as COVID-19 and subsequent global monetary tightening. Event-based analyses reinforce these conclusions. Harek and Berrag (2019), Said et al. (2024), and Al-Alawnh et al. (2025) show that major shocks, including the 2017 diplomatic blockade, the COVID-19 pandemic, and policy interventions, were associated with AR, volatility clustering, and delayed price adjustment indicating temporary departures from weak-form efficiency.

Taken together, the literature yields three consistent insights. First, studies of efficiency employ standard international methodologies, including autocorrelation diagnostics, runs tests, variance-ratio, and trading-rule tests. Second, findings are highly sensitive to data frequency, sample period, and market conditions, with daily data more likely to reveal weak-form inefficiencies. Third, most analyses focus on the aggregate QSE index, leaving sectoral efficiency largely unexplored.

From a temporal perspective, the most detailed Qatar-specific weak-form studies rely on data ending around 2015-2017, while later contributions either focus on isolated events or embed Qatar within regional panels extending only into the early post-COVID period. As a result, there remains limited evidence on how informational efficiency in the QSE has evolved through the sequence of major shocks experienced particularly when examined through sectoral indices that reflect Qatar's diversification trajectory.

Overall, the existing literature suggests that weak-form efficiency in the QSE is incomplete, time-varying, and sensitive to external shocks. At the same time, it remains dated, largely aggregate in nature, and insufficiently attentive to sectoral heterogeneity, leaving important questions unanswered regarding how different parts of the QSE process information in an era of sustained structural change.

2.3.2 Event Study

The event study methodology (ESM) is widely used in financial economics to analyse market reactions to new information. Formalised by Fama et al. (1969), it linked abnormal price movements to the weak form EMH, testing whether public information is rapidly reflected in prices. Later refinements by Brown and Warner (1980, 1985), Corrado (1989, 2011), and Kothari and Warner (2007) strengthened its econometric foundations and confirmed its robustness under non-normal return distributions.

Within this framework, abnormal returns (ARs) capture the unanticipated component of price changes attributable to an event, while cumulative abnormal returns (CARs) measure the magnitude and persistence of the market's response over a defined event window (MacKinlay, 1997). In an informationally efficient market, abnormal returns should be short-lived and dissipate quickly as prices adjust to new information. Persistent or asymmetric CARs, by contrast, are commonly interpreted as evidence of delayed adjustment, behavioural responses, or structural frictions.

Event studies are particularly useful in emerging markets like Qatar, where information asymmetries, episodic liquidity, and external shocks can amplify price reactions. Using high-frequency data around narrow event windows, the methodology allows direct observation of adjustment dynamics rather than inferring efficiency from long-horizon returns (Campbell, Lo & MacKinlay, 1997). This makes the event-study approach especially valuable for analysing how different sectors of the Qatar Stock Exchange (QSE) absorb and transmit shocks.

2.3.2.1 Methodological Foundations

A standard event study is implemented in three stages as enumerated in Figure 3. First, the event date (t_0) and event window (t_3 - t_4) to capture both immediate and short-term market reactions. Second, an estimation window (t_1 - t_2), usually between 120 to 250 trading days prior, which serves as the baseline for modelling AR in the absence of the shock. Third, ARs are computed as the difference between observed and expected returns, and summing ARs over the event window yields cumulative CAR, capturing the magnitude and persistence of the market response (Brown & Warner, 1980, 1985; MacKinlay, 1997).

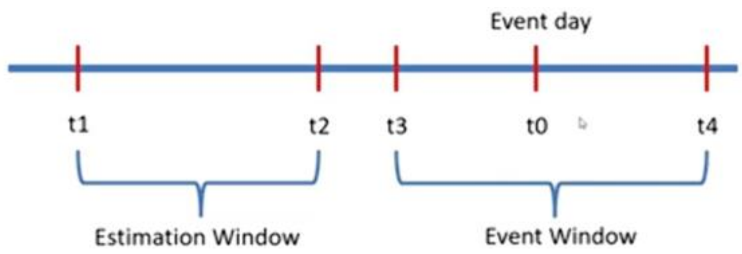

Figure 3: *Timeline of Estimation and Event Windows*

Adapted from (Said et al. 2024)

Expected returns can be estimated using several alternative models. As outlined by Obi, Waweru and Nyangu (2023), common specifications include the risk-adjusted return model based on the CAPM, the market-adjusted return model, and the mean-adjusted return (constant-mean) model. Simulation evidence suggests that, for short-horizon daily data, simpler specifications perform comparably to more complex models, as the variance of abnormal returns is rarely reduced materially by introducing additional risk factors (Brown & Warner, 1985; Kothari & Warner, 2007; Campbell et al., 1998). Consequently, market-model and mean-adjusted approaches remain standard in event studies of emerging markets.

To address potential violations of normality arising from thin trading or concentrated ownership, event studies frequently combine parametric tests with non-parametric procedures such as rank-based tests (Corrado, 1989, 2011). This mixed testing strategy is particularly relevant in the QSE context, where sectoral liquidity and trading intensity vary substantially.

2.3.2.2 Event Study in Qatar

Event studies show that equity markets in hydrocarbon-dependent, concentrated economies respond unevenly to external shocks due to limited diversification, significant state participation, and sensitivity to global commodity and financial cycles. In Qatar, such studies reveal the QSE's reactions to oil-price collapses, geopolitical disruptions, and global health crises. Although these events produce significant abnormal returns, most evidence relies on aggregate indices, leaving sector-level dynamics largely unexplored.

2.3.2.2.1 Oil and Geopolitical Events

Oil and geopolitical shocks have shaped the recent history of the QSE. Charfeddine and Barkat (2020b) show that the 2014-2016 oil-price collapse generated persistent negative abnormal returns and volatility spillovers across GCC markets, reflecting asymmetric responses to adverse information. Ben Cheikh et al. (2021) similarly find that large oil-price declines trigger stronger market reactions than positive shocks, consistent with loss aversion in energy-dependent economies.

The 2017 diplomatic blockade was a defining geopolitical event for Qatar. Al-Khasawneh (2018) and Buigut and Kapar (2020) report immediate negative abnormal returns, with sectoral impacts concentrated in transportation, industrials, and real estate, while banking remained relatively stable due to state support. Although aggregate prices largely corrected within weeks, sector-level evidence highlights uneven adjustment across industries.

2.3.2.2.2 Pandemic and Systemic Shocks

The COVID-19 pandemic and other global shocks provide a useful benchmark for understanding QSE reactions. Al Refai, Zeitun and Eissa (2021) document significant abnormal returns in GCC markets in response to oil-price shocks, while Said et al. (2024) show sharp initial declines followed by heterogeneous recoveries shaped by fiscal and monetary interventions. For Qatar, Al-Alawnh et al. (2025) find that abnormal returns persisted beyond announcement windows, indicating delayed, sector-dependent adjustment. Comparative evidence from Obi, Waweru and Nyangu (2023) shows that geopolitical shocks, such as the Russia–Ukraine conflict, generate immediate negative abnormal returns with partial reversals; developed markets exhibit more persistent CARs, whereas emerging markets, including Qatar, adjust faster but more erratically. Together, these findings highlight the importance of sector-level analysis in understanding the timing, magnitude, and persistence of market reactions under systemic stress.

2.3.2.2.3 Integration within Present Study

Across regions and event types, a consistent insight emerges: aggregate indices obscure meaningful cross-sector differences in event-driven reactions. In a concentrated market such as the QSE, sectors differ in size, liquidity, and exposure to macroeconomic forces, suggesting that event-driven adjustment is unlikely to be uniform.

By applying event-study analysis to sectoral indices across multiple systemic episodes between 2014 and 2025, this study extends the existing literature beyond single-event or aggregate-index approaches. The integration of multiple event windows, sector-specific indices, and efficiency diagnostics allows for a more granular assessment of how different QSE sectors absorb shocks, whether abnormal returns dissipate quickly or persist, and how sectoral behaviour evolves across repeated episodes of stress.

2.4 Research Gaps

Despite a growing body of work on GCC equity markets, research on the QSE remains narrow as most studies either use aggregate market indices or selected firm samples, which conceal the substantial differences in how sectors respond to macroeconomic and geopolitical shocks. For Qatar, evidence on the 2017 blockade, COVID-19 and oil price turbulence is typically framed at the market level, with limited attention to how individual sectors behaved before, during and after these events. This leaves unanswered why some sectors correct quickly while others display persistent volatility or structural weakness.

A similar limitation applies to work on market efficiency. Much of the empirical literature focuses on composite indices, both in the GCC and wider MENA region, and documents time-varying or partial weak-form efficiency using market-wide data. Sector size, liquidity, and concentration are known to shape return dynamics, yet longitudinal weak-form efficiency tests for QSE sector indices are largely absent. Studies on Qatar that do consider sectoral structure, focus on interdependence and spillovers rather than systematic efficiency diagnostics. As a result, it remains unclear whether some sectors have become more informationally efficient than others in the wake of repeated shocks and regulatory reform.

Event-study applications in the QSE context are also fragmented. Existing work on episodes such as the 2017 diplomatic crisis or COVID-19 generally relies on single events, short horizons and aggregate indices. Few studies estimate abnormal returns and cumulative abnormal returns at the sector level, and almost none compare multiple crises within a consistent framework. Consequently, the persistence, asymmetry and cross-sector pattern of event-driven reactions in Qatar remain underexplored, particularly in relation to oil price collapses, the blockade, the World Cup and post-2022 monetary tightening.

Finally, prior studies frequently treat weak-form efficiency testing and event-study analysis in isolation as separate inquiries, which limits interpretation of how informational conditions relate to event-driven market responses. Furthermore, many papers lack robustness checks such as non-event or placebo windows, which have become standard for validating event-study inferences in modern financial research. Without such diagnostics, it is difficult to determine whether observed abnormal returns genuinely reflect event-specific information or instead arise from underlying structural features of the market.

In response, this dissertation adopts a unified, multi-event framework that combines weak-form efficiency testing, event-study analysis and placebo-window robustness checks across all QSE sectors. This integrated design allows a comprehensive assessment of how sector-level returns adapt to successive macroeconomic and geopolitical shocks within Qatar's concentrated, evolving market structure and fills a clear gap in the existing literature.

2.5 Summary

This chapter has reviewed the theoretical and empirical literature relevant to sector-level behaviour on the QSE. It outlined how emerging and GCC markets combine structural concentration, policy dependence and exposure to external shocks, making sectoral analysis more informative than aggregate indices. Therefore, the QSE is situated within this context highlighted its evolving sectoral structure and summarised evidence on weak-form efficiency and event-driven reactions in MENA and GCC markets, including Qatar.

The next chapter outlines the methodological design used to implement this framework, detailing the data, estimation procedures and statistical tests for the empirical analysis.

Chapter Three: Methodology

3.1 Introduction

This chapter explains the methods used in the analysis. The study adopts a sector-level, longitudinal, event-driven design to examine how different segments of the QSE respond to major economic and geopolitical shocks. Rather than relying on external macroeconomic regressors, the framework focuses on price-based measures of market behaviour, allowing abnormal return dynamics and efficiency patterns to be directly attributed to identifiable events. The methodology also incorporates placebo (non-event) testing to validate the robustness of the empirical results.

3.2 Research Design

This study employs a quantitative, event-driven, longitudinal research design tailored to the QSE, which is highly concentrated, exhibits uneven liquidity across sectors, and responds strongly to external shocks, creating conditions that make sector-level, rather than aggregate-index, analysis more appropriate for examining return cycles, efficiency, and shock sensitivity.

Daily returns on sectoral indices - Banking & Financial Services (QBNK), Industrials (QIND), Real Estate (QREA), Consumer Goods & Services (QCON), Telecommunications (QTLC), Transportation (QTRN), and Insurance (QINS) and the QE All Share Index (QEAS) are used. These capture short-horizon price adjustments, serial dependence, and abnormal returns, a standard frequency in empirical finance that supports tests of weak-form efficiency and event-study methods (Fama, 1965; Fama et al., 1969; Brown & Warner, 1985; MacKinlay, 1997). The sectoral indices which reduce firm-specific noise and thin-trading effects while preserving cross-sector variation. This approach ensures comparability over time and aligns with evidence that inefficiencies in MENA markets are episodic and intensify during periods of stress, supporting an event-driven framework (Al-Khazali, Ding & Pyun, 2007; Elhami & Hefnaoui, 2018; Dalili & Boussedra, 2023).

The three core analytical stages that underpin this design are summarised below; with Table 2 linking each technique to the study's objectives and theoretical foundations:

1. **Descriptive Statistics:** Summarises log-transformed daily returns, assesses distributional properties, and maps cyclical highs, lows, and volatility regimes using rolling statistics. It provides baseline context for later tests of AR and serial dependence.

2. **Weak-Form Efficiency Testing:** assessed using three complementary techniques, each capturing a different dimension of return randomness:

   a) **Autocorrelation Analysis (ACF / Ljung–Box Q):** Detects linear dependence in returns. Significant autocorrelation suggests short-term predictability and deviation from weak-form EMH (Kendall, 1953; Fama, 1965; Lo & MacKinlay, 1988)

   b) **Runs Test (Non-parametric):** Evaluates directional randomness without relying on distributional assumptions, suitable for emerging markets with non-normal returns and uneven liquidity (Cowles, 1933; Cootner, 1964; Elhami & Hefnaoui, 2018)

   c) **Lo-MacKinlay Variance Ratio Test:** Examines whether return variance scales linearly with time, a key property of a random walk, and is sensitive to mean reversion and momentum effects in markets with microstructure frictions (Lo & MacKinlay, 1988; Al-Khazali et al., 2007; Hkiri et al., 2021).

3. **Event Study Analysis with Placebo Validation:** Abnormal returns (ARs) and cumulative abnormal returns (CARs) are estimated around defined event windows

Table 2: Analytical Techniques and Alignment with Research Objectives

Technique	Purpose	Research Objective
Descriptive Statistics	Map cycles and volatility patterns.	1
EMH Tests	To test weak-form efficiency.	2
Event Study (AR, CAR, Placebo)	Measure shock sensitivity and validate robustness	3

(Source: Developed by the Author)

In summary, the chosen quantitative event-driven design provides a rigorous yet context-sensitive framework for analysing the QSE. By combining statistical precision with exploratory depth, the study extends empirical finance research on market efficiency and sectoral adaptation within the distinctive institutional and macroeconomic environment of Qatar.

3.3 Methods of Data Collection

This study relies exclusively on secondary time-series data obtained from publicly available and reputable financial databases. The use of secondary data is appropriate given the study's focus on market-wide and sector-level return behaviour, where prices and index values represent the aggregation of information from all market participants. This approach ensures consistency, completeness, and replicability, which are essential for empirical financial analysis.

3.3.1 Data Period and Coverage

The sample period from July 2014 to June 2025 is used because it covers the full availability of QSE sectoral indices and spans multiple systemic shocks affecting Qatar's economy. This extended horizon allows both short-term event reactions and longer-term sectoral cycles examined within a unified framework.

3.3.2 Data Sources and Validation

Sectoral and market index data are obtained primarily from the QSE through its TradingView integration, which provides continuous daily index series. Event dates are independently verified using reports from Al Jazeera, the International Monetary Fund, and the World Bank to ensure accurate identification of information release timing. All sources are cross-checked to eliminate inconsistencies in index values or event dating, thereby strengthening data reliability and temporal accuracy.

3.4 Statistical and Econometric Techniques

To analyse return behaviour consistently across sectors, index levels are first transformed into daily logarithmic returns. This transformation allows meaningful comparison across sectors with different index magnitudes and ensures that subsequent statistical tests are applied to return series rather than non-stationary price levels.

Logarithmic returns also permit additive aggregation across time, which is essential for cumulative return analysis in event-study settings. Returns are computed as:

$$R_{i,t} = \ln\left(\frac{I_{i,t}}{I_{i,t-1}}\right),$$

where $I_{i,t}$ represents the closing index points of sector i at time t.

This transformation is standard practice in empirical asset-pricing research.

3.4.1 Descriptive Statistics and Preliminary Analysis

This section presents an initial examination of QSE sectoral returns, focusing on their central tendency, dispersion, and distribution. Descriptive statistics including mean, standard deviation, minimum, and maximum provide a baseline for comparing sectoral performance, identifying risk profiles, and detecting extreme fluctuations during periods of market stress.

Given that returns in emerging markets often exhibit non-normal, leptokurtic behaviour, skewness and kurtosis are analysed, and the Jarque–Bera test is applied to formally assess normality.

To ensure that the series are suitable for further analysis, stationarity is tested using the Augmented Dickey-Fuller (ADF) tests which reject the null hypothesis of a unit root at the 1% significance level for all sectors, confirming that log first-differenced returns are stationary (Dickey and Fuller, 1981).

To complement numerical diagnostics, visual inspection using rolling means and volatility bands is conducted. This approach highlights sectoral highs and lows, shifts in volatility regimes, and broader cyclical patterns that inform interpretation of subsequent efficiency and event-study results.

3.4.2 Market Efficiency

This stage examines whether QSE sectoral returns incorporate information efficiently over the full sample period, providing a baseline assessment before analysing event-specific behaviour. The analysis is conducted within a weak-form market efficiency framework, where returns are expected to follow a random walk if historical price information offers no predictive power.

Following recent evidence for Qatar and the wider MENA region (Dalili & Boussedra, 2023; Neaime, 2022; Bouri et al., 2021), three complementary tests are applied to capture different dimensions of return randomness. Combining parametric and non-parametric methods enhances robustness against non-normality and volatility clustering. The tests include

i. the autocorrelation test, which detects linear serial dependence.
ii. the Lo-MacKinlay Variance Ratio (VR) test, which evaluates the random-walk hypothesis across multiple return horizons (lags 2, 4, 8, and 16).
iii. the non-parametric Runs test, which assesses randomness in the sequence of returns.

3.4.2.1 Autocorrelation Test

The first diagnostic examines the serial dependence of returns. The autocorrelation function (ACF) measures the linear relationship between a return at time $t$and its lagged values $t-k$. The ACF at lag $k$is defined as:

$$\rho_k = \frac{\sum_{t=1}^{n-k}(R_t - \bar{R})(R_{t+k} - \bar{R})}{\sum_{t=1}^{n}(R_t - \bar{R})^2}$$

Where; R_t denotes the return at time t,

$\bar{R}$ represents the mean return, and

n is the total number of observations.

A value of $\rho_k = 0$indicates serial independence, while statistically significant values indicate serial dependence and deviation from weak-form efficiency (Fama, 1970).

Joint significance across multiple lags is evaluated using the Ljung–Box Q-statistics which are computed for lags 1-10 for each sectoral index to provide a detailed profile of short-term return dependence, which tests whether autocorrelations are collectively different from zero.

3.4.2.2 Runs Test

To complement the autocorrelation test, which captures linear dependence in return magnitudes, the runs test evaluates the randomness of return signs. As a non-parametric method, it is well suited for data that may exhibit non-normality, volatility clustering, or asymmetric behaviour features commonly observed in emerging markets.

A *run* is a sequence of consecutive returns with the same sign. The test compares the observed number of runs $A$to the expected number Eunder the null hypothesis of randomness (Butler & Malaikah, 1992):

$$E = \frac{[N(N+1) - \sum_{i=1}^{3} n_i^2]}{N}$$

where N is the total number of observations and $n_i$is the number of positive, negative, and zero returns. For large samples, the number of runs follows an approximately normal distribution with standard deviation σ_E, allowing computation of the test statistic:

$$Z = \frac{A - E}{\sigma_E}$$

Interpretation of the Z-statistic is as follows:

- **Positive Z:** Observed runs exceed expected runs, indicating frequent alternation between positive and negative returns, suggesting negative serial correlation.
- **Negative Z**: Observed runs are fewer than expected, indicating clustering of similar return signs, suggesting potential trends or positive serial correlation.

The null hypothesis of randomness is rejected at the 5% significance level if |Z| > 1.96.

Together with autocorrelation, the runs test provides a fuller assessment of weak-form efficiency by capturing non-linear dependence patterns that may not appear in magnitude-based measures.

3.4.2.3 Variance Ratio (VR) Test

The final diagnostic applies the Variance Ratio test (VR) to examine whether the variance of multi-period returns increases linearly with the holding period, as implied by a random-walk process. If returns follow a random walk, the variance of k-period returns should equal $k$times the variance of single-period returns, such that the variance ratio equals unity:

$$VR(k) = \frac{\mathrm{Var}(R_t + R_{t-1} + \cdots + R_{t-k+1})/k}{\mathrm{Var}(R_t)}$$

Under the null hypothesis,

- $VR(k) = 1$. Values of $VR(k) > 1$ indicate positive serial correlation (momentum),
- while $VR(k) < 1$ suggests negative serial correlation (mean reversion).

Given the presence of volatility clustering in financial returns, the heteroskedasticity-robust version of the test proposed by Lo and MacKinlay (1988) is applied. This adjustment ensures valid inference even in the presence of time-varying volatility, a prominent feature of QSE return dynamics.

3.4.2.4 Interpretive Framework

Taken together, the autocorrelation, Runs, and Variance Ratio tests provide a balanced evaluation of weak-form efficiency. The parametric diagnostics (autocorrelation and VR) are sensitive to linear dependence and variance-scaling behaviour, while the non-parametric runs test adds robustness in the presence of non-normality, volatility clustering, and outliers which are common features of emerging market returns.

Consistent findings across all three tests would indicate that QSE sectoral returns behave in line with weak-form efficiency. Divergent results, by contrast, signal short-term predictability or structural frictions.

3.4.3 Event Study Framework

The event-study framework assesses how QSE sectoral indices respond to major macroeconomic and geopolitical shocks. Following the short-horizon approach of MacKinlay (1997), detected shocks are assigned event date $\mathbf{t_0}$, corresponding to the first trading day on which new information becomes available to the market. Short-horizon event windows are deliberately employed to isolate market reactions, as longer windows risk contamination from overlapping announcements and unrelated developments in emerging markets.

In an efficient market, prices should adjust quickly once new information becomes public, so abnormal returns on the event day should be close to zero (Fama, 1970). When abnormal return (AR) are statistically significant, this indicates that the market reacts strongly, adjusts slowly, or temporarily overreacts to the event. Therefore, differences across sectors and events variation in AR and Cumulative Abnormal Return (CAR) show whether investors distinguish between shocks affecting expected cash flows and those primarily altering sentiment or risk perceptions.

Expected returns are estimated using a 120-day estimation window ending 15 trading days before each event. The event window spans ±15 trading days around t_0 and is partitioned into sub-periods consistent with recent geopolitical and crisis-focused event studies (Obi et al., 2023; Piccoli, Chaudhuri & Souza, 2017). Specifically:

- **W_A (–15 to +15):** Full event window capturing the overall market impact.
- **W_B (–15 to –1):** Pre-event window capturing early or anticipatory reactions.
- **W_C (+1 to +7):** Inner post-event window capturing immediate adjustment.
- **W_D (+8 to +15):** Outer post-event window capturing continued adjustment.
- **W_E (+1 to +15):** Full post-event window capturing delayed or overreaction effects.

These sub-periods are measured in trading days, excluding weekends and exchange-specific holidays to aid comparison across different stages of adjustment.

3.4.3.1 Market Model Estimation

Expected returns are modelled using the market model, which specifies a linear relation between sectoral returns and the overall market return. It is the most frequently used expected return model and can be presented as follows:

$$E(R_{i,t}) = \alpha_i + \beta_i R_{m,t} \qquad (1)$$

Where, $R_{m,t}$ is the daily return on the QE All Share Index (QEAS), as the market benchmark. The intercept α_i captures sector-specific drift, while β_i measures systematic sensitivity to market movements.

Parameter estimates $\widehat{\alpha_i}$ and $\widehat{\beta_i}$ are obtained through ordinary least squares (OLS) over the estimation window. This specification assumes stable linear dependence between sectoral, and market returns in the absence of an event, allowing any deviation during the event window to be interpreted as an abnormal return (Brown & Warner, 1985).

3.4.3.2 Abnormal and Cumulative Abnormal Returns

AR measure the difference between observed sectoral returns and those predicted by the market model. For sector i at time t, AR are computed as:

Abnormal returns for sector *i* at time *t* are computed as:

$$AR_{i,t} = R_{i,t} - E(R_{i,t}) \qquad (2)$$

To capture the total impact of an event over a given window, abnormal returns are aggregated to form CAR:

$$CAR_{i,(T_1,T_2)} = \sum_{t=T_1}^{T_2} AR_{i,t} \qquad (3)$$

where T_1 and T_2 denote the starting and ending days of the event window.

Positive CARs imply investor optimism or event-induced wealth gains, while negative CARs reflect pessimism or uncertainty and their pattern and persistency provide insights into the market's speed of adjustment and degree of informational efficiency.

3.4.3.4 Interpretive Framework

In this study, ARs and CARs are interpreted as indicators of how quickly QSE sectors incorporate new information following major shocks. Interpretation focuses on the magnitude, and persistence of CARs across the defined event windows rather than on isolated estimates.

CARs that dissipate rapidly after the event are taken as evidence of relatively efficient information assimilation, whereas CARs that persist or adjust gradually indicate delayed price adjustment and temporary departures from efficiency, followed by corrective behaviour. This pattern is consistent with evidence of gradual information diffusion in emerging markets (Obi, Waweru & Nyangu, 2023).

Finally, the window-based structure enables a clear separation between anticipatory behaviour, immediate market reaction, and post-event correction, ensuring that sectoral responses are evaluated in relation to the timing of information arrival rather than treated as static outcomes. This approach allows differences in sectoral sensitivity and adjustment speed to be assessed systematically across events.

3.4.4 Robustness (placebo)

To confirm that AR identified around major events are genuinely information-driven rather than artefacts of model specification or sample structure, a placebo (pseudo-event) test is implemented as a robustness check. First, the established shock event windows and their associated estimation periods are excluded to avoid contamination then a neutral date corresponding to the median trading day within the remaining non-event period is selected.

The null expectation for the placebo test is that no significant abnormal returns should appear, since no genuine informational event has occurred. This design allows the study to verify whether the event-study framework produces spurious signals in the absence of real shocks and thereby strengthens the internal validity of the main results.

3.5 Ethical Considerations

This study is based exclusively on secondary data and does not involve direct interaction with human participants, thereby presenting minimal ethical risk. Nonetheless, ethical considerations have been thoroughly integrated to ensure the research adheres to principles of integrity, transparency, and academic rigour. The study complies fully with the ethical guidelines of Liverpool John Moores University (LJMU) and Oryx Universal College (OUC).

The data utilised comprise publicly available historical sectoral indices and event timelines, sourced from reputable platforms such as the QSE (via TradingView), the IMF, the World Bank, Al Jeezera and official government publications. As no personal, confidential, or proprietary data were used, concerns regarding consent and privacy are not applicable.

All sources have been properly cited using the Harvard referencing style. The analysis was conducted without data manipulation or selective reporting, and findings are presented objectively, including those that diverge from expected outcomes. A Research Ethics Approval Form was submitted, detailing the use of non-human, secondary data, the analytical methods applied, and confirmation that no sensitive datasets were accessed. The project was classified as low-risk and approved.

In conclusion, although this research is based solely on secondary, non-sensitive data, strict adherence to ethical principles has ensured that the study maintains academic rigour, transparency, and compliance with institutional guidelines.

In summary, although the research is based solely on secondary, non-sensitive data, strict adherence to ethical standards has ensured compliance, transparency, and academic rigour.

3.6 Summary

This chapter outlined the methodological framework used to analyse sectoral return behaviour, weak-form efficiency, and event-driven price reactions on the QSE over 2014-2025. A quantitative longitudinal design was adopted, integrating descriptive analysis, efficiency diagnostics, and a structured event-study framework to address the study's objectives.

Descriptive statistics establish baseline sectoral characteristics and volatility patterns, while weak-form efficiency is assessed using autocorrelation, Runs, and Variance-Ratio tests to evaluate return randomness and short-term dependence. Event-study analysis estimates abnormal and cumulative abnormal returns around major macroeconomic and geopolitical shocks using multiple short-horizon windows.

Internal validity is reinforced through a placebo test, which applies the same estimation framework to a non-event date to confirm that significant abnormal returns arise only in response to genuine information shocks. Together, these methods provide a coherent and transparent empirical foundation for the analysis presented in Chapter Four. Figure 4 summarises the methodological structure adopted in this study.

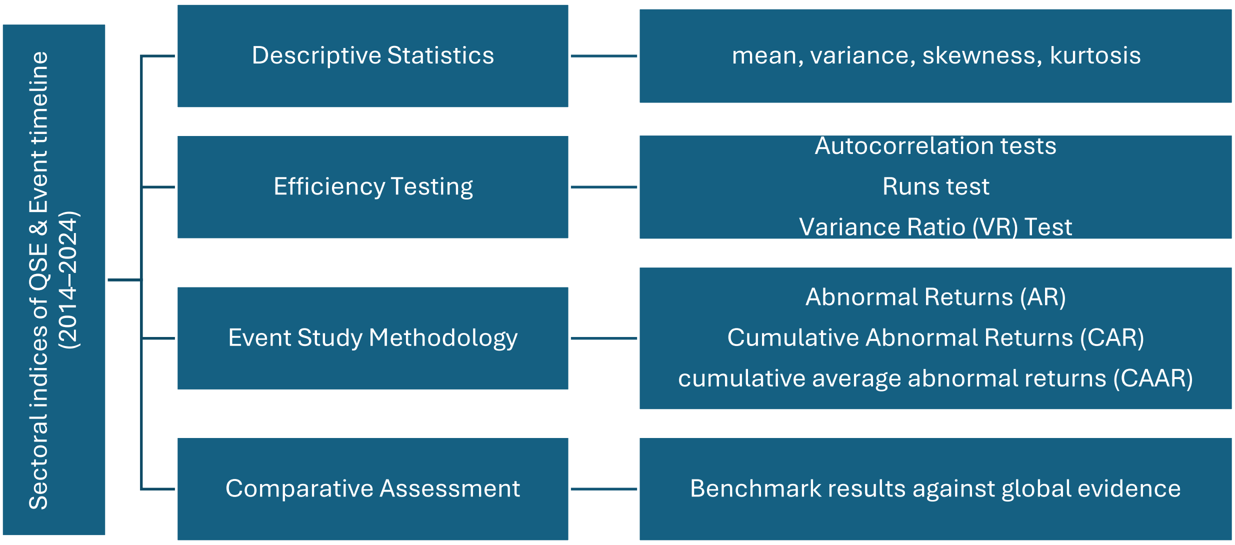

Figure 4: *Methodological Framework*
(Source: Developed by the Author)

Chapter 4: Results and Findings

4.1 Introduction

This chapter presents the empirical results for the period July 2014 to June 2025, following the structure established in chapter 3. The analysis begins with descriptive statistics and preliminary diagnostics, then proceeds to tests of weak-form efficiency, and reports the results of the multi-event event-study analysis, including placebo-based robustness checks.

To improve clarity and avoid repetition, the main text focuses on interpretation, cross-sector comparisons, and the economic significance of the findings. While detailed Stata outputs, correlograms, and supplementary figures are reported in the Appendix.

Finally, it concludes with an integrated synthesis of sectoral behaviour, highlighting differences in the speed of price adjustments and the persistence of deviations around major market events.

4.2 Descriptive Statistics and Preliminary Analysis

Table 3: Descriptive statistics, Jarque-Bera test and ADF test

	QEAS	QBNK	QCON	QIND	QREA	QTLC	QTRN	QINS
Min	-0.1000	-0.1012	-0.0982	-0.0996	-0.1047	-0.1052	-0.1028	-0.0921
Median	0.0002	0.0001	0.0002	0.0001	-0.0001	0.0000	0.0000	-0.0002
Mean	0.0001	0.0002	0.0000	-0.0000	-0.0002	0.0001	0.0004	-0.0002
Max	0.0727	0.0605	0.0943	0.0831	0.0952	0.0953	0.0911	0.0865
Std. Deviation (σ)	0.0097	0.0108	0.0102	0.0117	0.0156	0.0147	0.0119	0.0141
Skewness	-0.7807	-0.3731	-0.6441	-0.4047	-0.3211	-0.2071	-0.0944	0.0852
Kurtosis	14.2608	9.7332	20.3373	10.3035	9.2388	10.3191	12.5822	7.5965
JB Statistic	14609.95	5187.80	34165.91	6103.74	4446.49	6074.87	10383.44	2389.80
JB p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ADF (Z(t))	-35.473	-36.053	-34.452	-34.942	-35.987	-38.180	-36.899	-37.922
ADF p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ADF (1% Critical Value)	-3.43	-3.43	-3.43	-3.43	-3.43	-3.43	-3.43	-3.43

(Source: Author's computation using Stata 17)

Table 3 summarises the distributional properties of daily returns provide baseline evidence on central tendency, dispersion, distributional shape, and stationarity, which informs the interpretation of market efficiency and event-study results in subsequent sections.

The descriptive statistics indicate that daily returns on the QE All Share Index (QEAS) range from -0.1000 to 0.0727, with a mean return of 0.00007 and a standard deviation of 0.0097. The median return is slightly positive, suggesting limited asymmetry around the central tendency despite the presence of extreme observations. Sectoral returns exhibit wider dispersion than the aggregate market index. In particular, the Real Estate (QREA) and Telecommunications (QTLC) sectors display the highest volatility, with standard deviations of 0.0156 and 0.0147, respectively, whereas Banking (QBNK) and Consumer Goods (QCON) are comparatively less volatile. These differences point to substantial heterogeneity in risk across sectors, which would be obscured if analysis were confined to the market index alone.

Return distributions are markedly asymmetric and fat-tailed. Skewness is predominantly negative across sectors, indicating heavier left tails and more pronounced downside movements. Kurtosis values substantially exceed the normal benchmark for all indices, reaching 20.34 for QCON and exceeding 10 for most sectors. This confirms that return distributions are leptokurtic, a well-documented feature of equity returns, particularly in emerging markets. Consistent with this evidence, the Jarque-Bera test (JB) strongly rejects the null hypothesis of normality for all series at the 1% significance level.

Stationarity of returns assessed using the ADF test at the 1% significance level, showed a critical value of -3.43 for all sectors with statistically significant p-values at 5% level., remains constant due to similar sample sizes and trend specifications. All ADF statistics fall well below this threshold, providing compelling evidence to reject the unit-root null hypothesis and confirming that sectoral returns are stationary, making them suitable for weak-form efficiency and event-study analyses.

Overall, the data indicates that QSE sectoral returns differ in volatility, non-normally distributed, and stationary in levels.

4.3 Identification of Market Cycles and Event Windows

This section identifies market-wide cycles and corresponding event windows that anchor the subsequent event-study analysis. To avoid conflating system-level movements with sector-specific noise, the analysis focuses exclusively on the QE All Share Index (QEAS), which serves as the most comprehensive benchmark for overall market conditions on the QSE.

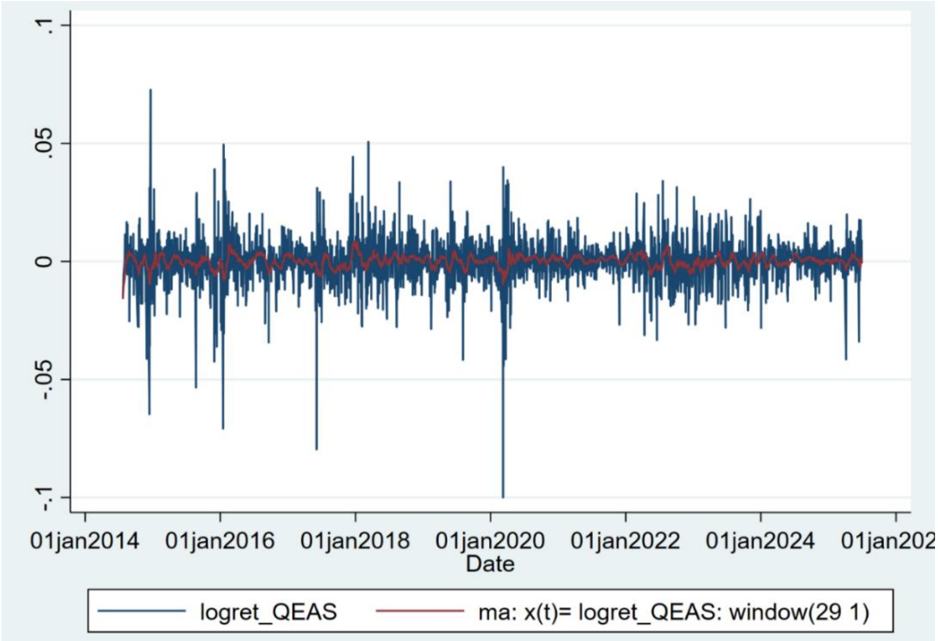

Figure 5: *QE All Share Index (QEAS) Return Cycles and Market Turning Points*

Source: Author's computation (Stata 17)

Table 4: *Summary Systemic Events and Event-Study Windows*

	Event	Event Date (t_0) [D-M-Y]	Estimation window (t_1) -135 Days	Pre-Event window (t_2) -15 Days	Post-Event window (t_3) +15 Days	News Source
1	Oil collapse	12-01-2016	25-06-2015	22-12-2015	02-02-2016	Al Jazeera
2	GCC blockade	05-06-2017	22-11-2016	15-05-2017	03-07-2017	Al Jazeera
3	COVID-19 pandemic (first confirmed case)	02-03-2020	19-08-2019	06-02-2020	24-03-2020	Al Jazeera
4	Russia-Ukraine War (full-scale invasion)	24-02-2022	17-08-2021	2022-02-09	20-03-2022	Al Jazeera
5	FIFA World Cup (opening match)	20-11-2022	10-05-2022	02-02-2022	11-12-2022	FIFA Official
6	Iran missile strike (Next trading day used)	24-06-2025	26-11-2024	28-05-2025	14-07-2025	Al Jazeera

Source: *Author's compilation from verified financial and media databases.*

Figure 5 shows market-wide cycles based on daily log returns and rolling means, with major inflection points aligning with verifiable external shocks rather than random variation. The series exhibits clear contraction and recovery phases linked to key macroeconomic and geopolitical events in Qatar between 2014 and 2025. Pronounced troughs occur during the global oil price collapse (2014-2016), the June 2017 GCC blockade, and the onset of COVID-19 in March 2020. Positive deviations appear in late 2022 around the FIFA World Cup, with shorter-lived disturbances associated with the Russia-Ukraine conflict in early 2022 and the Iran missile strike in June 2025.

Based on these identified turning points, six major events are selected for formal event-study analysis and summarised in Table 4. For the June 2025 Iran missile strike, the event date is set to 24 June 2025, as the incident occurred after QSE market close on 23 June 2025. The following trading day therefore represents the first point at which prices could adjust.

Together, Figure 5 and Table 4 provide an empirically grounded link between observed market cycles and the subsequent event-study analysis, establishing a consistent baseline for examining sectoral responses.

4.4 Weak-Form Efficiency Results

This section tests whether QSE's sectoral returns follow a random walk, as implied by the EMH. If so, past returns should not predict future movements. To evaluate this, three complementary diagnostics are applied:

i. Autocorrelation tests to identify serial dependence;
ii. Runs tests to examine randomness in return signs; and
iii. the Lo–MacKinlay variance-ratio (VR) test for random-walk over multiple horizons.

Together, these provide a multidimensional perspective on the short-term informational efficiency of the QSE.

4.4.1 Autocorrelation Analysis

Autocorrelation analysis tests whether past returns predict future price movements, implying weak-form inefficiency. Serial dependence is assessed using the Ljung–Box Q-statistic at selected Lags and supported by ACF plots with 95% confidence bands (Figures 6-13).

Table 5 reports Ljung–Box statistics at Q(1), Q(5), and Q(10), representing immediate dependence, short-run adjustment, and persistence over approximately two trading weeks. Q(10) statistics serves as the primary inferential benchmark because it jointly tests serial correlation over a short horizon while remaining robust to isolated lag effects. Full results for lags 1–10 are reported in Appendix D.

Table 5: Test (Ljung–Box Q) Ljung–Box Test for Autocorrelation

Sector	Q(1)	Q(5)	Q(10)	Q(10) p-value	Decision at 5%
QEAS	31.42	53.73	68.73	0.000	Reject H_0
QBNK	14.91	27.33	50.01	0.000	Reject H_0
QCON	4.40	19.99	31.69	0.000	Reject H_0
QIND	30.52	50.52	55.54	0.000	Reject H_0
QREA	37.75	55.29	64.80	0.000	Reject H_0
QTLC	1.47	3.31	17.14	0.071	Fail to reject H_0
QTRN	2.44	9.71	21.19	0.020	Reject H_0
QINS	3.02	4.47	23.43	0.009	Reject H_0

Source: Author's computation (Stata 17)

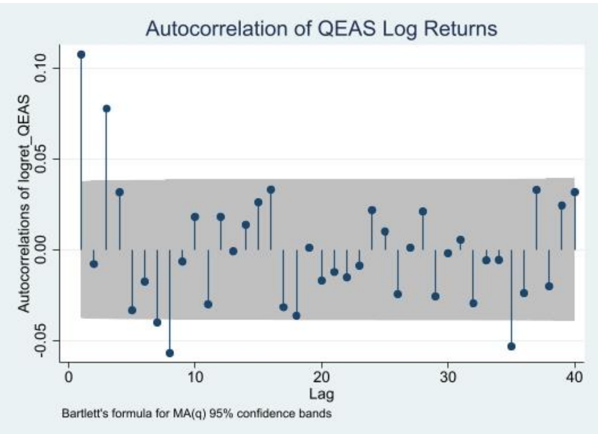

Figure 6: *ACF of QEAS*

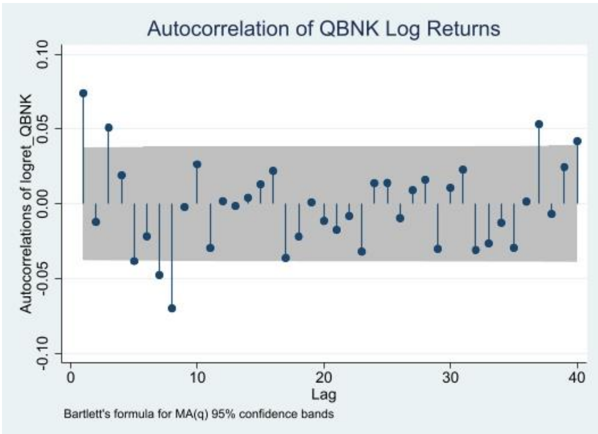

Figure 7: *ACF of QBNK*

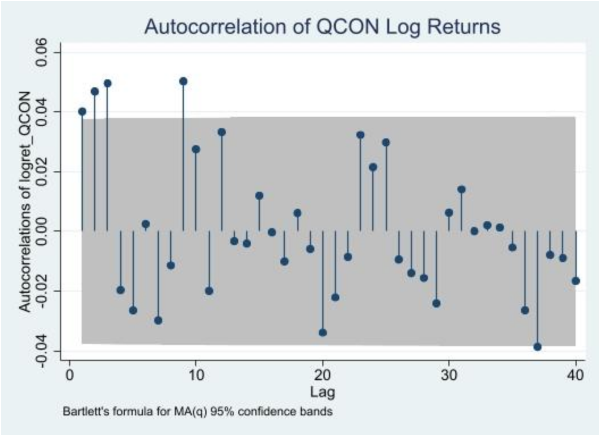

Figure 8: *ACF of QCON*

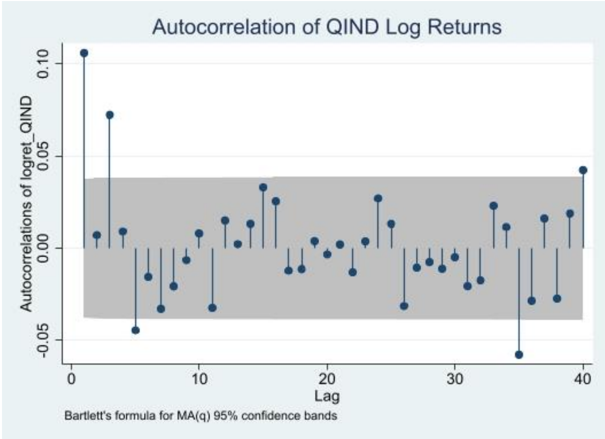

Figure 9: *ACF of QIND*

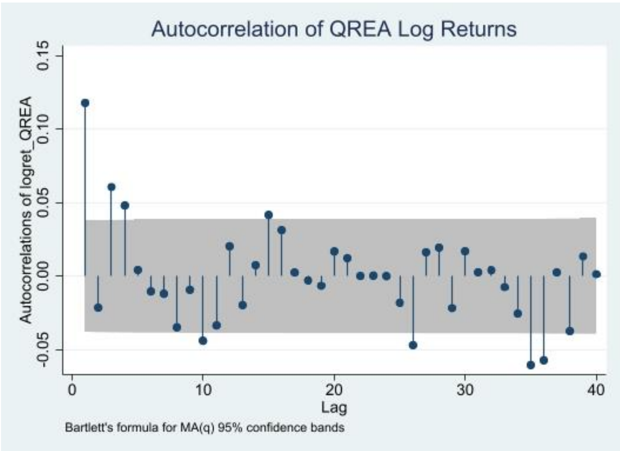

Figure 10: *ACF of QREA*

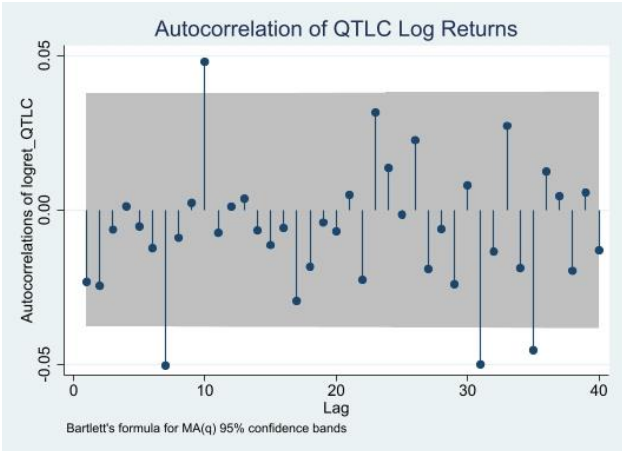

Figure 11: *ACF of QTLC*

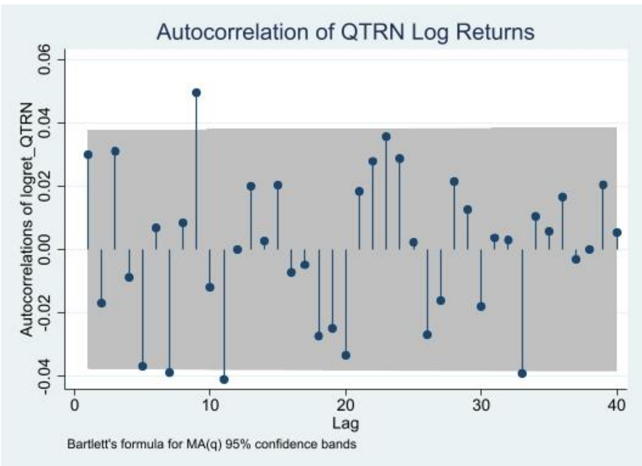

Figure 12: *ACF of QTRN*

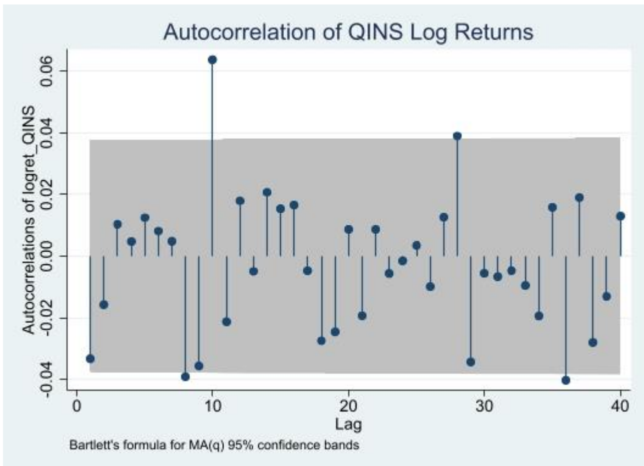

Figure 13: *ACF of QINS*

The market-wide index (QEAS) exhibits strong evidence of serial dependence. The null hypothesis of no autocorrelation is rejected at all horizons, with a Q(10) statistic of 68.73 and a p-value below 0.001. The corresponding ACF plot (Figure 6) displays pronounced positive autocorrelation at early lags that decays gradually, indicating short-memory dynamics rather than long-range persistence. This pattern suggests that market-level returns do not adjust instantaneously to new information, allowing for short-term predictability that diminishes over time.

Comparable dynamics are observed in the Banking (QBNK), Industrials (QIND), and Real Estate (QREA) sectors. All three sectors reject the null hypothesis across Q(1), Q(5), and Q(10), with test statistics that are highly significant at the 1 percent level. Their ACF plots (Figures 7, 8, and 10) show strong early-lag autocorrelation followed by gradual attenuation, consistent with delayed information assimilation. In the Real Estate sector, autocorrelation is both larger in magnitude and more persistent, reflecting liquidity constraints, valuation smoothing, and slower price discovery typical of property-related assets.

Consumer Goods (QCON) also rejects the null hypothesis at Q(10), although the associated Q-statistics are smaller than those observed in Banking and Industrials. The ACF plot (Figure 8) reveals intermittent short-run dependence rather than sustained persistence, indicating episodic predictability consistent with partial weak-form efficiency.

By contrast, Telecommunications (QTLC) shows no statistically significant evidence of autocorrelation. The Q(10) statistic of 17.14 with a p-value of 0.071 fails to reject the null hypothesis, and the ACF coefficients in Figure 11 remain within the 95 percent confidence bands across all lags. This behaviour is consistent with returns that approximate a random walk and adjust efficiently to new information.

Transportation (QTRN) and Insurance (QINS) exhibit intermediate behaviour. Both sectors reject the null hypothesis at Q(10), but their ACF plots (Figures 12 and 13) display only isolated significant spikes rather than systematic early-lag persistence. This suggests episodic serial dependence, where short-term predictability arises intermittently in response to sector-specific news or cyclical conditions rather than reflecting persistent inefficiency.

Overall, the results reveal substantial heterogeneity in weak-form efficiency across the QSE. The aggregate market index, along with the Banking, Industrials, and Real Estate sectors, exhibits statistically significant short-term predictability consistent with delayed price adjustment. Telecommunications appears to be the most informationally efficient sector, while Consumer Goods, Transportation, and Insurance occupy an intermediate position characterised by occasional dependence. These findings provide a clear empirical foundation for the event-study analysis that follows, where abnormal returns can be interpreted as meaningful deviations from normal price behaviour.

4.4.2 Runs Test of Randomness

While autocorrelation analysis captures linear dependence in returns, it does not test whether return directions follow a random sequence. The runs Test addresses this by examining the ordering of positive and negative returns around the mean without distributional assumptions, making it well suited to emerging markets such as Qatar, where non-normality and volatility clustering are common. Table 9 reports runs Test Z-statistics and p-values while the full results are provided in Appendix D.

Table 6: Runs Test of Randomness

Sector	Z-stats	p-value	Decision (5%)	Interpretation
QEAS	−5.2335	0.0000	Reject H_0	Non-random pattern; persistent serial clustering
QBNK	−3.0148	0.0026	Reject H_0	Moderate serial dependence; clustered positive runs
QCON	−1.3183	0.1874	Fail to reject	Random sign changes; consistent with weak-form efficiency
QIND	−4.3865	0.0000	Reject H_0	Strong dependence; serially correlated return signs
QREA	−2.5504	0.0108	Reject H_0	Mild predictability; partial inefficiency
QTLC	0.6759	0.4991	Fail to reject	Random sequence; relatively efficient sector
QTRN	−2.8670	0.0041	Reject H_0	Significant clustering; persistence in return direction
QINS	3.8025	0.0000	Reject H_0	Positive autocorrelation; momentum-type bias

Source: Author's computation (Stata 17)

At the aggregate level, QEAS strongly rejects the null hypothesis of randomness (Z = -5.23, p < 0.001), indicating pronounced clustering of return signs. This confirms that market-wide returns tend to move in persistent sequences of gains or losses rather than alternating randomly, reinforcing the presence of short-term predictability identified in the autocorrelation analysis.

Banking (QBNK) and Industrials (QIND) display similar behaviour, exhibiting statistically significant negative Z-statistics (-3.01 and -4.39). These results indicate sustained directional dependence, suggesting that return adjustments in these sectors occur gradually rather than instantaneously. This is consistent with their strong exposure to macroeconomic conditions, liquidity cycles, and policy signals.

Real Estate (QREA) and Transportation (QTRN) also reject the null hypothesis, though with smaller magnitudes. The evidence points to episodic clustering of returns rather than continuous predictability, reflecting sector-specific frictions such as illiquidity, project-based cash flows, and sensitivity to discrete economic events.

In contrast, Telecommunications (QTLC) and Consumer Goods (QCON) fail to reject the null hypothesis, suggesting that return signs in these sectors are approximately random. This finding is consistent with the autocorrelation results and supports the view that these sectors adjust more rapidly to new information.

Insurance (QINS) exhibits a distinct pattern, with a positive and statistically significant **positive** Z-statistic ($Z = 3.80$, $p < 0.001$), indicating momentum-type behaviour characterised by clustering of positive returns. This may reflect delayed correction following favourable sector-specific or regulatory developments.

In summary, the runs test shows that most QSE sectors exhibit non-random return behaviour, reflecting varying degrees of serial dependence in direction. Negative Z-values across QEAS, QBNK, QIND, QREA, and QTRN point to clustering of losses or gains, consistent with slow adjustment. The Insurance sector's positive Z indicates momentum-driven sequences, while QCON and QTLC show random sign flows consistent with weak-form efficiency. When considered alongside the autocorrelation results, these findings provide robust evidence of heterogeneous information assimilation across QSE sectors.

4.4.3 Lo-MacKinlay Variance-Ratio Results

The VR test provides a complementary perspective on weak-form efficiency by examining whether return variance scales linearly with the investment horizon, as implied by a random-walk process. Unlike autocorrelation and runs tests, which focus on short-run dependence and sign randomness, it assesses whether deviations from efficiency persist or correct over longer horizons.

Table 7 reports the heteroskedastic-robust VR statistics across horizons of 2, 4, 8, and 16 trading days. Interpretation focuses on the longest horizon (lag 16), which captures whether short-run deviations identified in earlier tests persist or are corrected over time.

Table 7: Variance-Ratio Test

Sector	Lag 2		Lag 4		Lag 8		Lag 16		p-value (Overall)
	VR	R-stat	VR	R-stat	VR	R-stat	VR	R-stat	
QEAS	0.5646	−22.61	0.2719	−20.21	0.1487	−14.94	0.0685	−10.97	0.000
QBNK	0.5470	−23.53	0.2658	−20.38	0.1453	−15.00	0.0669	−10.99	0.000
QCON	0.4956	−26.20	0.2659	−20.37	0.1321	−15.23	0.0660	−11.00	0.000
QIND	0.5553	−23.11	0.2776	−20.05	0.1434	−15.04	0.0690	−10.97	0.000
QREA	0.5769	−21.98	0.2696	−20.27	0.1468	−14.98	0.0697	−10.96	0.000
QTLC	0.5013	−25.90	0.2447	−20.96	0.1239	−15.38	0.0623	−11.05	0.000
QTRN	0.5242	−24.72	0.2604	−20.53	0.1281	−15.30	0.0655	−11.01	0.000
QINS	0.5470	−23.5299	0.2658	−20.3757	0.1453	−15.0031	0.0669	−10.9906	0.000

Source: Author's computation (Stata 17)

Across all indices, the variance ratios are consistently and significantly below unity, with p-values of 0.000 at all horizons. For the market-wide QEAS index, the VR declines sharply from 0.56 at lag 2 to 0.07 at lag 16, accompanied by strongly negative test statistics. This pattern indicates pronounced mean-reverting behaviour, whereby short-term price deviations are systematically corrected over time rather than compounding.

A similar structure is observed in Banking (QBNK), Industrials (QIND), and Real Estate (QREA). These sectors exhibit variance ratios at lag 16 clustered around 0.07, closely mirroring the market index. The magnitude and persistence of mean reversion in these sectors suggest that although prices display short-run dependence, such deviations do not persist indefinitely and are eventually reversed. This behaviour is consistent with delayed information assimilation followed by corrective trading, particularly in sectors characterised by higher capital intensity, policy sensitivity, or liquidity frictions.

Consumer Goods (QCON), Transportation (QTRN), and Insurance (QINS) also display statistically significant mean reversion, though with slightly less pronounced magnitudes. Their variance ratios at longer horizons remain well below unity, indicating contrarian adjustment rather than momentum-driven persistence. Telecommunications (QTLC) shows the weakest degree of mean reversion among all sectors; however, its variance ratios remain statistically below one, confirming that even sectors exhibiting near-random behaviour in short-run diagnostics ultimately display corrective dynamics.

Overall, the variance-ratio results highlight two key findings. First, weak-form inefficiencies in the QSE are predominantly short-lived. Although earlier tests detect serial dependence and non-random behaviour in several sectors, the VR results demonstrate that these effects dissipate over medium horizons. Second, the prevalence of mean reversion across sectors supports the use of short-horizon event-study windows.

4.4.4 Synthesis and Interpretation

Taken together, the three diagnostics (ACF, RUNS test and VR) analysis indicate that weak-form efficiency in the QSE is neither uniform across sectors nor persistent over time. Banking, Industrials, Real Estate, and the market index exhibit statistically significant short-run predictability, reflecting delayed information assimilation and sector-specific frictions. By contrast, Telecommunications and Consumer Goods display faster adjustment and behaviour closer to a random walk. Crucially, the variance-ratio evidence shows that deviations from efficiency are short-lived, with strong mean-reverting dynamics dominating at longer horizons across all sectors. This combination of short-run dependence and medium-run correction characterises the QSE as an emerging market with transient inefficiencies rather than structural predictability, providing a coherent empirical foundation for the event-study analysis that follows, where abnormal returns can be interpreted as genuine responses to discrete shocks.

4.5 Event Study Results

This section reports how QSE sector indices responded to the six identified shocks between 2014 and 2025. Results are presented in two layers. First, event-day AR summarise the immediate repricing at t_0. Second, CAR across the event windows capture the speed and persistence of adjustment, allowing sectoral comparison of anticipation, impact, and post-event correction. Full Stata outputs including p-values, standard deviations, t-statistics, and CAR plots are provided in the Appendix.

4.5.1 Abnormal Returns (Event-Day Effects)

This section reports event-day abnormal returns (ARs), capturing the immediate market reaction to each shock. Since event-day ARs isolate the unanticipated component of information arrival, they provide a direct test of whether shocks generated statistically meaningful price adjustments at the point of impact.

Overall, statistically significant ARs are relatively infrequent, indicating that much of the information surrounding these events was either anticipated or rapidly incorporated into prices. Where significance does occur, however, the magnitudes are economically meaningful and concentrated in sectors directly exposed to the dominant transmission channel of the shock, rather than at the market-wide level.

Table 8: Abnormal Returns on Event Day (t_0)

Event	QBNK	QCON	QIND	QREA	QTLC	QTRN	QINS
Oil Price Crash	-0.02	-0.90	0.05	0.74	1.22	-2.11**	0.23
GCC Blockade	2.31***	-5.95***	-1.32*	-0.67	1.98	-6.58***	0.42
COVID-19	0.09	-0.40	-0.90*	0.02	2.45**	1.20	0.44
Russia-Ukraine War	0.26	-0.90*	0.25	-0.68	-0.35	0.01	-2.54***
FIFA World Cup	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iran Missile Strike	-0.27	0.01	-0.53	1.49**	1.35	1.30	0.36

Notes: Values in %; *** *$p < 0.01$ (1 % level); ** $p < 0.05$ (5 % level); * $p < 0.10$ (10 % level)*

Source: Author's computation (Stata 17)

As shown in Table 8, the 2017 GCC Blockade generates the most pronounced event-day reactions in the sample. Consumer Goods (-5.95%), Transportation (-6.58%), and Banking (+2.31%) exhibit large and statistically significant ARs, while Industrials record a smaller negative response (-1.32%). These values represent the largest single-day deviations observed across all events and sectors, underscoring the salience of the blockade as a locally binding shock.

By contrast, global shocks produce more muted immediate responses. During the COVID-19 announcement, only Telecommunications posts a positive and significant AR (+2.45%), while Industrials show a marginally negative reaction (-0.90%). Similarly, the Russia-Ukraine conflict yields limited event-day effects, with Insurance recording a significant negative AR (-2.54%), while other sectors remain statistically neutral.

Event-day responses to commodity and geopolitical shocks in later years are notably subdued. The oil price collapse is associated with a significant AR only in Transportation (-2.11%), while the Iran missile strike produces a modest but significant positive reaction in Real Estate

(+1.49%). In contrast, no sector displays a statistically significant AR on the event day of the 2022 FIFA World Cup, indicating the absence of an immediate repricing effect at t_0.

Across all six events, two empirical regularities emerge. First, event-day ARs are highly sector-specific, with significance confined to industries most directly exposed to each shock. Second, market-wide reactions are largely absent, suggesting that adjustment primarily occurs through relative price movements rather than uniform market repricing.

Taken together, the evidence shows that statistically significant AR are infrequent and sector-specific, occurring primarily when shocks are unexpected and directly relevant to sectoral cash flows. Most events do not trigger immediate market-wide repricing, underscoring the importance of examining CARs to capture delayed and asymmetric adjustment patterns.

4.5.2 Cumulative Abnormal Returns (CAR)

CARs are analysed across multiple event windows using subperiods (W_A-W_E). Specifically, W_A corresponds to Total Event Window (-15 to +15), W_B to Pre-Event Window (-15 to -1), W_C to Post-Event Inner Window (+1 to +7), W_D to Post-Event Outer Window (+8 to +15), and W_E to Post-Event Extended Window (+1 to +15). Then, tables 9 to 14 report CAR estimates using identical window definitions to ensure comparability across events and sectors. The analysis emphasises the direction, magnitude, and statistical significance of CARs, while Cumulative Average Abnormal Returns (CAARs) summarise average sectoral effects.

4.5.2.1 2016 Oil Price Crash

Table 9: Oil Price Crash (CAR)

Oil Price Crash (12th Jan 2016)								
Window	**QBNK**	**QCON**	**QIND**	**QREA**	**QTLC**	**QTRN**	**QINS**	**CAAR**
W_A	-0.10	-2.96	1.55	-4.74	20.53**	-7.29	2.95	1.69
W_B	-1.17	-1.84	3.37*	-1.96	10.32**	−2.60	-2.55	0.57
W_C	1.24	-6.74***	-1.29	-1.89	11.79***	−2.98	1.59	0.36
W_D	-0.15	6.52**	-0.58	-1.63	−2.80	0.39	3.67	0.87
W_E	1.09	-0.22	-1.87	-3.52	8.99*	-2.58	5.27	1.23

Notes: Values in %; **** $p < 0.01$ (1 % level); ** $p < 0.05$ (5 % level); * $p < 0.10$ (10 % level)*

Source: Author's computation (Stata 17)

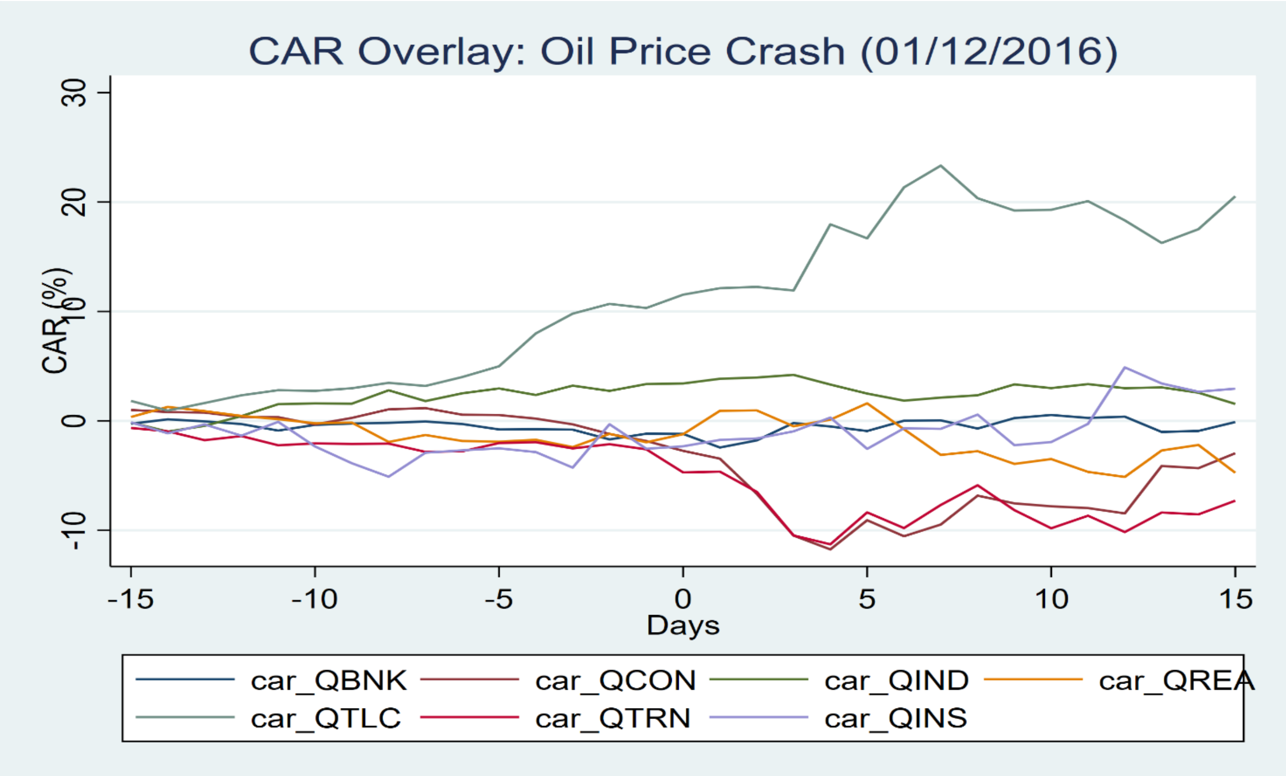

Figure 14: *Sectoral CAR Plots around the Global Oil Price Collapse*

Table 9 and Figure 14 provides a dynamic view of pre and post shock adjustment across sectors

- Over the full window W_A, reactions are clearly asymmetric: Telecommunications (QTLC= +20.53%,) large positive CAR with a significance level of 5% while Transportation (QTRN = -7.29%) and Real Estate (QREA = -4.74%) move sharply lower, and Consumer Goods (QCON = -2.96%) drifts into negative territory. Banking remains effectively neutral (QBNK = -0.10%), and the aggregate CAAR of +1.69% is insignificant, indicating that the shock was transmitted unevenly across sectors rather than as a broad market event.
- Pre-event behaviour in W_B points to selective anticipation rather than a general sell-off. Industrials record a borderline-significant gain of +3.37%, and QTLC rises +10.32%, suggesting early repositioning into sectors perceived as resilient. Other sectors, including Banking (-1.17%) and Consumer Goods (-1.84%), move only modestly and without statistical support, implying that credit and consumption risks were not fully repriced ahead of the crash.
- Post-event windows highlight both crisis-phase pressure and subsequent mean reversion. In W_C, QTLC (+11.79%) extends its outperformance, while QCON experiences a significant cumulative loss of -6.74%, consistent with income and

demand sensitivity. QREA, QIND, and QTRN register smaller, non-significant declines, indicating gradual rather than abrupt adjustment. By W_D, Consumer Goods swings back to a +6.52% gain, reversing earlier losses, while other sectors hover around zero. Over the broader post-event horizon W_E, QTLC retains a sizeable, though only marginally significant, gain of +8.99%, and the overall CAAR of +1.23% remains statistically neutral.

Taken together, the CAR dynamics the 2016 oil price collapse did not generate sustained market-wide mispricing, but instead triggered sector-specific rotation. Telecommunications and, to a lesser extent, Industrials attracted defensive inflows, while Consumer Goods, Transportation, and Real Estate absorbed the bulk of the downside. The persistent insignificance of CAARs and the relatively rapid post-event stabilisation suggest that the QSE adjusted quickly but unevenly to commodity-price news, with short-term mispricing concentrated in the most demand- and trade-sensitive sectors rather than across the broader market.

4.5.2.2 GCC Blockade

Table 10: 2017 GCC Blockade (CARs)

GCC Blockade (5th June 2017)								
	QBNK	**QCON**	**QIND**	**QREA**	**QTLC**	**QTRN**	**QINS**	**CAAR**
W_A	3.71	-8.16**	−2.49	−5.64	-2.24	4.09	4.11	-0.64
W_B	4.91***	-1.00	0.92	-11.73***	-3.97	1.61	-3.22	-1.67
W_C	-2.72***	1.32	-0.31	5.46***	-2.40	3.71**	3.62	1.31*
W_D	-0.79	-2.52	-1.79	1.3	2.15	5.35***	3.3	1.06
W_E	-3.51**	-1.20	-2.09	6.76**	-0.25	9.06***	6.92*	2.37

Notes: Values in %; *** *p < 0.01 (1 % level); ** p < 0.05 (5 % level); * p < 0.10 (10 % level)*

Source: Author's computation (Stata 17)

Table 10 and Figure 15 reports a shock whose transmission was primarily trade, logistics, and liquidity-driven, rather than macro-financial in nature. As such, the adjustment pattern differs markedly from commodity or global risk shocks, with outcomes shaped by sectoral exposure to imports, mobility, and domestic policy buffers.

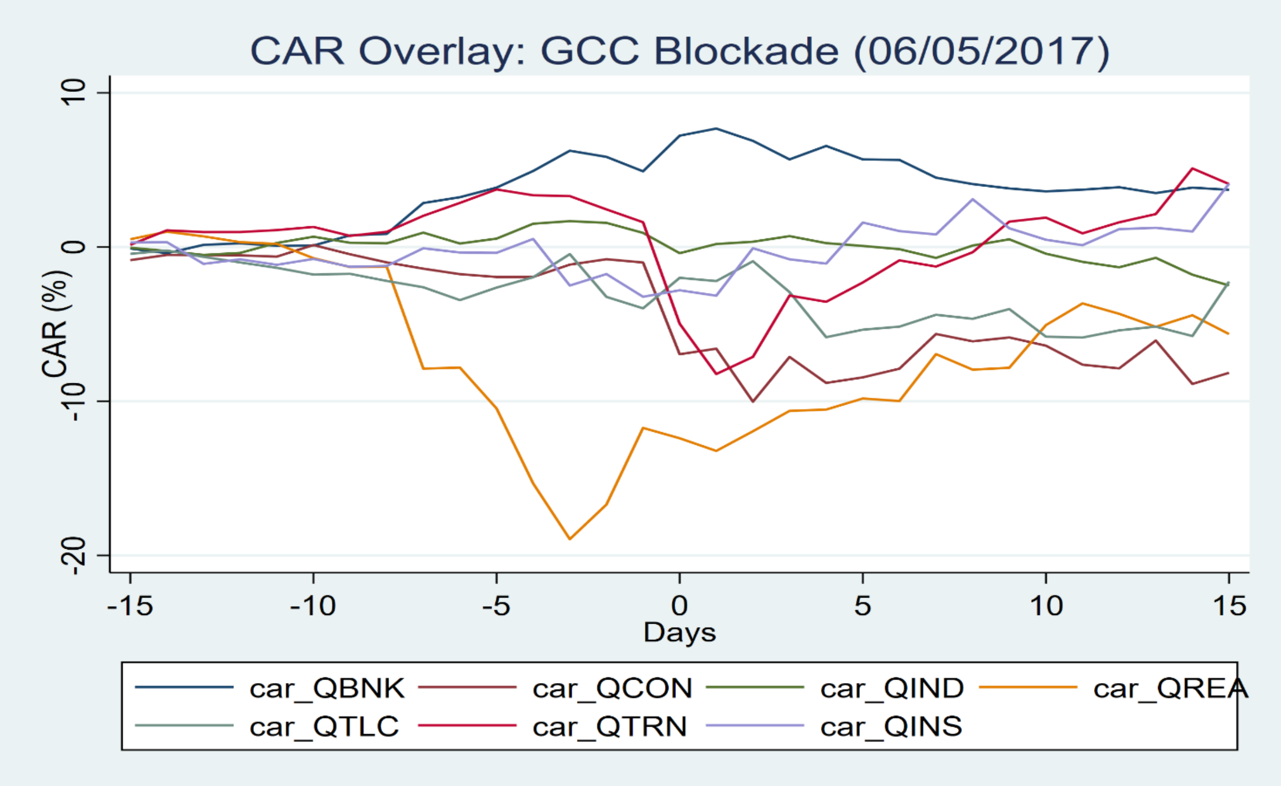

Figure 15: *Sectoral CAR Plots around the GCC Diplomatic Blockade (2017)*

- Across the full event window (W_A), reactions are sharply asymmetric. Consumer Goods records a pronounced cumulative loss (-8.16%), reflecting immediate disruption to supply chains and import dependence. Real Estate (-5.64%) and Telecommunications (-2.24%) also weaken, consistent with funding sensitivity and cross-border connectivity risks. By contrast, Banking (+3.71%), Transportation (+4.09%), and Insurance (+4.11%) post positive but statistically neutral gains, leaving the aggregate CAAR slightly negative (-0.64%) and underscoring the absence of a broad market sell-off.
- Pre-event behaviour (W_B) points to selective anticipation rather than generalised repricing. Banking rises sharply (+4.91%), suggesting early repositioning toward domestically anchored balance sheets, while Real Estate experiences a substantial decline (-11.73%), consistent with pre-emptive liquidity withdrawal. Other sectors remain largely flat, indicating that information leakage was sector-specific rather than market-wide.
- Post-event dynamics reflect phased adjustment and rapid sectoral reallocation. In the W_C, Banking reverses (-2.72%) as speculative inflows unwind, while Real Estate rebounds strongly (+5.46%), likely reflecting policy support and reassurance around domestic financing. Transportation continues to strengthen (+3.71%), consistent with

swift logistical re-routing, whereas Consumer Goods and Telecommunications remain subdued, signalling persistent exposure to import and connectivity constraints.

- Subsequent windows reinforce this rotation. Transportation extends its gains (+5.35%), Real Estate stabilises with modest positives (+1.30%), while Banking and Industrials drift lower as initial defensive positioning fades. Over the extended window (W_E), recovery becomes more pronounced in Transportation (+9.06%) and Real Estate (+6.76%), while Banking turns moderately negative (-3.51%), producing a positive CAAR (+2.37%) driven by late-stage sectoral normalisation rather than market-wide momentum.

Overall, the blockade CARs reveal a progressive, sector-differentiated adjustment rather than abrupt repricing. Early anticipation in Banking and Real Estate gives way to targeted reversals as policy responses and supply-chain adaptation take effect. Persistent underperformance in Consumer Goods and Telecommunications highlights genuine structural exposure to trade and connectivity disruptions. The sequence of anticipation, correction, and recovery illustrates how the QSE processes idiosyncratic geopolitical shocks through sectoral rotation and staggered information assimilation, shaped by liquidity conditions and cross-border dependence rather than systemic financial stress.

4.5.2.3 COVID-19

Table 11: 2020 COVID-19 (CARs)

COVID-19 (2nd March 2020)								
	QBNK	**QCON**	**QIND**	**QREA**	**QTLC**	**QTRN**	**QINS**	**CAAR**
W_A	5.63***	-9.18**	-8.83***	-14.83**	-5.84	0.48	-6.44	-5.23***
W_B	2.74**	-4.37	-3.27	-11.76***	-2.78	-1.73	1.02	-2.80**
W_C	1.42**	-3.97**	-2.21	-0.57	-2.66	3.02	-4.63	−1.23
W_D	1.38*	-0.44	-2.45*	-2.52	-2.84	-2.01	-3.27	-1.61*
W_E	2.80**	-4.41	-4.66**	-3.10	-5.50	1.01	-7.90	-2.85**

Notes: Values in %; *** *$p < 0.01$ (1 % level);* ** *$p < 0.05$ (5 % level);* * *$p < 0.10$ (10 % level)*

Source: Author's computation (Stata 17)

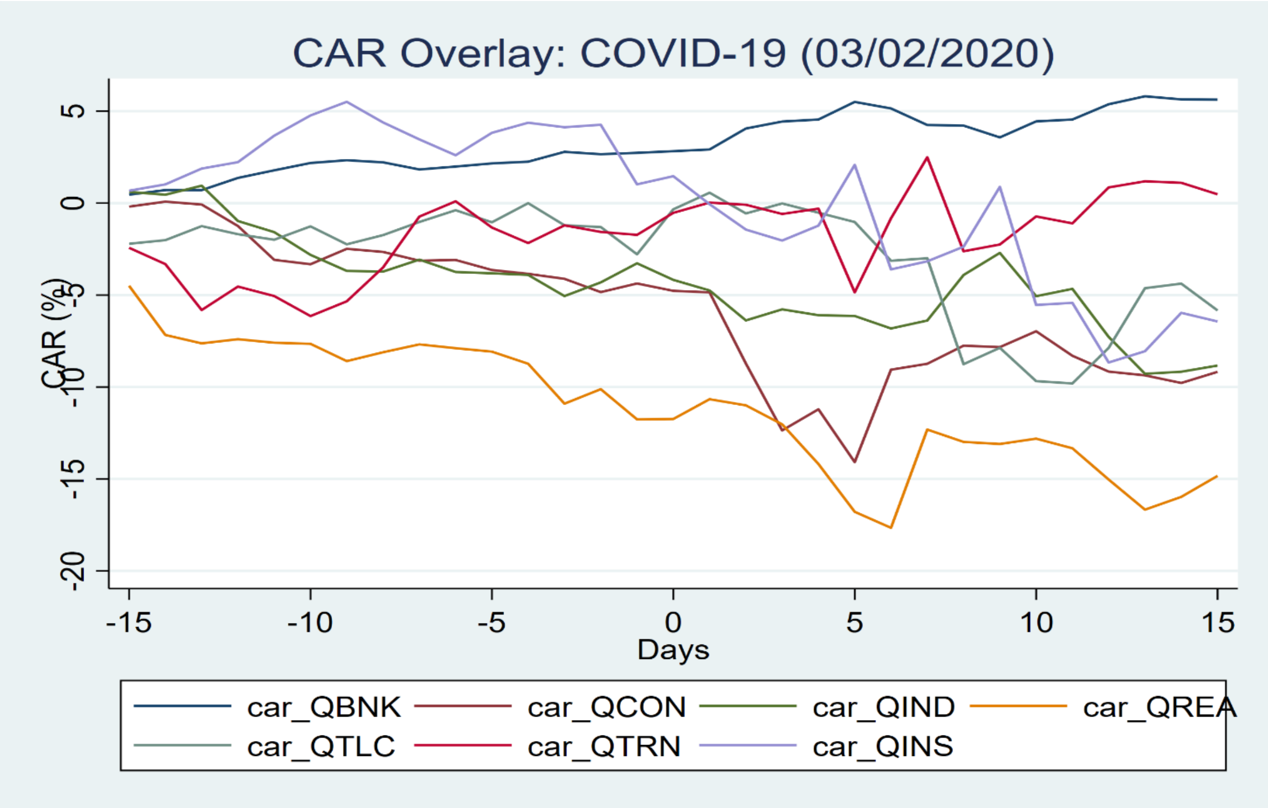

Figure 16: *Sectoral CAR Plots around the COVID-19 Pandemic*

Table 11 and Figure 16 reports the most systemic and synchronised disturbance in the sample period. Unlike earlier events characterised by sectoral reallocation, the pandemic triggered broad-based losses concentrated in demand-sensitive and leverage-exposed sectors, alongside a temporary flight into financial intermediaries.

- Across the full event window (W_A), cumulative losses are pronounced and statistically significant for Consumer Goods (-9.18%), Industrials (-8.83%), and Real Estate (-14.83%), underscoring the abrupt collapse in consumption, production, and asset valuations. Telecommunications and Insurance also declined materially, though without statistical support. In contrast, Banking recorded a significant positive CAR of +5.63%, reflecting a short-lived safe-haven effect driven by expectations of policy support and balance-sheet resilience. The aggregate CAAR of -5.23% confirms that COVID-19 constituted a genuine market-wide shock rather than a sector-isolated disruption.
- Pre-event movements in W_B indicate early and selective anticipation. Real Estate fell sharply (-11.76%), and Consumer Goods also declined (-4.37%), suggesting information leakage and pre-emptive selling ahead of Qatar's first confirmed case. Banking recorded a significant gain (+2.74%), consistent with its short-lived safe-haven

role. Other sectors remained broadly neutral, implying that advance repricing was concentrated rather than market-wide.

- Post-event behaviour reveals asymmetric and phased adjustment rather than rapid stabilisation. In W_C, Banking maintained a modest rebound (+1.42%), consistent with continued policy-support expectations. However, Real Estate remained weak (-0.57%) relative to its sharp pre-event losses, indicating that funding sensitivity and valuation uncertainty persisted in property-linked assets. Consumer Goods (-3.97%) and Industrials (-2.21%) continued to contract, pointing to a split recovery path between financial intermediaries and real-economy sectors. By W_D, pressure re-emerged in Industrials (-2.45%), while Insurance (-3.27%) and Telecommunications (-2.84%) also drifted lower, signalling ongoing volatility spillovers.
- Over the extended window (W_E), divergence remained evident. Banking sustained positive cumulative performance (+2.80%), while Industrials (-4.66%) and Insurance (–7.90%) recorded further losses. The negative CAAR (-2.85%) indicates that, despite partial stabilisation, the market had not fully absorbed pandemic-related uncertainty.

Taken together, the COVID-19 CARs profile reflects a sharp, asymmetric adjustment driven by systemic risk rather than sector-specific news. Defensive inflows into Banking contrast with deep and persistent losses in consumption, production, and leverage-sensitive sectors. The sequence of early anticipation, partial correction, and incomplete recovery highlights delayed information assimilation under extreme uncertainty.

4.5.2.4 Russia-Ukraine War

Table 12: 2022 Russia-Ukraine War (CAR)

Russia-Ukraine War (24th Feb 2022)								
	QBNK	**QCON**	**QIND**	**QREA**	**QTLC**	**QTRN**	**QINS**	**CAAR**
W_A	-0.74	-3.12	5.55*	-4.95	-1.51	-6.61*	-3.14	-1.95
W_B	-0.88	0.59	3.17	1.1	4.28	-6.89***	-1.61	0.01
W_C	-0.84	-3.03**	3.08**	-0.54	-5.26***	-0.32	0.73	-0.83
W_D	0.72	0.23	−0.95	-4.82***	-0.17	0.58	0.28	-0.57
W_E	-0.13	-2.81	2.13	-5.36 **	-5.43**	0.27	1.01	-1.40

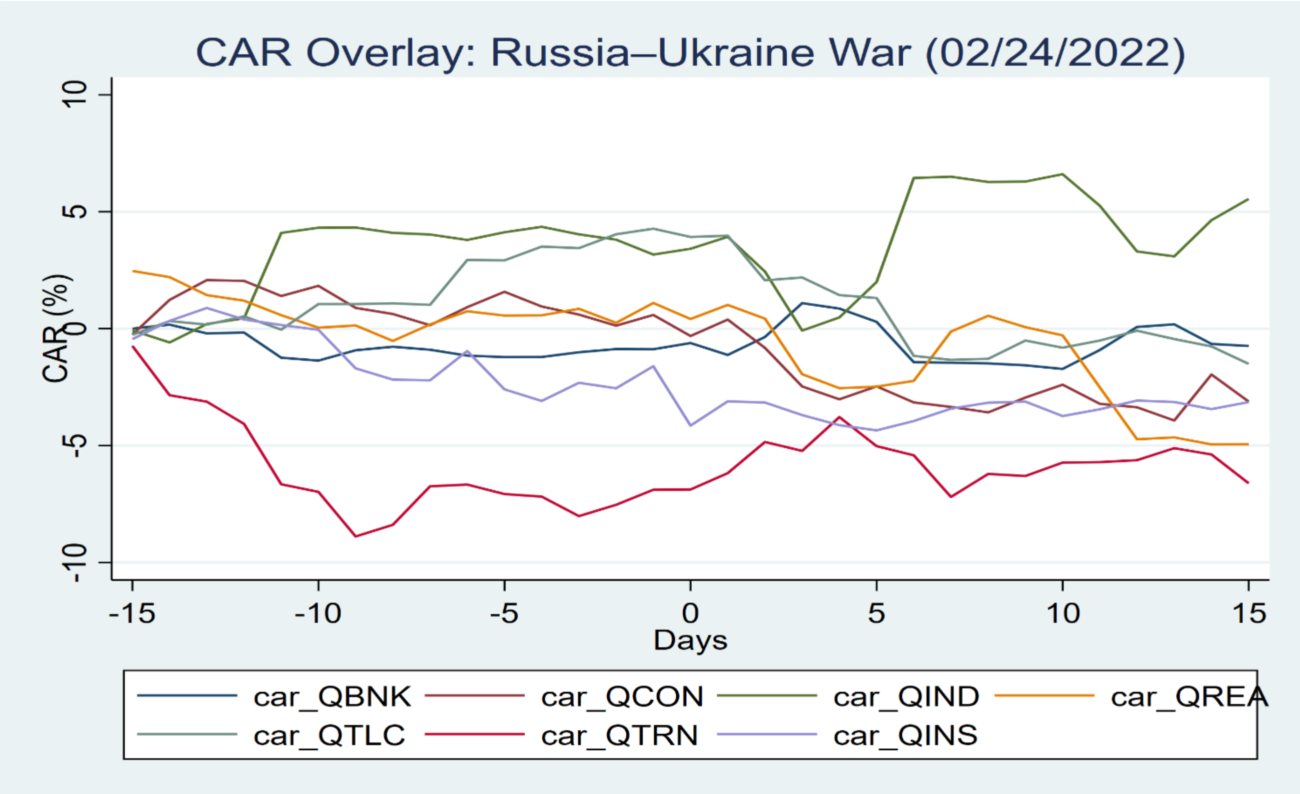

Figure 17: *Sectoral CAR Plots around the Russia-Ukraine War*

Table 12 and Figure 17 report a geopolitical shock characterised by indirect transmission through global energy prices, risk premia, and external financing conditions, rather than direct domestic disruption. Compared with COVID-19, market reactions are more contained and sectorally selective.

- Across W_A, reactions were uneven but broadly negative: Industrials posted a positive but marginally significant CAR (+5.55%), while Transportation recorded a sizeable decline (-6.61%). Consumer Goods (-3.12%), Real Estate (-4.95%), Telecommunications (-1.51%), and Insurance (-3.14%) all weakened without statistical significance. Banking was effectively flat (-0.74%), leaving the overall CAAR mildly negative (-1.95%).
- Pre-event movements in W_B indicates selective anticipation. Transportation fell sharply (–6.89%), pointing to early risk reduction ahead of the invasion, while Telecommunications gained (+4.28%), suggesting rotation into defensives. Real Estate (+1.10%) and Industrials (+3.17%) registered modest advances, consistent with early expectations that regional exposure to the conflict might be limited. Other sectors remained close to zero, implying that any pre-event information leakage was sector-specific rather than market-wide.

- Post-event movements show phased and asymmetric repricing rather than immediate stabilisation. In W_C, Industrials rose significantly (+3.08%), supported by commodity-price spillovers, while Telecommunications dropped sharply (-5.26%). Consumer Goods weakened further (-3.03%), and Real Estate slipped slightly (-0.54%). By W_D, the delayed correction became clearer as Real Estate recorded a significant decline (-4.82%), while other sectors stabilised. Transportation turned slightly positive (+0.58%), likely reflecting higher energy prices offsetting demand concerns. Over the broader W_E window, Real Estate (-5.36%, $p = 0.0315$) and Telecommunications (-5.43%) continued to underperform, while Industrials held mild gains (+2.13%) and Banking remains largely unaffected, reinforcing its insulation from external geopolitical shocks (-0.13%). The overall CAAR (-1.40%) indicates a contained but persistent market impact, rather than a systemic market dislocation.

Taken together, the war-related CARs show a gradual, sector-differentiated adjustment rather than an abrupt market-wide response. Early declines in Transportation and gains in Telecommunications suggest selective anticipation, while post-event reversals in Real Estate and Industrials reflect shifting global liquidity conditions and commodity-linked sentiment. Sustained weakness in Real Estate and Telecommunications indicates structural sensitivity to external financing and volatility. The sequence of anticipation, correction, and moderated recovery aligns with a market that absorbs geopolitical shocks with sector-specific lags, shaped by differences in global exposure, liquidity depth, and sensitivity to external risk channels.

4.5.2.5 FIFA World Cup

Table 13: 2022 FIFA World Cup (CAR)

2022 FIFA World Cup								
Window	**QBNK**	**QCON**	**QIND**	**QREA**	**QTLC**	**QTRN**	**QINS**	**CAAR**
W_A	1.81	-3.93	-0.24	-4.86	-3.32	-4.91	-4.60	-2.73
W_B	1.17	0.8	-2.25	-2.65	0.8	-1.88	-2.70	-0.93
W_C	1.17	-4.15**	0.72	-1.92	-8.45***	-2.23	0.74	-1.97**
W_D	-0.52	-0.58	1.29	-0.29	4.34	-0.80	-2.65	0.16
W_E	0.64	-4.73	2.01	-2.21	-4.12	-3.03	-1.91	-1.80

Notes: Values in %; **** $p < 0.01$ (1 % level); ** $p < 0.05$ (5 % level); * $p < 0.10$ (10 % level)*

Source: Author's computation (Stata 17)

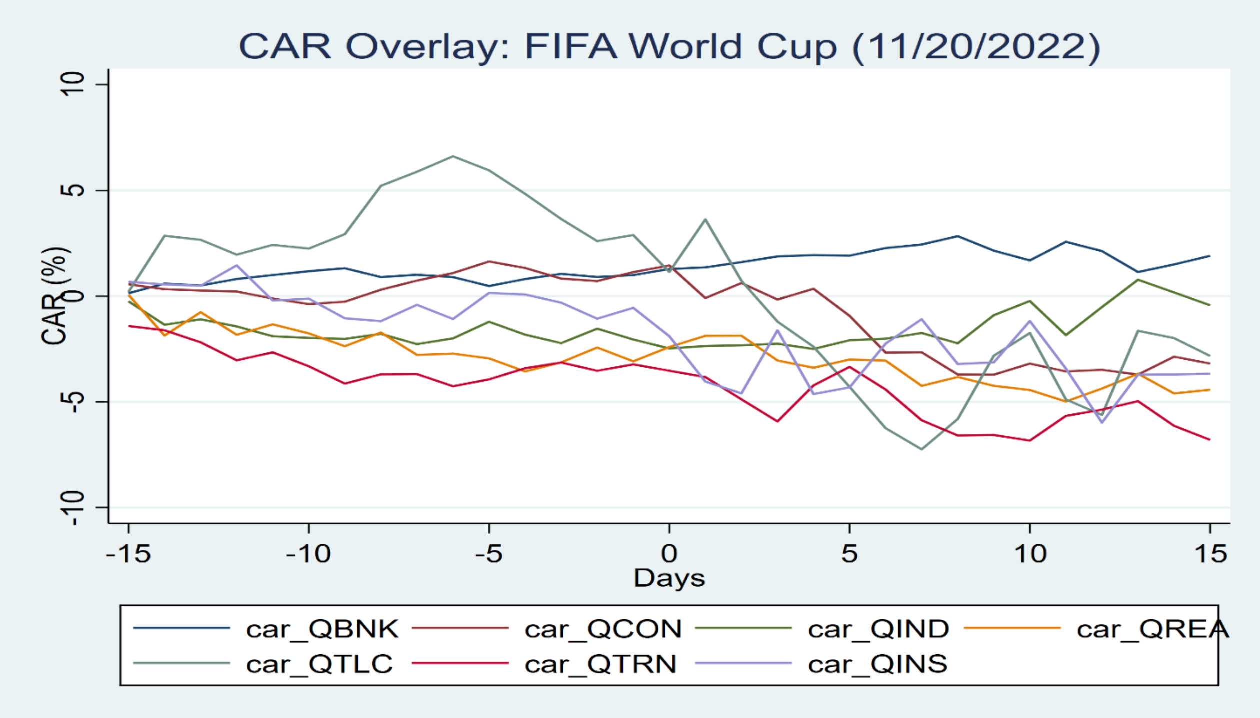

Figure 18: *Sectoral CAR Plots around the FIFA World Cup*

Table 13 and Figure 18 report captures an anticipated mega-event whose financial effects were largely priced in ahead of time. Unlike geopolitical or macroeconomic shocks, the tournament generated modest, sentiment-driven adjustments rather than systemic repricing, with outcomes shaped by profit-taking, post-event correction, and sectoral positioning after years of infrastructure-led optimism.

- Across the full event window (W_A), market reactions are mildly negative and broadly dispersed. Consumer Goods (-3.93%), Real Estate (-4.86%), Telecommunications (-3.32%), Transportation (-4.91%), and Insurance (-4.60%) all decline, indicating post-event cooling rather than shock-induced distress. Industrials remain largely unchanged (-0.24%), while Banking posts a small, statistically neutral gain (+1.81%). The aggregate CAAR (-2.73%) confirms that the World Cup did not trigger a market-wide repricing but instead prompted selective adjustment.
- Pre-event behaviour (W_B) reflects limited anticipation effects. Small gains in Banking (+1.17%) and Telecommunications (+0.80%) suggest that most tournament-related optimism had already been absorbed well before the event. Declines in Real Estate (-2.65%) and Insurance (-2.70%) are consistent with profit-taking following prolonged investment cycles, while other sectors remain broadly flat, pointing to minimal information leakage and selective rather than market-wide repositioning.

- Post-event behaviour reflects phased and asymmetric adjustment. In W_C, Telecommunications recorded a significant decline (-8.45%), indicating a sharp correction following earlier overvaluation. Consumer Goods also weakened notably (-4.15%,). Banking (+1.17%) and Insurance (+0.74%) posted modest, non-significant gains, while Real Estate (-1.92%) and Transportation (-2.23%) softened further. In W_D, partial mean reversion emerged as Telecommunications rebounded (+4.34%), Transportation stabilised (-0.80%), and Real Estate (-0.29%) remained broadly unchanged. Insurance (-2.65%) and Consumer Goods (-0.58%) continued to drift lower, indicating persistent sector-specific adjustments rather than broad-based recovery. Over W_E, sectoral outcomes remained mixed. Banking retained a small gain (+0.64%), Industrials improved (+2.01%), whereas Consumer Goods (-4.73%), Real Estate (-2.21%), and Telecommunications (-4.12%) remained weak. The overall CAAR (-1.80%) reflects a mild and short-lived net impact.

Taken together, this reveals a progressive, sector-differentiated adjustment rather than a market-wide repricing. Telecommunications and Consumer Goods experienced sharp but temporary corrections, while Banking and Industrials remained relatively stable, suggesting rational pricing under heightened visibility. Continued weakness in Real Estate and Insurance indicates structural, rather than event-driven, pressures. The pattern of muted anticipation, selective correction, and partial recovery aligns with a market processing new information with sector-specific lags, consistent with the transient nature of the tournament's financial impact.

4.5.2.6 Iran Missile Strike

Table 14: 2025 Iran Missile Strike (CAR)

Iran Missile Strike								
Window	**QBNK**	**QCON**	**QIND**	**QREA**	**QTLC**	**QTRN**	**QINS**	**CAAR**
W_A	0.41	1.41	1.28	-0.24	-6.35	-3.49	1.57	-0.69
W_B	0.43	-0.31	1.26	-1.68	-3.00	-1.54	-3.50	-1.14
W_C	0.11	1.45	-0.67	-0.69	-2.08	-0.48	4.47 **	0.32
W_D	0.14	0.26	1.23	0.65	-2.62	-2.77	0.25	-0.40
W_E	0.25	1.71	0.55	-0.04	-4.70	-3.25	4.72	-0.08

Notes: Values in %; *** *p < 0.01 (1 % level); ** p < 0.05 (5 % level); * p < 0.10 (10 % level)*

Source: Author's computation (Stata 17)

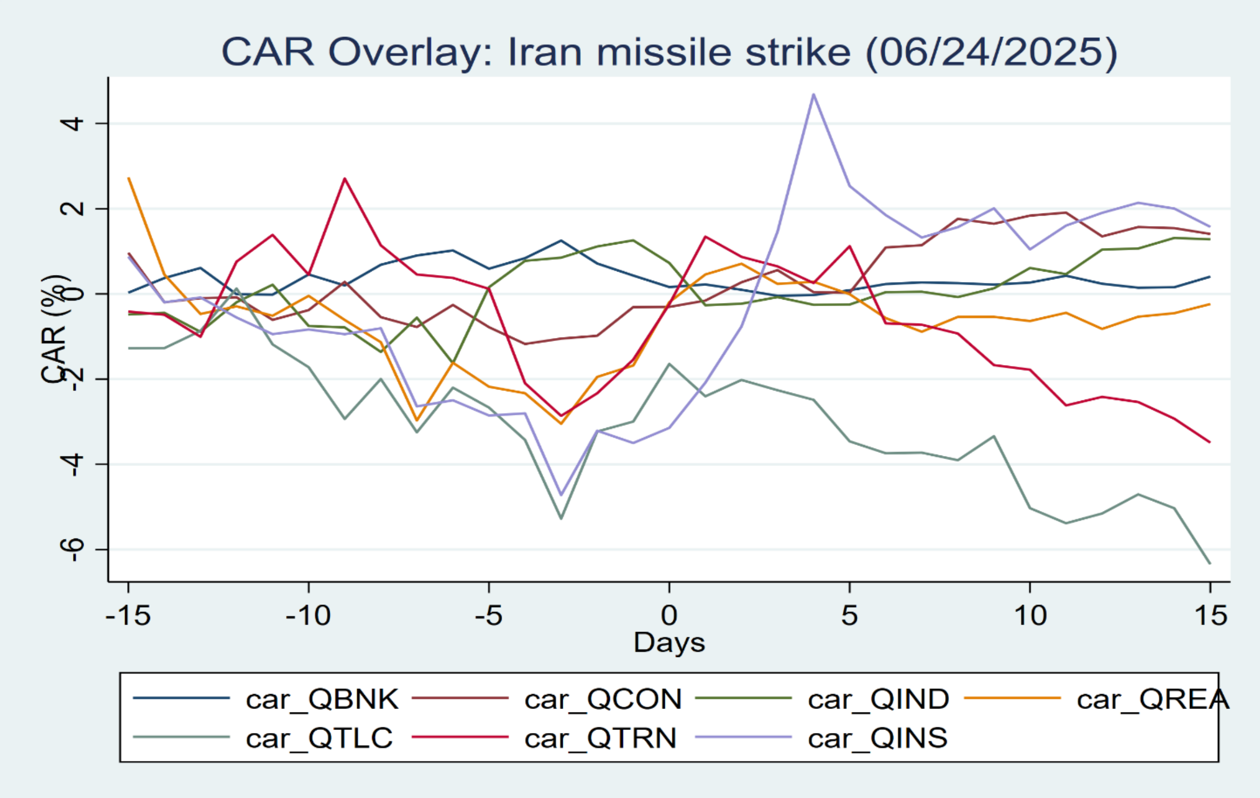

Figure 19: *Sectoral CAR Plots around the Iran Missile Strike*

Table 14 and Figure 19 report captures a short-lived geopolitical shock with limited direct economic transmission to Qatar. In contrast to earlier regional or global crises, market responses are contained, selective, and quickly absorbed, reflecting improved institutional credibility and investor familiarity with episodic geopolitical risk.

- Across the full window (W_A), reactions are muted and heterogeneous. Banking (+0.41%) and Industrials (+1.28%) show mild resilience, suggesting confidence in domestic financial stability and limited disruption to core production channels. By contrast, Telecommunications (-6.35%) and Transportation (-3.49%) record the largest declines, consistent with their exposure to cross-border mobility and information-flow sensitivity. Other sectors move only marginally, leaving the aggregate CAAR slightly negative (-0.69%) and confirming the absence of market-wide repricing.
- Pre-event movements in W_B indicate negligible anticipatory behaviour. Most sectors, including Banking (+0.43%), Industrials (+1.26%), and Consumer Goods (-0.31%), remained statistically neutral, suggesting that the market did not price in any forewarning or anticipatory volatility. Telecom (-3.00%) and Transportation (-1.54%) registered modest declines, while Real Estate (-1.68%) and Insurance (-3.50%) were broadly flat, implying selective rather than market-wide positioning.

- Post-event dynamics reveal phased and sector-specific adjustment. In W_C, Insurance (QINS) posted a significant positive CAR (+4.47%), reflecting a safe-haven rotation as investors reassessed exposure to geopolitical risk. Banking (+0.11%), Consumer Goods (+1.45%), and Industrials (-0.67%) showed minor, non-significant drift, whereas Telecom (-2.08%) and Transportation (-0.48%) remained weak. In W_D, most sectors stabilised: Insurance held steady (+0.25%), Banking (+0.14%) and Industrials (+1.23%) remained positive, while Telecom (-2.62%) and Transportation (-2.77%) continued underperforming slightly. Over the extended W_E period, Insurance retained its large positive cumulative gain (+4.72%), while Telecom (-4.70%) and Transportation (-3.25%) lagged, resulting in a near-zero overall CAAR (-0.08%).

Overall, the CAR evidence indicates that the Iran missile strike generated localized, short-lived sectoral adjustments rather than systemic disruption. Insurance briefly functioned as a defensive allocation, while Telecommunications and Transportation absorbed most of the downside. The absence of broad anticipation, the limited magnitude of reactions, and the rapid return to equilibrium are consistent with a market that processes geopolitical shocks efficiently, with pricing effects confined to sectors directly exposed to uncertainty rather than propagating across the QSE.

4.5.3 Cross-Event Comparisons

Across the six shocks examined, the QSE displays no single "crisis template" instead responding in ways that reflect the dominant transmission channel of each event. Aggregate CAARs are most negative during COVID-19 (-5.23%) and the FIFA World Cup (-2.73%), consistent with broad sentiment effects driven by global health uncertainty and post-event corrections. In contrast, the 2016 oil price collapse generates a mildly positive CAAR (+1.69%), while the Iran missile strike produces only a marginal net response (-.69%), indicating increasingly contained and segmented market reactions over time.

Table 15 summarises cross-event CAARs alongside the most pronounced sectoral responses. While the direction and magnitude of effects vary, several patterns emerge. Telecommunications (QTLC) initially functions as a crisis hedge, delivering a large positive CAR during the oil collapse (+20.5%), but subsequently underperforms in later shocks, including the World Cup (-8.45%) and the Iran strike. This shift suggests that early defensive premia were gradually unwound. Real Estate (QREA) remains persistently vulnerable, recording deep losses during COVID-19 (-14.83%) and the Russia-Ukraine war (-5.36%), reflecting sensitivity to leverage, funding conditions, and macroeconomic risk. Banking (QBNK), by contrast, repeatedly acts as a stabiliser, posting significant gains ahead of the GCC blockade and during COVID-19 (+5.63%). This pattern is consistent with a domestic safe-haven role supported by credible policy intervention.

Other sectors respond more conditionally. Consumer Goods (QCON) and Transportation (QTRN) absorb the bulk of losses during trade and mobility-related shocks, while Insurance (QINS) remains relatively inactive in earlier episodes but emerges as the strongest post-event performer following the Iran strike (+4.47%), indicating a late-stage rotation into risk-transfer assets. Across events, large CARs align closely with each shock's primary transmission mechanism - trade disruptions affect QCON and QTRN, macro and funding stress depress QREA, policy support benefits QBNK, and geopolitical risk ultimately favours QINS.

Table 15: Cross-Event CAARs and Key Sectoral Significance

Event	CAAR (%)	Strongest Positive CARs	Strongest Negative CARs	Interpretation
Oil Price Collapse	+1.69	QTLC (+20.5**)	QREA (-4.74)	Energy rebound, sector divergence
GCC Blockade	-0.64	QREA (+6.76**)	QCON (-8.16**)	Mixed adjustment, resilience in real estate
COVID-19 Pandemic	-5.23*	QBNK (+5.63***)	QREA (-14.83**), QIND (-8.83***)	Market-wide contraction, liquidity stress
Russia-Ukraine War	-1.95	QIND (+5.55*)	QTRN (-6.61*), QREA (-5.36**)	Mild sectoral gains amid global volatility
FIFA World Cup	-2.73	QTLC (+4.34)	QCON (-4.15**), QTLC (−8.45***)	Event fatigue, sentiment reversal
Iran Missile Strike	-0.69	QINS (+4.47**)	QTLC (-6.35)	Contained reaction, selective reallocation

Notes: **** $p < 0.01$ (1 % level); ** $p < 0.05$ (5 % level); * $p < 0.10$ (10 % level)*

Source: Author's computation (Stata 17)

Despite pronounced sectoral movements, market-wide CAARs remain moderate and often mean-reverting. This pattern suggests that the QSE processes information rapidly but unevenly, adjusting primarily through sectoral rotation rather than uniform selloffs. This is precisely the setting in which an event-study framework is most informative.

4.5.4 Placebo for Robustness Checks Results

This serves as a control to validate that Ars and CARs observed in true event windows were not artefacts of random market drift or model bias.

Table 16: Placebo (AR)

Placebo Event								
	QBNK	**QCON**	**QIND**	**QREA**	**QTLC**	**QTRN**	**QINS**	**CAAR**
AR (%)	0.65	0.27	0.15	-3.49**	0.13	0.83	-0.14	-0.22

Notes: Values in %; **** p < 0.01 (1 % level); ** p < 0.05 (5 % level); * p < 0.10 (10 % level)*
Source: Author's computation (Stata 17)

Table 16 reports ARs at the placebo event day. At t_0, ARs are statistically insignificant across all sectors except Real Estate, which records a moderate decline of -3.49% at the 5% level. Importantly, this movement is not accompanied by spillovers across other sectors or persistence in subsequent cumulative windows, suggesting a transitory fluctuation rather than an information-driven response.

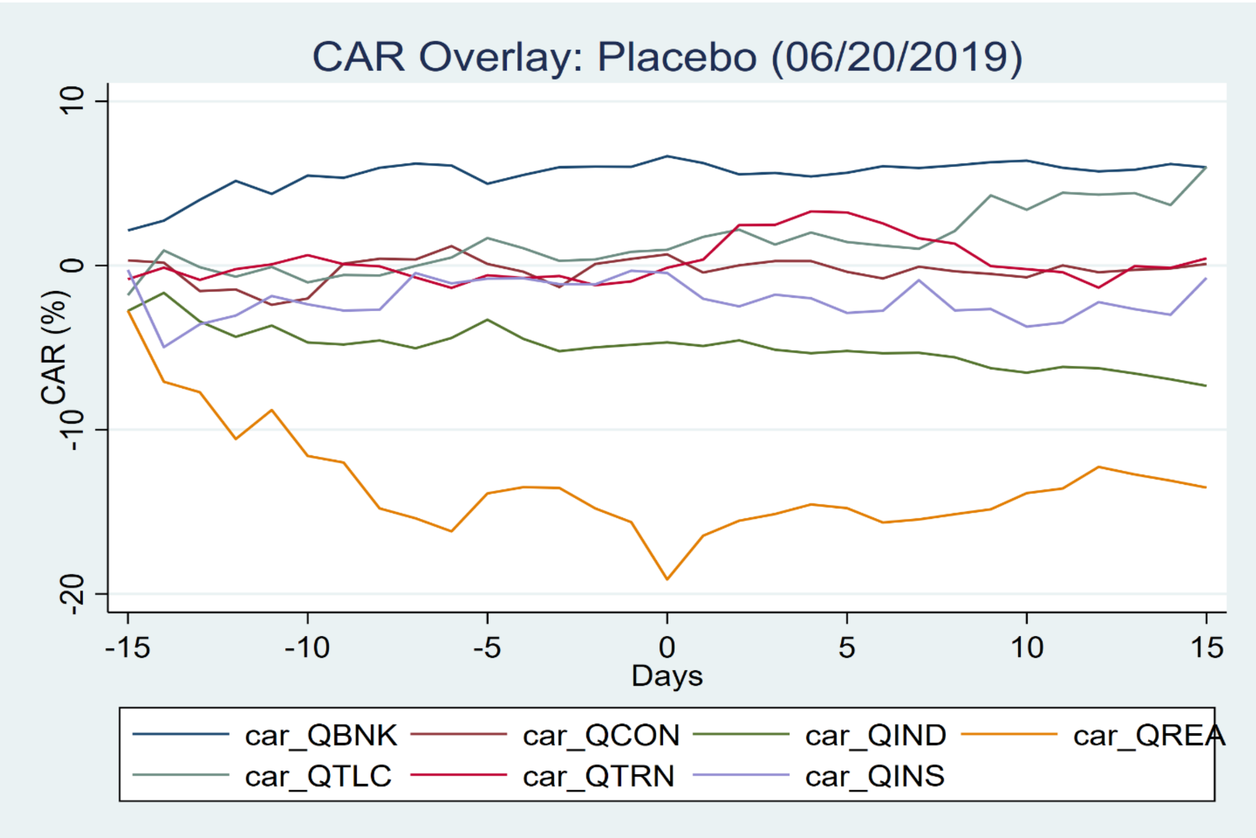

Figure 20: *Sectoral CAR Plots around Placebo*

Table 17: Placebo (CAR)

Placebo Event								
Window	**QBNK**	**QCON**	**QIND**	**QREA**	**QTLC**	**QTRN**	**QINS**	**CAAR**
W_A	5.98 **	0.1	-7.33*	−13.53	6.01	0.43	-0.75	-1.14
W_B	6.01***	0.41	-4.83*	−15.63**	0.84	-0.97	-0.32	-1.97
W_C	-0.72	-0.75	-0.63	3.66	0.06	1.8	-0.44	0.44
W_D	0.04	0.17	-2.01	1.94	5.00**	-1.23	0.14	0.60
W_E	-0.68	-0.58	-2.65	5.59	5.05	0.57	-0.30	1.04

Notes: Values in %; **** $p < 0.01$ (1 % level); ** $p < 0.05$ (5 % level); * $p < 0.10$ (10 % level)*

Source: Author's computation (Stata 17)

Table 17 and Figure 20 report CARs around the Placebo, capturing sectoral adjustment before and after a non-event shock.

- Across the full window W_A, CARs are small, mixed in direction, and largely insignificant. Banking shows a temporary positive CAR (+5.98%), while Industrials (-7.33%) and Real Estate (-13.53%) exhibit moderate declines. The aggregate CAAR remains statistically neutral (-1.14%), indicating the absence of a market-wide reaction.
- Pre-event movements in W_B were similarly isolated. Again, Banking recorded a marginally significant gain (+6.01%), while Real Estate (-15.63%) and Industrials (-4.83%) declined moderately. Other sectors, including Telecommunications (+0.84%) and Transportation (-0.97%), remained largely flat, suggesting that pre-event positioning reflected sector-specific noise rather than predictive anticipation.
- Post-event dynamics in W_C and W_D shows limited adjustment. Across sectors, CARs were low and mixed in direction. Telecom (+5.00%) exhibited a mild positive drift in WD, while Real Estate and Industrials continued slight declines. Banking, Consumer Goods, and Transportation showed minimal movement, leaving the market effectively stable. Over the extended window W_E, sectoral CAARs hovered near zero (+1.04% to -1.14%), confirming the absence of a systematic reaction.

Taken together, the placebo results demonstrate that statistically meaningful and persistent ARs do not arise in the absence of genuine events. The lack of coherent anticipation, adjustment, or sectoral propagation contrasts sharply with the structured responses observed during actual macroeconomic and geopolitical shocks, thereby, provides strong validation that the ARs and CARs patterns are event-driven rather than artefacts of random volatility or model misspecification. Finally, the placebo confirms that the QSE efficiently absorbs information and reacts primarily to meaningful events.

4.6 Summary

This chapter presented empirical findings from descriptive statistics, weak-form efficiency tests, and six event studies. Sectoral returns exhibited pronounced peaks and troughs around major shocks, demonstrating that market behaviour reflected event-specific news rather than smooth cyclical trends. Efficiency diagnostics revealed partial serial dependence in several sectors, indicating uneven or delayed information incorporation.

Event studies highlighted strong sectoral differentiation. Banking, Telecomms, and Industrials adjusted quickly, while Real Estate, Insurance, Consumer Goods, and Transportation experienced deeper or more persistent deviations. COVID-19 caused the broadest market-wide declines, whereas regional shocks such as the GCC blockade and the 2025 missile strike produced selective, sector-specific responses. Robustness and placebo checks confirmed that CAR and CAAR patterns were driven by the events themselves rather than random volatility. Overall, QSE sectors respond meaningfully to new information, with speed and magnitude of adjustment varying by sector and shock type.

Chapter Five: Discussions

5.1 Introduction

This chapter interprets the empirical findings presented in Chapter Four, examining the underlying mechanisms and their implications in relation to the study's objectives and hypotheses, while maintaining a clear link to the research questions outlined in Chapter One.

5.2 Interpretation of Results in Relation to Research Objectives and Hypotheses

This section organises the interpretation of empirical findings according to the study's objectives (1 to 3) and corresponding hypotheses (H1 to H4) as follows.

5.2.1 Objective 1 and H1: Sectoral Cycles and Alignment with Major Shocks

Objective 1 examined whether sectoral returns on the Qatar Stock Exchange exhibit identifiable highs and lows and whether these turning points align with major macro-financial and geopolitical shocks. Hypothesis H1 proposed that sectoral cycles would correspond with such events rather than arise randomly over time.

Rather than reflecting smooth or internally generated fluctuations, the return environment documented in Chapter Four indicates crisis-regime behaviour characterised by fat-tailed distributions, volatility dispersion, and heterogeneous sectoral risk exposure. These features imply that price dynamics on the QSE are shaped by episodic information shocks and uneven transmission mechanisms rather than gradual macroeconomic drift, a pattern widely documented in GCC equity markets during periods of stress (Nusair & Al-Khasawneh, 2018; Ben Cheikh et al., 2021; Maghyereh & Abdoh, 2022).

Against this backdrop, market-wide turning points in the QE All Share Index, together with the event mapping exercise, show a clear alignment between sectoral cycles and the most binding shocks affecting Qatar's economy and investor sentiment. The oil price collapse, the 2017 GCC blockade, and the onset of COVID-19 coincide with the deepest and most synchronised contractions, indicating system-level stress. By contrast, later disturbances, including the Russia-Ukraine conflict, the FIFA World Cup, and the 2025 Iran missile strike, generate shallower and more segmented responses, reflecting narrower transmission channels and improved shock absorption.

This pattern indicates that the breadth and severity of sectoral cycles depend critically on whether shocks propagate economy-wide or remain confined to specific industries. Systemic shocks compress adjustment across sectors, while externally mediated or anticipated events are absorbed through relative sectoral repricing. Such event-contingent behaviour is consistent with crisis-regime dependence in GCC markets, where sectoral co-movement intensifies during major disruptions but weakens as markets adapt and policy buffers strengthen (Alqahtani & Chevallier, 2020; Kapar et al., 2024).

Overall, Objective 1 is satisfied and H1 is supported. Sectoral highs and lows on the QSE align closely with major macro-financial and geopolitical events, but these cycles are neither smooth nor regular. Instead, they are predominantly event-driven and sector-conditioned, shaped by discrete shocks, heterogeneous risk exposure, and uneven information transmission rather than endogenous market rhythms. This behaviour is characteristic of frontier and emerging markets operating under episodic stress and evolving institutional depth (Neaime, 2016; Hkiri et al., 2021).

5.2.2 Objective 2 and H2: Weak-Form Efficiency and Sectoral Heterogeneity

Objective 2 assessed whether sectoral returns on the Qatar Stock Exchange satisfy weak-form efficiency, as proposed under Hypothesis H2. Weak-form efficiency implies that current prices fully reflect past return information, such that return predictability should not persist beyond random variation.

The evidence from the combined autocorrelation, runs, and variance-ratio diagnostics indicates that weak-form efficiency on the QSE is not uniform across sectors and not constant across horizons. Instead, efficiency exhibits a sector-structured and time-dependent profile, reflecting differences in liquidity, information processing, and institutional exposure.

At the market level, the QEAS displays statistically significant short-run serial dependence and non-random return sequences, indicating delayed incorporation of information. Similar behaviour is observed in Banking, Industrials, Real Estate, Transportation, and Insurance, where returns exhibit measurable predictability at short horizons. These deviations suggest gradual adjustment to information related to macroeconomic conditions, policy signals, funding constraints, and sector-specific risk exposures. Such patterns are consistent with the informational frictions framework of Grossman and Stiglitz (1980) and with evidence that aggregate indices mask substantial sectoral heterogeneity in emerging and MENA markets (Ahmed, 2012; Benjelloun & Squalli, 2008; Harrison & Moore, 2012; Kapar et al., 2024).

In contrast, Telecommunications emerges as the sector most consistent with weak-form efficiency. It fails to reject the null of no autocorrelation and randomness under multiple diagnostics, indicating rapid information assimilation and limited short-run predictability.

Consumer Goods also exhibits behaviour closer to weak-form efficiency, with largely random sign patterns and weaker serial dependence, although episodic deviations still occur during periods of heightened uncertainty. These findings suggest that sectors characterised by clearer revenue structures, broader investor participation, or stronger information visibility tend to adjust more efficiently.

The Insurance sector displays a distinct efficiency profile. While it rejects randomness under several tests, the direction of dependence suggests episodic momentum rather than persistent mean reversion. This behaviour is consistent with delayed reassessment of regulatory, risk-transfer, or geopolitical information, rather than systematic inefficiency. Similar sector-specific deviations have been documented in GCC and emerging markets where thin trading and asymmetric information amplify short-run predictability without generating permanent mispricing (Lahmiri, 2013; Hkiri et al., 2021).

Importantly, the variance-ratio evidence demonstrates that short-run inefficiencies across all sectors are transitory rather than structural. Variance ratios significantly below unity across horizons indicate strong mean reversion, implying that deviations from weak-form efficiency are corrected over medium horizons. This confirms that predictability arises from delayed adjustment rather than sustained informational failure, aligning with classic random-walk rejection evidence in emerging markets (Lo & MacKinlay, 1988; Al-Khazali, Ding & Pyun, 2007; Almujamed, 2018).

Overall, Objective 2 is satisfied and Hypothesis H2 is supported. The QSE does not exhibit strict weak-form efficiency across all sectors, but neither does it display persistent inefficiency. Telecommunications and, to a lesser extent, Consumer Goods approximate weak-form efficiency, while Banking, Industrials, Real Estate, Transportation, and Insurance exhibit short-horizon deviations that correct over time. This pattern reflects a market characterised by heterogeneous information processing and sector-specific frictions, consistent with evidence from GCC and MENA exchanges that efficiency is conditional, adaptive, and uneven rather than absolute (Benjelloun & Squalli, 2008; Meero, 2018; Kapar et al., 2024).

5.2.3 Objective 3 and H3: Event Sensitivity and Asymmetric Sectoral Responses

Objective 3 examined whether sectoral indices on the Qatar Stock Exchange respond asymmetrically to major macroeconomic and geopolitical shocks and whether the timing and magnitude of these responses differ across sectors, as proposed under Hypothesis H3. Rather than assuming uniform information incorporation, the analysis distinguishes between immediate event-day reactions (ARs) and cumulative adjustment (CARs) over multiple pre and post event windows, allowing a structured assessment of sectoral price discovery.

5.2.3.1 Event-day AR

Across the six events analysed, statistically significant event-day ARs are infrequent and strongly sector-specific. The most pronounced immediate reactions occur during the 2017 GCC diplomatic blockade, the most locally binding and unexpected shock in the sample. On the event day, Banking records a significant positive abnormal return, while Consumer Goods, Transportation, and Industrials experience sharp and significant declines. This configuration reflects disruption transmitted through trade restrictions, mobility constraints, and confidence effects, consistent with blockade-focused evidence for GCC markets (Bouoiyour and Selmi, 2019; Buigut and Kapar, 2020).

By contrast, other events generate muted or negligible event-day responses. The COVID-19 announcement produces statistically significant abnormal returns only in Telecommunications and Industrials, while most sectors remain neutral, suggesting that immediate repricing was limited despite the scale of the subsequent crisis. Similarly, the Russia–Ukraine conflict triggers significant event-day effects only in Consumer Goods and Insurance, reflecting selective exposure to global risk premia rather than broad market panic. The 2016 oil price collapse produces a significant event-day reaction solely in Transportation, consistent with fuel-cost sensitivity and demand expectations, while the June 2025 Iran missile strike generates a modest positive abnormal return in Real Estate, possibly reflecting short-lived reassessment of asset values rather than fundamental repricing.

Notably, the 2022 FIFA World Cup generates no statistically significant event-day abnormal returns across any sector. This absence of immediate reaction is consistent with an anticipated event whose informational content was largely incorporated prior to the event date, with adjustment shifting to surrounding windows (MacKinlay, 1997; Corrado, 2011).

Taken together, the event-day evidence indicates that immediate repricing on the QSE is confined to shocks that are both unexpected and directly disruptive to sectoral cash flows. For most global or anticipated events, price adjustment does not occur instantaneously, reinforcing the importance of examining cumulative dynamics.

5.2.3.2 Cumulative Abnormal Returns (CAR)

Cumulative abnormal returns provide the strongest empirical support for Hypothesis H3. Across all events, CAR significance is neither uniform nor random but aligns closely with the dominant economic transmission channel of each shock.

- The 2016 oil price collapse is characterised by pronounced sectoral divergence rather than broad contraction. Telecommunications records large and persistent positive CARs across multiple windows, reflecting defensive positioning and stable revenue expectations, while demand-sensitive sectors experience cumulative losses followed by mean reversion. This behaviour is consistent with evidence that oil shocks generate asymmetric sectoral effects in GCC markets rather than uniform downturns (Nusair and Al-Khasawneh, 2018; Ben Cheikh et al., 2021; Maghyereh and Abdoh, 2022).
- The 2017 GCC blockade exhibits the clearest anticipation-shock-adaptation sequence in the sample. Significant pre-event reallocation is observed, followed by sharp short-run disruption and subsequent recovery in later windows. Transportation, Real Estate, and Insurance record strong positive CARs during the adaptation phase, while Banking reverses earlier gains as confidence stabilises. This dynamic mirrors documented resilience mechanisms in Qatar, where policy intervention and supply-chain reorientation mitigated longer-term damage (Bouoiyour and Selmi, 2019; Buigut and Kapar, 2020).
- The COVID-19 pandemic constitutes a regime-breaking episode. Unlike other events, it generates both large sectoral CARs and a statistically significant negative aggregate CAAR, confirming a genuine market-wide contraction. Consumption, production, and leverage-sensitive sectors record deep and persistent cumulative losses, while Banking exhibits sustained positive CARs across post-event windows. This divergence reflects a combination of systemic uncertainty and policy-buffered financial intermediation, consistent with GCC evidence on pandemic-era stress and institutional support (Bahrini and Filfilan, 2020; Al Samman and Akkas, 2021; Said et al., 2024; IMF, 2025).
- The Russia-Ukraine conflict produces delayed and sector-selective adjustment rather than immediate disruption. Anticipation effects appear in Transportation, while lagged stress emerges in Real Estate and Telecommunications, reflecting indirect transmission through global risk premia, energy uncertainty, and financing conditions. This lag structure aligns with evidence that geopolitical shocks often propagate gradually

through sectoral connectedness and volatility spillovers in GCC markets (Obi et al., 2023; Nawaz et al., 2025; Kapar et al., 2024; Dang et al., 2024).

- The 2022 FIFA World Cup displays a distinct anticipated-event profile. While event-day reactions are absent, statistically significant post-event correction occurs in Consumer Goods and Telecommunications, alongside a negative aggregate CAAR. This pattern suggests post-event reassessment or profit-taking following extended optimism rather than surprise-driven repricing, consistent with event-study theory for scheduled mega-events (MacKinlay, 1997; Corrado, 2011).
- Finally, the 2025 Iran missile strike generates contained and highly selective CAR effects, confined primarily to Insurance. This response indicates defensive rotation into risk-transfer assets rather than systemic repricing, supporting evidence that geopolitical risk in GCC markets often manifests through narrow sectoral channels rather than broad market disruption (Saad, 2025).
- Taken together, the event-study evidence reveals a clear hierarchy in how shocks are processed on the QSE. Locally binding and unexpected shocks generate limited but sharp immediate repricing followed by rapid sectoral reallocation. Systemic global shocks overwhelm offsetting sectoral movements and produce genuine market-wide contraction. Externally mediated or anticipated events are absorbed primarily through delayed, sector-specific cumulative adjustment rather than event-day reactions. This hierarchy confirms that cumulative abnormal returns, rather than event-day responses, constitute the dominant price-discovery mechanism on the QSE.

Overall, Objective 3 is satisfied and Hypothesis H3 is strongly supported. Sectoral responses on the QSE are asymmetric, economically structured, and time-dependent. Event-day repricing is rare and confined to unexpected, locally binding shocks, while cumulative abnormal returns capture the primary mechanism of adjustment across most macroeconomic and geopolitical events. Price discovery on the QSE therefore operates through differentiated transmission channels and staged correction rather than uniform or instantaneous repricing, consistent with event-study theory and the growing empirical literature on GCC and emerging equity markets (MacKinlay, 1997; Buigut and Kapar, 2020; Kapar et al., 2024).

5.2.4 H4: Placebo validation of Event-Driven Reactions

Hypothesis H4 tests whether the abnormal returns identified around major events reflect genuine information effects rather than background volatility or model artefacts. This is assessed using a placebo design that applies the same event-study framework to a non-event period.

On the placebo event day, abnormal returns are insignificant across all sectors except Real Estate (-3.49%). Placebo CARs show isolated and inconsistent significance at the sectoral level, while aggregate CAARs remain statistically insignificant across all windows. This indicates the absence of market-wide adjustment when no new information is present.

Two distinctions separate placebo outcomes from true events. First, placebo significance lacks economic structure: unlike real events, sectoral movements do not align with identifiable transmission channels or follow a clear anticipation-adjustment pattern. Second, placebo sensitivity is concentrated in Real Estate, the most volatile sector and the deepest loser during systemic shocks, indicating structural volatility rather than spurious event detection.

Overall, H4 is supported. The placebo results do not reproduce the coherent, sector-consistent patterns observed around actual events, confirming that the abnormal returns documented in Chapter Four are event-driven rather than manifestations of random volatility (Kothari & Warner, 2007; Corrado, 2011).

5.2.5 Integrated Synthesis: Adjustment Dynamics on the QSE

Taken together, the evidence from Objectives 1 to 3 reveals a coherent adjustment mechanism on the Qatar Stock Exchange that links sectoral cycles, weak-form efficiency, and event-driven responses. Rather than exhibiting uniform market-wide repricing, the QSE processes new information through sectoral reallocation, staged correction, and horizon-dependent adjustment, with outcomes conditioned by the nature of the shock and sectoral exposure.

First, sectoral cycles and turning points are overwhelmingly event-driven rather than endogenous. Periods of heightened volatility and synchronised drawdowns coincide with systemic shocks such as the oil price collapse, the GCC blockade, and COVID-19, while later events generate increasingly segmented responses. This confirms that sectoral co-movement intensifies under economy-wide stress but weakens when shocks are anticipated or externally mediated, reflecting adaptive shock absorption rather than persistent fragility (Alqahtani & Chevallier, 2020; Kapar et al., 2024).

Second, weak-form efficiency on the QSE is conditional rather than absolute. Short-run predictability and non-random behaviour are concentrated in sectors exposed to policy signals, funding constraints, and valuation opacity, notably Banking, Real Estate, Transportation, and Insurance. In contrast, Telecommunications and, to a lesser extent, Consumer Goods display faster information assimilation. Crucially, variance-ratio evidence shows that these inefficiencies are transitory, with strong mean reversion dominating at longer horizons. This indicates delayed adjustment rather than persistent mispricing, consistent with informational frictions in emerging markets (Grossman & Stiglitz, 1980; Lo & MacKinlay, 1988).

Third, event-study results demonstrate that cumulative adjustment dominates immediate repricing. Statistically significant event-day abnormal returns are rare and largely confined to unexpected, locally binding shocks such as the GCC blockade. For most events, including COVID-19, geopolitical conflicts, and the FIFA World Cup, price discovery unfolds through CARs across post-event windows. COVID-19 stands out as the only episode generating a significant market-wide CAAR, confirming it as a genuine systemic shock, while other events are absorbed through sector-specific rotation and staggered correction (MacKinlay, 1997; Buigut & Kapar, 2020).

Overall, the QSE exhibits transient inefficiency, sector-specific vulnerability, and rapid medium-horizon correction. Market adjustment reflects the interaction of shock type, sectoral exposure, and institutional buffers rather than uniform behavioural responses. This integrated evidence supports a view of the QSE as an adaptive emerging market in which prices respond meaningfully to new information, but adjustment is uneven, horizon-dependent, and primarily channelled through sectoral dynamics rather than aggregate market dislocation (Benjelloun & Squalli, 2008; Kapar et al., 2024).

5.3 Comparative and Structural Insights: Evidence from the GCC Context

In comparative perspective, the Qatar Stock Exchange increasingly resembles an intermediate emerging market rather than a sentiment-driven frontier exchange. While sectoral asymmetries and short-run deviations from weak-form efficiency persist, volatility persistence has weakened and post-shock price adjustments have become more rapid and contained relative to earlier periods. This pattern is consistent with evidence from GCC and MENA markets showing that efficiency and resilience tend to improve with greater market depth, disclosure quality, and institutional participation, even as sector-level frictions remain (Benjelloun & Squalli, 2008; Erer, Erer & Güngör, 2023; Alnatour, 2025).

This structural profile mirrors developments observed in other Gulf exchanges, particularly Dubai and Riyadh, where regulatory reforms and enhanced transparency have shortened the duration of abnormal pricing following shocks. Comparative studies indicate that, although oil price dynamics and regional geopolitical risks continue to influence GCC equity markets, shock transmission increasingly occurs through selective sectoral channels rather than persistent market-wide dislocation (Buigut & Kapar, 2020; Kapar et al., 2024; Nawaz et al., 2025). The QSE displays a similar configuration, with global systemic shocks generating broader disruption while regional or anticipated events are absorbed through narrower sectoral adjustment.

From a structural standpoint, the persistent delayed adjustment observed in Real Estate and consumer-oriented sectors reflects continued exposure to leverage, liquidity constraints, and valuation opacity, whereas the relative stability of Banking underscores the role of regulatory oversight and policy credibility in moderating stress transmission (PwC, 2021; 2023). This reinforces regional evidence that market efficiency in MENA exchanges depends less on aggregate market size and more on sectoral composition, institutional quality, and disclosure standards (Arab Monetary Fund, 2023; Dalili & Boussedra, 2023).

Overall, the evidence suggests that the QSE is transitioning toward a more disciplined emerging-market structure characterised by selective shock absorption and faster correction of mispricing rather than uniform efficiency. This trajectory aligns with Qatar's broader financial development objectives under QNV 2030, while persistent sector-specific vulnerabilities indicate that structural transformation remains incomplete and targeted market-deepening reforms remain relevant.

5.4 Implications of the Findings

This section synthesises the empirical results into broader theoretical, policy, and investment implications. Rather than treating market efficiency as a binary condition, the findings reveal a nuanced landscape in which informational efficiency, sectoral resilience, and adjustment dynamics vary systematically across time, industries, and shock types.

5.4.1 Theoretical Contribution

The findings challenge the static interpretation of the Efficient Market Hypothesis (EMH) as articulated by Fama (1970, 1991), by demonstrating that weak-form efficiency in the QSE is uneven across sectors and varies systematically with market conditions and shock characteristics. Evidence of statistically significant short-run serial dependence alongside robust longer-horizon mean reversion indicates that prices do not always incorporate information instantaneously, particularly during periods of heightened uncertainty or liquidity constraints.

Importantly, the results do not imply persistent inefficiency, but rather conditional weak-form deviations that emerge around identifiable macroeconomic and geopolitical shocks and subsequently dissipate. This interpretation is consistent with Grossman and Stiglitz's (1980) information-cost framework, as well as empirical evidence documenting time-varying weak-form efficiency in emerging and frontier markets (Benjelloun and Squalli, 2008; Al-Khazali and Mirzaei, 2017; Dalili and Boussedra, 2023).

At the sectoral level, the findings reinforce the argument that aggregate market indices conceal substantial heterogeneity in return dynamics and efficiency properties. Banking and Telecommunications exhibit faster adjustment and weaker serial dependence, while Real Estate, Consumer Goods, and Insurance display delayed correction and episodic predictability. Similar sector-specific efficiency breakdowns during crisis periods are documented by Erer, Erer and Güngör (2023) and Meero (2018), who show that stress conditions amplify information frictions and thin-trading effects without generating permanent predictability.

Overall, the study contributes to GCC and MENA literature by demonstrating that deviations from weak-form efficiency are event-contingent, sector-specific, and transient, rather than structural, aligning with regional evidence on crisis-induced predictability and asymmetric information transmission (Neaime, 2016; Alqahtani, Bouri and Vo, 2020; Kapar et al., 2024).

5.4.2 Policy Implications

From a regulatory standpoint, the presence of asymmetric and sector-specific efficiency patterns underscores the importance of strengthening information diffusion and market microstructure, particularly during periods of stress. Delayed adjustment in several sectors suggests that improvements in disclosure timeliness, real-time reporting, and transparency could reduce short-run mispricing and volatility clustering.

Institutions such as the QFMA and the Qatar Central Bank (QCB) may use these findings to design sector-sensitive regulatory and liquidity interventions, rather than relying solely on uniform market-wide measures. Evidence from GCC markets indicates that targeted regulatory responses following the 2014-2016 oil price collapse and the COVID-19 shock helped stabilise sectoral volatility and improve price discovery (AMF, 2023; Al Samman and Akkas, 2021).

Persistent delayed adjustment in Real Estate and Consumer Goods highlights the need for deeper secondary market liquidity, enhanced valuation transparency, and improved disclosure standards, particularly in sectors closely linked to leverage, credit cycles, and non-tradable assets. Policies encouraging institutional participation, market-making activity, and the development of hedging instruments could help accelerate sectoral price adjustment and reduce behavioural herding during shocks.

These findings support financial development and diversification objectives as Qatar continues to expand non-hydrocarbon sectors and deepen its capital markets (NPC, 2024; OBG, 2025), improving sector-level efficiency and resilience becomes increasingly important for effective capital allocation and financial stability.

5.4.3 Investment Implications

The evidence of short-horizon predictability followed by strong mean reversion is consistent with Qatar-specific findings on return predictability at both the market and sectoral levels. Almujamed (2018) documents statistically significant predictable components in QSE returns arising from thin trading, liquidity frictions, and delayed information diffusion, particularly during periods of heightened uncertainty. The present results align with this evidence by showing that predictability in the QSE is episodic and event-contingent rather than persistent, and is most pronounced in sectors characterised by funding sensitivity and valuation opacity, notably Real Estate and Insurance.

Moreover, the asymmetric sectoral responses observed around geopolitical and macroeconomic shocks are consistent with evidence that geopolitical risk and oil-price uncertainty amplify return predictability in GCC markets, but do so unevenly across sectors. Alqahtani, Bouri and Vo (2020) demonstrate that geopolitical risk significantly affects the predictability of GCC stock returns, particularly in sectors with stronger links to external trade, energy markets, and capital flows. The present study corroborates this mechanism in the QSE context: Consumer Goods and Transportation display sharp short-window losses during trade- and mobility-related shocks, while Banking remains comparatively insulated, reflecting policy credibility and institutional backing.

Taken together, these results imply that event-driven and contrarian investment strategies may be effective only within narrowly defined windows, where ARs emerge before being corrected through mean reversion. This reinforces the conclusion that momentum-based strategies are unlikely to deliver sustained excess returns in the QSE, whereas disciplined contrarian positioning around identifiable shocks is more consistent with observed market dynamics.

5.5 Summary

This chapter discussed the study's empirical findings, interpreted their implications for market efficiency and sectoral behaviour on the QSE, and linked the results to the research hypotheses as seen in Table18.

Table 18: ***Summary of Hypothesis***

Hypothesis	Decision	Conclusion
H1: QSE Sectoral returns exhibit identifiable cyclical highs and lows that correspond with major macroeconomic and geopolitical events.	Accepted	Sectoral peaks and troughs cluster around shocks, with timing and magnitude varying by sector, indicating event-driven cyclicality rather than random fluctuation.
H2: QSE sectoral indices deviate from weak-form efficiency, with short-horizon serial dependence during turbulent periods.	Accepted	Short-run serial dependence appears in several sectors, while variance-ratio tests indicate mean reversion at longer-horizon, implying temporary rather than persistent predictability.
H3: The sensitivity of sectoral returns to shocks varies significantly across sectors, reflecting asymmetric reactions and differential resilience.	Accepted	Event-study results show economically and statistically significant cross-sector differences in sensitivity, adjustment speed, and resilience.
H4: Event-study abnormal returns are significant around actual event dates but insignificant around placebo dates.	Accepted	Statistically significant ARs and CARs are concentrated in true event windows, while placebo windows show weak and inconsistent responses, confirming event-driven rather than structural effects.

Chapter Six: Limitations and Future Recommendations

6.1 Introduction

This chapter presents the key limitations encountered in the research process and suggests pathways for further inquiry. Every empirical investigation operates within practical and theoretical confines, and recognising these ensures analytical transparency. The limitations identified here primarily relate to data scope, model specification, event identification, and market structure. The section concludes with proposed research extensions that could deepen understanding of adaptive market behaviour in emerging economies such as Qatar.

6.2 Limitations of the Study

Despite employing a rigorous econometric framework and triangulating evidence across descriptive analysis, weak-form efficiency tests, and event-study models, the study is subject to several limitations inherent to its design and data environment. These limitations arise from methodological assumptions, structural features of the QSE, and the broader regional and global context in which the market operates. Acknowledging these constraints is essential for interpreting the results appropriately and for identifying directions for future research.

The methodological constraints stem from the classical event-study framework. While widely recognised and suitable for detecting abnormal price reactions, it assumes stability in the relationship between sectoral returns and the market benchmark over the estimation period. Episodes of regulatory reform, shifts in foreign ownership limits, and changes in market participation may have temporarily altered this relationship, particularly during periods of high volatility. Moreover, the presence of non-normality, leptokurtosis, and volatility clustering in sectoral returns implies state-dependent risk dynamics, which constrain the ability of fixed-window event-study methods to fully distinguish abnormal returns from time-varying risk during stress periods. Although the framework is generally robust to moderate departures from normality, it is less effective in capturing asymmetric volatility, regime shifts, or evolving risk dynamics associated with repeated shocks. Likewise, fixed event windows of ±15 trading days, while ensuring consistency across events, may not fully capture adjustment paths that differ in intensity, duration, or informational complexity across shocks.

Structural limitations stem from the QSE's high market concentration and uneven liquidity distribution. A small number of large-capitalisation firms dominate sectors such as Banking and Industrials, meaning sector-level indices may reflect dominant-firm behaviour rather than broad industry responses. In less liquid sectors, including Real Estate and Insurance, thin trading and episodic participation can delay price adjustment or generate abrupt post-event movements. In addition, reliance on sector-level indices obscures variation in ownership structures, governance quality, free-float proportions, and foreign investor participation, limiting insight into firm-level responses.

Contextual limitations relate to the broader regional and global dynamics within which the QSE operates. The market is exposed to overlapping shocks, including oil price fluctuations, regional political developments, global monetary shifts, and pandemic-related disruptions, with these effects amplified by the peg of the Qatari riyal to the US dollar. In such an environment, isolating the effects of concurrent events is inherently difficult in a market closely linked to global energy and financial systems. Furthermore, the event-driven design deliberately excluded macroeconomic control variables in order to focus on abnormal returns attributable to specific events, limiting the decomposition of domestic influences from external macro-financial forces. Finally, reliance on quantitative secondary data constrains behavioural interpretation, as investor sentiment, regulatory timing, shifts in retail participation, and market psychology, which may influence short-term price reactions, are not directly observable.

Together, these limitations do not invalidate the findings but reflect the constraints of studying a concentrated emerging market such as the QSE.

6.3 Future Research Recommendations

Building on this study, several avenues for future research emerged owing to the QSE's market dynamics. They are as follows:

1. **Firm-level analysis:** In a concentrated market such as the QSE, sector returns are often driven by a small number of large-cap firms. Firm-level analysis would help distinguish sector-wide behaviour from dominant-firm effects, particularly in sectors characterised by state ownership, concentrated control, or limited free float.

2. **Higher-frequency data and market microstructure:** Predictability observed at the daily frequency may reflect liquidity frictions, order imbalances, or delayed trading rather than persistent mispricing. Intraday prices, bid–ask spreads, order flow, and trading intensity would improve identification of short-term price adjustment mechanisms.

3. **Integration of macro-financial variables:** Given Qatar's exposure to global energy markets and international capital flows, integrating oil prices, interest rates, inflation,

and global risk indicators would help disentangle event-specific effects from broader macroeconomic shocks.

4. **Time-varying and adaptive modelling frameworks:** Flexible approaches such as rolling-window event studies, DCC-GARCH, or VAR-based models would allow sectoral relationships to evolve over time and test whether repeated exposure to shocks leads to faster price adjustment and diminishing abnormal returns, consistent with the Adaptive Market Hypothesis.
5. **Behavioural and sustainability-related extensions:** In a market with a narrow investor base and limited analyst coverage, investor sentiment and information diffusion may exert a disproportionate influence on short-term price dynamics. Incorporating news-based sentiment measures, digital attention proxies, or ESG characteristics would allow assessment of whether firms with stronger governance or sustainability profiles exhibit greater resilience during systemic stress, in line with Qatar National Vision 2030.
6. **Cross-market GCC comparisons:** Extending the analysis to other GCC markets would help determine whether observed efficiency patterns are specific to Qatar or reflect broader regional dynamics. Comparisons between conventional and Sharia-compliant indices could also shed light on how investment constraints affect information assimilation during major shocks.

Collectively, these directions position the QSE as a valuable setting for examining how small, concentrated emerging markets balance episodic inefficiency with longer-term correction, learning, and resilience.

6.4 Summary

This chapter clarified the key limitations that shape the scope and interpretation of the study and outlined focused directions for future research. By situating these constraints within the structural, methodological, and contextual realities of the QSE, it reinforces analytical transparency while highlighting opportunities for deeper and more granular investigation. Overall, it positions the study as a robust foundation for extending empirical work on market efficiency, shock transmission, and resilience in small, concentrated emerging equity markets.

Chapter Seven: Conclusion

7.1 Introduction

This dissertation examined how sector-level prices on the Qatar Stock Exchange (QSE) adjust to information over time and across major macroeconomic and geopolitical shocks, using daily data from July 2014 to June 2025. The motivation was a simple but fundamental question: in a small, highly visible, and policy-sensitive market, do prices adjust instantaneously to new information, or does adjustment occur gradually, with meaningful differences across sectors?

To address this question, the research combined three complementary layers of analysis. First, it characterised the distributional properties of QSE sector returns and identified market turning points associated with major economic and geopolitical episodes. Second, it tested weak-form efficiency using multiple diagnostics designed to capture short-run serial dependence, directional clustering, and multi-horizon return scaling behaviour. Third, it implemented a multi-event event-study framework to examine sectoral repricing across anticipation and post-event correction windows, supplemented by placebo tests to distinguish genuine event effects from background volatility.

Taken together, the findings indicate that the QSE responds meaningfully to information shocks, but not in a uniform or instantaneous manner. Price adjustment is sector-dependent and shaped by the interaction between shock-specific transmission channels and Qatar's institutional and policy environment.

7.2 Summary of Main Findings

Overall, the evidence shows how sectoral prices on the QSE adjust to information, differ in efficiency, and reallocate risk across shocks.

- QSE sector returns are stationary but strongly non-normal, with fat tails and downside asymmetry, indicating that price behaviour is shaped by clustered shock-driven drawdowns and recoveries rather than smooth cycles, and that tail risk differs materially across sectors.
- Market turning points align with major shocks, but systemic depth depends on transmission. The oil collapse, GCC blockade, and COVID-19 generate broad stress, while the Russia-Ukraine war and the 2025 missile strike remain largely sector-contained.

- Weak-form efficiency is rejected at short horizons for the market index and most sectors, including Banking, Industrials, Real Estate, Transportation, and Insurance, reflecting delayed adjustment and non-random return patterns, while Telecommunications and parts of Consumer Goods behave more closely to weak-form efficiency.
- These inefficiencies are temporary. Variance-ratio evidence shows strong mean reversion across all sectors, indicating that short-run predictability is episodic and corrected over medium horizons rather than persistent.
- Event-day repricing is uncommon and concentrated in locally binding shocks, most clearly during the GCC blockade, while most adjustment occurs through cumulative returns, reflecting staged repricing and sector rotation.
- Sectoral responses align with economic roles. Consumer Goods and Transportation are most exposed to trade and mobility shocks, Real Estate is the dominant funding- and liquidity-sensitive sector, Banking acts as a stabiliser under policy credibility, Telecommunications shifts across regimes, and Insurance emerges as a selective geopolitical hedge.

Overall, the QSE processes shocks primarily through relative price adjustment across sectors, with systemic episodes producing broader contraction and non-systemic shocks absorbed through sectoral rotation rather than uniform market collapse.

7.3 Why the Findings Matter for Qatar, the GCC, and Emerging Markets

The value of this study lies not only in what it shows about return behaviour on the QSE, but in what that behaviour reveals about how small, policy-sensitive equity markets absorb shocks and reallocate risk across sectors.

For Qatar, the findings provide a clear, evidence-based map of sectoral vulnerability and resilience. Banking consistently displays stability during stress episodes, reflecting expectations of regulatory support and institutional credibility. Real Estate emerges as the most funding- and liquidity-sensitive sector, showing the deepest and most persistent cumulative losses during systemic shocks. Transportation and Consumer Goods react sharply to trade and mobility disruptions, while Telecommunications and Insurance shift roles depending on the nature of the shock. Together, these patterns identify the channels through which stress is most likely to propagate in future episodes, offering practical insight for financial stability monitoring and market development.

For the GCC, the results reinforce that regional equity markets should not be treated as homogeneous or purely oil-driven. Similar shocks generate different adjustment paths depending on sector composition, policy buffers, and market microstructure. The QSE illustrates how institutional credibility and sector structure shape repricing dynamics, helping explain why GCC markets often diverge in response to shared regional or global events. This sector-level perspective adds nuance to comparative Gulf market analysis and cautions against broad generalisations based on aggregate indices alone.

For emerging markets more broadly, the study highlights an important methodological and economic insight. Aggregate tests of market efficiency can obscure meaningful sectoral differences. Short-run inefficiency can coexist with strong longer-horizon correction, and both can vary substantially across industries. The QSE shows that informational frictions are real and economically relevant without implying persistent or easily exploitable predictability. Adjustment occurs through learning, correction, and reallocation over time, rather than through instantaneous absorption or chronic delay.

7.4 Summary

This dissertation examined how sector-level prices on the Qatar Stock Exchange adjust to information over time and across major economic and geopolitical shocks using a sectoral, event-driven framework. The findings show that price adjustment on the QSE is neither instantaneous nor uniform, with short-run inefficiencies emerging episodically but corrected over medium horizons through sectoral reallocation rather than persistent mispricing. Sectoral responses are shaped by underlying economic roles, institutional credibility, and liquidity conditions, highlighting the importance of disaggregated analysis in small, policy-sensitive markets. Overall, the study contributes a nuanced perspective on market efficiency and shock transmission in emerging equity markets, with implications for policymakers, investors, and future research.

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Appendix

Appendix A: Data Cleaning and Log-Return Transformation Procedures

Daily closing values for the QEAS and the sectoral indices were first imported into Stata and sorted by calendar date. However, since raw dataset contains only trading days, weekends and exchange holidays appear as gaps in the calendar, which prevents Stata from recognising the series as a continuous time index. To ensure that lagged return calculations function correctly, a simple numeric time variable was created using the natural row order of the cleaned dataset. This approach preserves the true sequence of trading days while overcoming irregular gaps in the calendar, enabling a valid "***tsset***" declaration. Finally, log returns were then generated and as expected, the first observation in each series is missing due to the lag.

Note: The Excel file containing the secondary index points time series, along with the Stata do-file and .dta data files are included with the submission and available upon request.

	Date	time	logret_QEAS	logret_QBNK	logret_QCON	logret_QIND	logret_QREA	logret_QTLC	logret_QTRN	logret_QINS
1	23jul2014	1	.	.	.	.	.	.	.	.
2	24jul2014	2	-.0158694	-.0146363	-.0147031	-.0093691	-.0630184	-.0233535	-.0092669	.0045854
3	27jul2014	3	-.0053463	-.0034788	.0038419	-.0062375	-.0330862	.0011544	-.0031216	-.002567
4	03aug2014	4	.0003655	-.0036666	.0174846	-.0053688	.0223194	.0047053	.0073785	.0015091
5	04aug2014	5	.0088295	.0116986	.0181603	.0038034	.0126561	-.018737	.0184847	.0162867
6	05aug2014	6	.0114581	.0089479	.0087602	.0147798	.0143461	.027419	.0087346	-.0009267
7	06aug2014	7	-.0048445	-.0100187	-.0004775	-.0016374	-.0000851	-.001471	.0010784	.0002802
8	07aug2014	8	-.0003569	.0011592	.0024726	-.0086095	.0040854	.0014522	.0074044	.0072914
9	10aug2014	9	-.001032	-.0061905	.007619	.0029958	.0037805	-.0053121	.0043301	.0045203
10	11aug2014	10	.0071056	.0064462	.0241172	.0071656	.0111625	.0040603	-.0046996	.0042191
11	12aug2014	11	.0105632	.009023	-.0005805	.0101278	.0300391	.0089596	.0184734	.0057602
12	13aug2014	12	.0166981	.0213936	.0013741	.0210876	.001231	.0194427	-.0015413	.0129454
13	14aug2014	13	-.0006614	-.0026056	-.0088551	.0080823	-.004608	-.010126	-.0060571	.0049519
14	17aug2014	14	-.0055986	-.0063924	-.005756	-.0016832	-.008071	-.0131974	-.008784	-.0021992
15	18aug2014	15	.0156976	.0231692	.008621	.0145686	.0111341	-.00174	-.0005148	.0128322
16	19aug2014	16	.0023824	.005118	.0034792	-.0017231	.0080925	-.0057216	.0004977	.0029634
17	20aug2014	17	.000133	.0010865	.0019388	.0010767	-.006214	-.0080934	-.00404	.008097
18	21aug2014	18	.0052937	.009663	.0034421	.0032408	-.0008124	.0008098	.0051845	-.0060041
19	24aug2014	19	.0000316	.0010748	-.0032957	.0019643	-.0062783	.0018575	-.0105216	.0034522
20	25aug2014	20	.0071061	.009328	-.0023137	.0080611	.0041584	-.0004798	.0014753	.0135084
21	26aug2014	21	.0029166	.005246	-.0012283	.001813	-.0067781	.0179371	-.0017005	-.0066934
22	27aug2014	22	-.002146	-.0054929	-.0056108	.0075837	-.0106099	.0026265	-.0108854	-.003852
23	28aug2014	23	-.0253686	-.0212597	-.0129464	-.0219946	-.027505	-.1052492	-.0310483	.0081166
24	31aug2014	24	.006362	-.0032616	.0026113	-.0012295	.0190275	.07606	.0363665	.0023192
25	01sep2014	25	.0068764	.0169852	.0034502	-.0025933	.000527	.0028242	-.0000305	-.0068511
26	02sep2014	26	.0038996	.0089408	-.0016572	-.002567	-.0065339	.0183274	-.0013248	.0014068
27	03sep2014	27	.0060027	.0064398	-.0063363	.0078016	.0015304	.0199863	-.0023532	.0056878
28	04sep2014	28	.0105892	.0125779	.0054462	.0094499	.0038279	.0147032	.011041	.0079148
29	07sep2014	29	-.0065115	-.0088414	.0045801	-.0103427	-.0040021	-.0073398	.0049203	.0049887
30	08sep2014	30	.0046878	.0032447	-.0040592	.0081173	.010077	.0137047	.0050675	-.0080715

Sample of Generated Time series and Log Return

Appendix B: Stationarity and Diagnostic Tests

This appendix presents the full Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) test outputs for log-return series as well as the stata commands used.

B1.0: Augmented Dickey-Fuller (ADF) Test Output

B 1.1: QE All Share (QEAS)

```
. dfuller logret_QEAS, lags(1)

Augmented Dickey-Fuller test for unit root

Variable: logret_QEAS                     Number of obs  = 2,711
                                          Number of lags =     1

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test      ─────────  critical value ──────────
              statistic           1%             5%           10%
─────────────────────────────────────────────────────────────────
 Z(t)           -35.473       -3.430         -2.860        -2.570
─────────────────────────────────────────────────────────────────
MacKinnon approximate p-value for Z(t) = 0.0000.
```

B 1.2: Banking (QBNK)

```
. dfuller logret_QBNK, lags(1)

Augmented Dickey-Fuller test for unit root

Variable: logret_QBNK                     Number of obs  = 2,711
                                          Number of lags =     1

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test      ─────────  critical value ──────────
              statistic           1%             5%           10%
─────────────────────────────────────────────────────────────────
 Z(t)           -36.053       -3.430         -2.860        -2.570
─────────────────────────────────────────────────────────────────
MacKinnon approximate p-value for Z(t) = 0.0000.
```

B 1.3: Consumer Goods (QCON)

```
. dfuller logret_QCON, lags(1)

Augmented Dickey-Fuller test for unit root

Variable: logret_QCON                     Number of obs  = 2,711
                                          Number of lags =     1

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test      ─────────  critical value ──────────
              statistic           1%             5%           10%
─────────────────────────────────────────────────────────────────
 Z(t)           -34.452       -3.430         -2.860        -2.570
─────────────────────────────────────────────────────────────────
MacKinnon approximate p-value for Z(t) = 0.0000.
```

B 1.4: Industrials (QIND)

```
. dfuller logret_QIND, lags(1)

Augmented Dickey-Fuller test for unit root

Variable: logret_QIND                   Number of obs  = 2,711
                                        Number of lags =     1

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test      ------- critical value ---------
              statistic           1%           5%         10%
--------------------------------------------------------------
 Z(t)           -34.942       -3.430       -2.860      -2.570
--------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000.
```

B 1.5: Real Estate (QREA)

```
. dfuller logret_QREA, lags(1)

Augmented Dickey-Fuller test for unit root

Variable: logret_QREA                   Number of obs  = 2,711
                                        Number of lags =     1

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test      ------- critical value ---------
              statistic           1%           5%         10%
--------------------------------------------------------------
 Z(t)           -35.987       -3.430       -2.860      -2.570
--------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000.
```

B 1.6: Telecom (QTEL)

```
. dfuller logret_QTLC, lags(1)

Augmented Dickey-Fuller test for unit root

Variable: logret_QTLC                   Number of obs  = 2,711
                                        Number of lags =     1

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test      ------- critical value ---------
              statistic           1%           5%         10%
--------------------------------------------------------------
 Z(t)           -38.180       -3.430       -2.860      -2.570
--------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000.
```

B :1.7 Transport (QTRN)

```
. dfuller logret_QTRN, lags(1)

Augmented Dickey-Fuller test for unit root

Variable: logret_QTRN                    Number of obs  = 2,711
                                         Number of lags =     1

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test         ──────── critical value ─────────
              statistic             1%           5%          10%
─────────────────────────────────────────────────────────────────
 Z(t)           -36.899         -3.430       -2.860       -2.570
─────────────────────────────────────────────────────────────────
MacKinnon approximate p-value for Z(t) = 0.0000.
```

B 1.8: Insurance (QINS)

```
. dfuller logret_QINS, lags(1)

Augmented Dickey-Fuller test for unit root

Variable: logret_QINS                    Number of obs  = 2,707
                                         Number of lags =     1

H0: Random walk without drift, d = 0

                                       Dickey-Fuller
                   Test         ──────── critical value ─────────
              statistic             1%           5%          10%
─────────────────────────────────────────────────────────────────
 Z(t)           -37.922         -3.430       -2.860       -2.570
─────────────────────────────────────────────────────────────────
MacKinnon approximate p-value for Z(t) = 0.0000.
```

Appendix C: Descriptive Statistics

This section provides stsata output and the key commands used to obtain descriptive statistics, distributional plots, and Jarque-Bera normality tests for the log-return series.

C 1.0: Sector Descriptive Tables

```
  log type:  smcl
 opened on:  21 Oct 2025, 06:43:26

. tabstat logret_QEAS logret_QBNK logret_QCON logret_QIND logret_QREA logret_QTLC log
> ret_QTRN logret_QINS, statistics(mean median sd skewness kurtosis min max) columns(
> statistics)
```

Variable	Mean	p50	SD	Skewness	Kurtosis	Min	Max
logret_QEAS	.0000659	.0001627	.009679	-.7806497	14.26083	-.0999834	.0727252
logret_QBNK	.0001612	.0001484	.0107745	-.3731169	9.733198	-.1011892	.0604644
logret_QCON	.0000469	.0001649	.0101948	-.6441339	20.3373	-.0982043	.0942858
logret_QIND	-5.75e-06	.0001199	.0116536	-.404712	10.30345	-.0995832	.08307
logret_QREA	-.0002177	-.0000851	.0156122	-.3211261	9.238789	-.1046998	.0951716
logret_QTLC	.0001118	.0000394	.0146606	-.207128	10.31905	-.1052492	.0953102
logret_QTRN	.000352	0	.0119161	-.0944241	12.58224	-.1027634	.0911022
logret_QINS	-.0001511	-.0002061	.0141013	.0852018	7.596459	-.0921056	.0864799

C 2.0: Confidence Interval Results

```
. ci mean logret_QEAS logret_QBNK logret_QCON logret_QIND logret_QREA logret_QTLC log
> ret_QTRN logret_QINS
```

Variable	Obs	Mean	Std. err.	[95% conf.	interval]
logret_QEAS	2,713	.0000659	.0001858	-.0002985	.0004302
logret_QBNK	2,713	.0001612	.0002069	-.0002445	.0005668
logret_QCON	2,713	.0000469	.0001957	-.0003369	.0004307
logret_QIND	2,713	-5.75e-06	.0002237	-.0004445	.000433
logret_QREA	2,713	-.0002177	.0002997	-.0008055	.00037
logret_QTLC	2,713	.0001118	.0002815	-.0004401	.0006637
logret_QTRN	2,713	.000352	.0002288	-.0000966	.0008006
logret_QINS	2,711	-.0001511	.0002708	-.0006822	.0003799

C 3.0: Jarque-Bera Results

```
===============================
 Jarque-Bera Test Results for QEAS

stats_QEAS[1,9]
                N          Mean        StdDev           Min           Max      Skewness      Kurtosis   Jarque-Bera       p-value
QEAS         2713     .00006587     .00967903    -.09998336     .07272521    -.78064971     14.260831     14609.954     1.23e-126
===============================
 Jarque-Bera Test Results for QBNK

stats_QBNK[1,9]
                N          Mean        StdDev           Min           Max      Skewness      Kurtosis   Jarque-Bera       p-value
QBNK         2713     .00016115     .01077452    -.10118919     .06046443     -.3731169     9.7331982     5187.8011     2.561e-76
===============================
 Jarque-Bera Test Results for QCON

stats_QCON[1,9]
                N          Mean        StdDev           Min           Max      Skewness      Kurtosis   Jarque-Bera       p-value
QCON         2713     .00004691     .01019476    -.09820432     .09428579    -.64413391     20.337304     34165.911     8.77e-137
===============================
 Jarque-Bera Test Results for QIND

stats_QIND[1,9]
                N          Mean        StdDev           Min           Max      Skewness      Kurtosis   Jarque-Bera       p-value
QIND         2713    -5.746e-06     .01165364    -.09958317        .08307    -.40471204     10.303446     6103.7411     1.585e-81
===============================
 Jarque-Bera Test Results for QREA

stats_QREA[1,9]
                N          Mean        StdDev           Min           Max      Skewness      Kurtosis   Jarque-Bera       p-value
QREA         2713    -.00021775     .01561219     -.1046998     .09517165    -.32112612     9.2387888      4446.491     1.504e-70
===============================
 Jarque-Bera Test Results for QTLC

stats_QTLC[1,9]
                N          Mean        StdDev           Min           Max      Skewness      Kurtosis   Jarque-Bera       p-value
QTLC         2713     .00011178     .01466059    -.10524917     .09531018    -.20712802     10.319051     6074.8718     3.747e-73
===============================
 Jarque-Bera Test Results for QTRN

stats_QTRN[1,9]
                N          Mean        StdDev           Min           Max      Skewness      Kurtosis   Jarque-Bera       p-value
QTRN         2713     .00035204     .01191609    -.10276338     .09110221    -.09442414     12.582239     10383.439     8.880e-83
===============================
 Jarque-Bera Test Results for QINS

stats_QINS[1,9]
                N          Mean        StdDev           Min           Max      Skewness      Kurtosis   Jarque-Bera       p-value
QINS         2711    -.00015114     .01410126     -.0921056     .08647987     .08520176      7.596459     2389.7999     5.243e-51
```

Appendix D: Weak-Form Efficiency Diagnostics

This appendix presents the full statistical outputs for all weak-form efficiency tests: autocorrelation Q-statistics, runs tests, and variance-ratio matrices. The graphical representations (ACF plots) have already been presented in the main results chapter and are therefore not repeated here.

D 1.0: Autocorrelation Q-Statistic Output (Lags 1–10)

```
============================================
 Autocorrelation Tests for Sector: QEAS
============================================

ac_QEAS[2,10]
                   Lag 1      Lag 2      Lag 3      Lag 4      Lag 5      Lag 6      Lag 7      Lag 8      Lag 9     Lag 10
QEAS Q-sta~c   31.421271  31.593723  47.983508  50.683155  53.725953  54.557092  58.915398  67.714076  67.834467  68.729056
QEAS p-value   2.077e-08  1.379e-07  2.147e-10  2.600e-10  2.386e-10  5.695e-10  2.484e-10  1.399e-11  4.041e-11  7.796e-11
============================================
 Autocorrelation Tests for Sector: QBNK
============================================

ac_QBNK[2,10]
                   Lag 1      Lag 2      Lag 3      Lag 4      Lag 5      Lag 6      Lag 7      Lag 8      Lag 9     Lag 10
QBNK Q-sta~c   14.913083  15.316811  22.353541  23.338571  27.329019   28.60454   34.74817   48.10322  48.115491  50.012747
QBNK p-value   .00011258  .00047206  .00005506  .00010835  .00004921  .00007227  .00001247  9.441e-08  2.430e-07  2.655e-07
============================================
 Autocorrelation Tests for Sector: QCON
============================================

ac_QCON[2,10]
                   Lag 1      Lag 2      Lag 3      Lag 4      Lag 5      Lag 6      Lag 7      Lag 8      Lag 9     Lag 10
QCON Q-sta~c   4.3983445  10.346412  17.036222  18.091134  19.992293  20.009671  22.410992  22.764971  29.632347  31.692269
QCON p-value   .03597384  .00566637  .00069472   .0011845   .0012539  .00275844  .00215725  .00367947  .00050658  .00045055
============================================
 Autocorrelation Tests for Sector: QIND
============================================

ac_QIND[2,10]
                   Lag 1      Lag 2      Lag 3      Lag 4      Lag 5      Lag 6      Lag 7      Lag 8      Lag 9     Lag 10
QIND Q-sta~c   30.519186  30.659579  44.924849  45.149973   50.52112  51.177294  54.086672  55.258153   55.37194  55.544163
QIND p-value   3.306e-08  2.200e-07  9.599e-10  3.700e-09  1.084e-09  2.729e-09  2.261e-09  3.933e-09  1.034e-08  2.499e-08
============================================
 Autocorrelation Tests for Sector: QREA
============================================

ac_QREA[2,10]
                   Lag 1      Lag 2      Lag 3      Lag 4      Lag 5      Lag 6      Lag 7      Lag 8      Lag 9     Lag 10
QREA Q-sta~c   37.746131  39.003148  48.984266  55.245895  55.293626  55.596543  55.998059  59.269344  59.501226  64.800518
QREA p-value   8.058e-10  3.393e-09  1.315e-10  2.885e-11  1.136e-10  3.512e-10  9.452e-10  6.482e-10  1.673e-09  4.425e-10
============================================
 Autocorrelation Tests for Sector: QTLC
============================================

ac_QTLC[2,10]
                   Lag 1      Lag 2      Lag 3      Lag 4      Lag 5      Lag 6      Lag 7      Lag 8      Lag 9     Lag 10
QTLC Q-sta~c   1.4697774  3.1189218  3.2299843  3.2338892  3.3105116  3.7322704  10.635139  10.858756  10.873529   17.13604
QTLC p-value   .22538082  .21024939    .357507  .51947472  .65223275  .71285377  .15534487  .20983144  .28447764  .07140745
============================================
 Autocorrelation Tests for Sector: QTRN
============================================

ac_QTRN[2,10]
                   Lag 1      Lag 2      Lag 3      Lag 4      Lag 5      Lag 6      Lag 7      Lag 8      Lag 9     Lag 10
QTRN Q-sta~c    2.438866  3.2164979  5.8230907  6.0283834  9.7052231   9.830369  13.933519  14.127607  20.800324  21.186305
QTRN p-value   .11836176  .20023793  .12054174  .19703859   .0840317  .13197972   .0523765  .07849942  .01356713  .01983126
============================================
 Autocorrelation Tests for Sector: QINS
============================================
(note: time series has 1 gap)

ac_QINS[2,10]
                   Lag 1      Lag 2      Lag 3      Lag 4      Lag 5      Lag 6      Lag 7      Lag 8      Lag 9     Lag 10
QINS Q-sta~c   3.0213911  3.6868609  3.9805583  4.0424174  4.4669322  4.6474746  4.7135793  8.8707943  12.337789  23.434056
QINS p-value   .08217295  .15827354  .26357115  .40029572  .48431995  .58975402   .6948693  .35331267  .19492921  .00925296
```

D 2.0: Runs Test Output

Runs Test for logret_QEAS (D)

	N	N <= mean	N > mean	Z	p-value
logret_QEA~D	**2713.0000**	**1338.0000**	**1375.0000**	**-5.2335**	**0.0000**

Runs Test for logret_QBNK (D)

	N	N <= mean	N > mean	Z	p-value
logret_QBN~D	**2713.0000**	**1357.0000**	**1356.0000**	**-3.0148**	**0.0026**

Runs Test for logret_QCON (D)

	N	N <= mean	N > mean	Z	p-value
logret_QCO~D	**2713.0000**	**1341.0000**	**1372.0000**	**-1.3183**	**0.1874**

Runs Test for logret_QIND (D)

	N	N <= mean	N > mean	Z	p-value
logret_QIN~D	**2713.0000**	**1336.0000**	**1377.0000**	**-4.3865**	**0.0000**

Runs Test for logret_QREA (D)

	N	N <= mean	N > mean	Z	p-value
logret_QRE~D	**2713.0000**	**1345.0000**	**1368.0000**	**-2.5504**	**0.0108**

Runs Test for logret_QTLC (D)

	N	N <= mean	N > mean	Z	p-value
logret_QTL~D	**2713.0000**	**1368.0000**	**1345.0000**	**0.6759**	**0.4991**

Runs Test for logret_QTRN (D)

	N	N <= mean	N > mean	Z	p-value
logret_QTR~D	**2713.0000**	**1408.0000**	**1305.0000**	**-2.8670**	**0.0041**

Runs Test for logret_QINS (D)

	N	N <= mean	N > mean	Z	p-value
logret_QIN~D	**2714.0000**	**1363.0000**	**1351.0000**	**3.8025**	**0.0001**

D 3.0: Lo–MacKinlay Variance-Ratio Test

Variance Ratio Test for logret_QEAS

	Lag2	Lag4	Lag8	Lag16
VR	**0.5646**	**0.2719**	**0.1487**	**0.0685**
R-stat	**-22.6135**	**-20.2077**	**-14.9434**	**-10.9718**
p-value	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Variance Ratio Test for logret_QBNK

	Lag2	Lag4	Lag8	Lag16
VR	**0.5470**	**0.2658**	**0.1453**	**0.0669**
R-stat	**-23.5299**	**-20.3757**	**-15.0031**	**-10.9906**
p-value	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Variance Ratio Test for logret_QCON

	Lag2	Lag4	Lag8	Lag16
VR	**0.4956**	**0.2659**	**0.1321**	**0.0660**
R-stat	**-26.1990**	**-20.3744**	**-15.2348**	**-11.0011**
p-value	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Variance Ratio Test for logret_QIND

	Lag2	Lag4	Lag8	Lag16
VR	**0.5553**	**0.2776**	**0.1434**	**0.0690**
R-stat	**-23.1009**	**-20.0489**	**-15.0361**	**-10.9657**
p-value	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Variance Ratio Test for logret_QREA

	Lag2	Lag4	Lag8	Lag16
VR	**0.5769**	**0.2696**	**0.1468**	**0.0697**
R-stat	**-21.9777**	**-20.2704**	**-14.9765**	**-10.9581**
p-value	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Variance Ratio Test for logret_QTLC

	Lag2	Lag4	Lag8	Lag16
VR	**0.5013**	**0.2447**	**0.1239**	**0.0623**
R-stat	**-25.9013**	**-20.9614**	**-15.3781**	**-11.0452**
p-value	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Variance Ratio Test for logret_QTRN

	Lag2	Lag4	Lag8	Lag16
VR	**0.5242**	**0.2604**	**0.1281**	**0.0655**
R-stat	**-24.7152**	**-20.5273**	**-15.3040**	**-11.0075**
p-value	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Variance Ratio Test for logret_QINS

	Lag2	Lag4	Lag8	Lag16
VR	**0.4915**	**0.2413**	**0.1262**	**0.0602**
R-stat	**-26.4149**	**-21.0576**	**-15.3374**	**-11.0698**
p-value	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Event-Study Outputs

This appendix presents the (AR), (CAR), and (CAAR) outputs from Stata for the event study. CAAR values represent CARs, and the CAR [0,0] reports the event-day abnormal return. The CAR plots show the cumulative return path over [-15, +15], followed by the aggregated CAAR curve for all sector indices. These are included to ensure transparency and replicability of the results.

Note: "Ptf CARs n 1 (7 securities)" and "CAAR group 1 (7 securities)" are Stata-generated aggregates an equal-weighted portfolio series and a cross-sectional average respectively, and while retained for completeness, neither is used in this study's sector-level analysis.

Appendix E: Oil Price Collapse (2016)

```
. estudy QBNK QCON QIND QREA QTLC QTRN QINS, datevar(Date) evdate(01122016) dateformat(MDY) modt(SIM) indexlist(QEAS) diagn(Norm) lb1(-15) u
> b1(15) lb2(-15) ub2(-1) lb3(1) ub3(7) lb4(8) ub4(15) lb5(1) ub5(15) lb6(0) ub6(0) dec(4) eswlb(-135) eswub(-16) showp
```

Event study with common event date
Event date: 12jan2016, with 6 event windows specified, under the Normality assumption

SECURITY	CAAR[-15,15]	CAAR[-15,-1]	CAAR[1,7]	CAAR[8,15]	CAAR[1,15]	CAAR[0,0]
QBNK	-0.1029%	-1.1694%	1.2372%	-0.1513%	1.0859%	-0.0194%
	(0.9707)	(0.5256)	(0.3271)	(0.9130)	(0.5566)	(0.9659)
QCON	-2.9562%	-1.8387%	-6.7390%***	6.5179%**	-0.2211%	-0.8964%
	(0.5830)	(0.6034)	(0.0062)	(0.0156)	(0.9503)	(0.3055)
QIND	1.5509%	3.3670%*	-1.2919%	-0.5775%	-1.8694%	0.0533%
	(0.5555)	(0.0533)	(0.2760)	(0.6571)	(0.2819)	(0.9005)
QREA	-4.7402%	-1.9553%	-1.8934%	-1.6311%	-3.5245%	0.7396%
	(0.3643)	(0.5688)	(0.4205)	(0.5276)	(0.3065)	(0.3829)
QTLC	20.5275%**	10.3195%**	11.7942%***	-2.8030%	8.9912%*	1.2169%
	(0.0104)	(0.0489)	(0.0012)	(0.4739)	(0.0864)	(0.3436)
QTRN	-7.2915%	-2.5980%	-2.9752%	0.3927%	-2.5826%	-2.1110%**
	(0.2261)	(0.5109)	(0.2721)	(0.8948)	(0.5146)	(0.0319)
QINS	2.9464%	-2.5468%	1.5931%	3.6737%	5.2668%	0.2264%
	(0.7007)	(0.6134)	(0.6442)	(0.3334)	(0.2983)	(0.8555)
Ptf CARs n 1 (7 securities)	1.5352%	0.5134%	0.3102%	0.8290%	1.1392%	-0.1174%
	(0.3584)	(0.6400)	(0.6797)	(0.3163)	(0.3015)	(0.6648)
CAAR group 1 (7 securities)	1.6929%	0.5688%	0.3639%	0.8681%	1.2319%	-0.1078%
	(0.4333)	(0.6886)	(0.7080)	(0.4167)	(0.3873)	(0.7582)

*** p-value < .01, ** p-value <.05, * p-value <.1
p-values in parentheses

Appendix F: GCC Blockade (2017)

```
. estudy QBNK QCON QIND QREA QTLC QTRN QINS, datevar(Date) evdate(06052017) dateformat(MDY) modt(SIM) indexlist(QEAS) diagn(Norm) lb1(
> -15) ub1(15) lb2(-15) ub2(-1) lb3(1) ub3(7) lb4(8) ub4(15) lb5(1) ub5(15) lb6(0) ub6(0) dec(4) eswlb(-135) eswub(-16) showp
```

Event study with common event date
Event date: 05jun2017, with 6 event windows specified, under the Normality assumption

SECURITY	CAAR[-15,15]	CAAR[-15,-1]	CAAR[1,7]	CAAR[8,15]	CAAR[1,15]	CAAR[0,0]
QBNK	3.7116%	4.9110%***	-2.7232%***	-0.7880%	-3.5112%**	2.3117%***
	(0.1179)	(0.0013)	(0.0067)	(0.4634)	(0.0203)	(0.0001)
QCON	-8.1568%**	-1.0005%	1.3151%	-2.5188%	-1.2037%	-5.9526%***
	(0.0268)	(0.6648)	(0.3894)	(0.1305)	(0.6024)	(0.0000)
QIND	-2.4909%	0.9198%	-0.3088%	-1.7856%	-2.0945%	-1.3163%*
	(0.4586)	(0.6652)	(0.8260)	(0.2433)	(0.3255)	(0.0956)
QREA	-5.6435%	-11.7284%***	5.4574%***	1.2989%	6.7563%**	-0.6713%
	(0.1709)	(0.0000)	(0.0019)	(0.4869)	(0.0104)	(0.4849)
QTLC	-2.2401%	-3.9739%	-2.3983%	2.1527%	-0.2457%	1.9795%
	(0.7391)	(0.3514)	(0.3948)	(0.4818)	(0.9540)	(0.2098)
QTRN	4.0869%	1.6086%	3.7077%**	5.3503%***	9.0580%***	-6.5796%***
	(0.3346)	(0.5481)	(0.0378)	(0.0061)	(0.0010)	(0.0000)
QINS	4.1122%	-3.2245%	3.6196%	3.2964%	6.9160%*	0.4207%
	(0.4889)	(0.3915)	(0.1468)	(0.2233)	(0.0678)	(0.7619)
Ptf CARs n 1 (7 securities)	-0.7512%	-1.6934%**	1.2820%**	1.0430%*	2.3249%***	-1.3827%***
	(0.5536)	(0.0365)	(0.0169)	(0.0722)	(0.0044)	(0.0000)
CAAR group 1 (7 securities)	-0.6439%	-1.6656%	1.3094%*	1.0590%	2.3684%**	-1.3467%***
	(0.7086)	(0.1284)	(0.0711)	(0.1778)	(0.0316)	(0.0011)

*** p-value < .01, ** p-value <.05, * p-value <.1
p-values in parentheses

Appendix G: COVID-19 pandemic (2020)

```
. estudy QBNK QCON QIND QREA QTLC QTRN QINS, datevar(Date) evdate(03022020) dateformat(MDY) modt(SIM) indexlist(QEAS) diagn(Norm) lb1(
> -15) ub1(15) lb2(-15) ub2(-1) lb3(1) ub3(7) lb4(8) ub4(15) lb5(1) ub5(15) lb6(0) ub6(0) dec(4) eswlb(-135) eswub(-16) showp
```

Event study with common event date
Event date: **02mar2020**, with **6** event windows specified, under the Normality assumption

SECURITY	CAAR[-15,15]	CAAR[-15,-1]	CAAR[1,7]	CAAR[8,15]	CAAR[1,15]	CAAR[0,0]
QBNK	5.6300%***	2.7358%**	1.4238%**	1.3805%*	2.8043%**	0.0899%
	(0.0012)	(0.0110)	(0.0471)	(0.0636)	(0.0101)	(0.7366)
QCON	-9.1753%**	-4.3696%	-3.9684%**	-0.4377%	-4.4060%	-0.3996%
	(0.0405)	(0.1165)	(0.0341)	(0.8204)	(0.1179)	(0.5667)
QIND	-8.8336%***	-3.2724%	-2.2116%	-2.4503%*	-4.6619%**	-0.8993%*
	(0.0088)	(0.1163)	(0.1130)	(0.0913)	(0.0279)	(0.0867)
QREA	-14.8345%**	-11.7599%***	-0.5728%	-2.5222%	-3.0951%	0.0204%
	(0.0152)	(0.0022)	(0.8203)	(0.3365)	(0.4173)	(0.9828)
QTLC	-5.8365%	-2.7833%	-2.6603%	-2.8412%	-5.5015%	2.4484%**
	(0.3637)	(0.4872)	(0.3220)	(0.3087)	(0.1762)	(0.0164)
QTRN	0.4827%	-1.7253%	3.0238%	-2.0124%	1.0115%	1.1966%
	(0.9236)	(0.5828)	(0.1521)	(0.3578)	(0.7503)	(0.1317)
QINS	-6.4354%	1.0223%	-4.6302%	-3.2714%	-7.9015%	0.4439%
	(0.4032)	(0.8311)	(0.1508)	(0.3275)	(0.1054)	(0.7128)
Ptf CARs n 1 (7 securities)	-5.3850%***	-2.8570%***	-1.3068%*	-1.6401%**	-2.9469%***	0.4188%
	(0.0013)	(0.0060)	(0.0582)	(0.0226)	(0.0051)	(0.1055)
CAAR group 1 (7 securities)	-5.2317%***	-2.8030%**	-1.2347%	-1.6135%*	-2.8482%**	0.4196%
	(0.0098)	(0.0260)	(0.1408)	(0.0647)	(0.0255)	(0.1825)

Appendix H: Russia-Ukraine War (20

```
. estudy QBNK QCON QIND QREA QTLC QTRN QINS, datevar(Date) evdate(02242022) dateformat(MDY) modt(SIM) indexlist(QEAS) diagn(Norm) lb1(
> -15) ub1(15) lb2(-15) ub2(-1) lb3(1) ub3(7) lb4(8) ub4(15) lb5(1) ub5(15) lb6(0) ub6(0) dec(4) eswlb(-135) eswub(-16) showp
```

Event study with common event date
Event date: **24feb2022**, with **6** event windows specified, under the Normality assumption

SECURITY	CAAR[-15,15]	CAAR[-15,-1]	CAAR[1,7]	CAAR[8,15]	CAAR[1,15]	CAAR[0,0]
QBNK	-0.7412%	-0.8802%	-0.8413%	0.7156%	-0.1256%	0.2647%
	(0.6061)	(0.3492)	(0.2363)	(0.2909)	(0.8966)	(0.2582)
QCON	-3.1199%	0.5850%	-3.0339%**	0.2284%	-2.8056%	-0.8994%*
	(0.2967)	(0.7641)	(0.0409)	(0.8708)	(0.1638)	(0.0656)
QIND	5.5493%*	3.1688%	3.0826%**	-0.9506%	2.1320%	0.2485%
	(0.0789)	(0.1241)	(0.0481)	(0.5201)	(0.3135)	(0.6262)
QREA	-4.9452%	1.0969%	-0.5375%	-4.8211%***	-5.3585%**	-0.6836%
	(0.1792)	(0.6474)	(0.7664)	(0.0060)	(0.0315)	(0.2530)
QTLC	-1.5081%	4.2751%*	-5.2580%***	-0.1719%	-5.4299%**	-0.3533%
	(0.6749)	(0.0707)	(0.0036)	(0.9191)	(0.0263)	(0.5457)
QTRN	-6.6143%*	-6.8912%***	-0.3184%	0.5849%	0.2665%	0.0105%
	(0.0712)	(0.0044)	(0.8592)	(0.7329)	(0.9134)	(0.9858)
QINS	-3.1405%	-1.6062%	0.7256%	0.2812%	1.0068%	-2.5412%***
	(0.5294)	(0.6225)	(0.7681)	(0.9047)	(0.7643)	(0.0021)
Ptf CARs n 1 (7 securities)	-1.9812%	-0.0140%	-0.8294%	-0.5742%	-1.4037%*	-0.5635%***
	(0.1093)	(0.9861)	(0.1733)	(0.3225)	(0.0919)	(0.0056)
CAAR group 1 (7 securities)	-1.9525%	0.0100%	-0.8338%	-0.5679%	-1.4018%	-0.5607%***
	(0.1408)	(0.9907)	(0.2015)	(0.3613)	(0.1162)	(0.0100)

Appendix I: FIFA World Cup (2022)

```
. estudy QBNK QCON QIND QREA QTLC QTRN QINS, datevar(Date) evdate(11202022) dateformat(MDY) modt(SIM) indexlist(QEAS) diagn(Norm) lb
> 1(-15) ub1(15) lb2(-15) ub2(-1) lb3(1) ub3(7) lb4(8) ub4(15) lb5(1) ub5(15) lb6(0) ub6(0) dec(4) eswlb(-135) eswub(-16) showp
```

Event study with common event date
Event date: **20nov2022**, with **6** event windows specified, under the Normality assumption

SECURITY	CAAR[-15,15]	CAAR[-15,-1]	CAAR[1,7]	CAAR[8,15]	CAAR[1,15]	CAAR[0,0]
QBNK	1.8106%	1.1656%	1.1688%	-0.5239%	0.6449%	0.0000%
	(0.5499)	(0.5655)	(0.3855)	(0.7169)	(0.7512)	(.)
QCON	-3.9311%	0.7963%	-4.1476%**	-0.5797%	-4.7273%	0.0000%
	(0.3793)	(0.7900)	(0.0383)	(0.7856)	(0.1170)	(.)
QIND	-0.2360%	-2.2504%	0.7195%	1.2949%	2.0144%	0.0000%
	(0.9650)	(0.5323)	(0.7633)	(0.6141)	(0.5774)	(.)
QREA	-4.8602%	-2.6505%	-1.9234%	-0.2863%	-2.2097%	0.0000%
	(0.3795)	(0.4740)	(0.4337)	(0.9135)	(0.5518)	(.)
QTLC	-3.3185%	0.7973%	-8.4527%***	4.3368%	-4.1158%	0.0000%
	(0.6282)	(0.8620)	(0.0063)	(0.1864)	(0.3720)	(.)
QTRN	-4.9135%	-1.8816%	-2.2324%	-0.7996%	-3.0319%	0.0000%
	(0.5188)	(0.7121)	(0.5095)	(0.8258)	(0.5535)	(.)
QINS	-4.6043%	-2.6971%	0.7429%	-2.6502%	-1.9072%	0.0000%
	(0.3725)	(0.4352)	(0.7457)	(0.2826)	(0.5821)	(.)
Ptf CARs n 1 (7 securities)	-2.8503%	-0.9862%	-1.9982%*	0.1342%	-1.8640%	0.0000%
	(0.2233)	(0.5284)	(0.0559)	(0.9041)	(0.2360)	(.)
CAAR group 1 (7 securities)	-2.7299%	-0.9262%	-1.9651%**	0.1615%	-1.8036%	0.0000%
	(0.1990)	(0.5142)	(0.0386)	(0.8732)	(0.2067)	(.)

Appendix J: Iran Missile Strike (2025)

```
. estudy QBNK QCON QIND QREA QTLC QTRN QINS, datevar(Date) evdate(06242025) dateformat(MDY) modt(SIM) indexlist(QEAS) diagn(Norm) lb
> 1(-15) ub1(15) lb2(-15) ub2(-1) lb3(1) ub3(7) lb4(8) ub4(15) lb5(1) ub5(15) lb6(0) ub6(0) dec(4) eswlb(-135) eswub(-16) showp
```

Event study with common event date
Event date: **24jun2025**, with 6 event windows specified, under the Normality assumption

SECURITY	CAAR[-15,15]	CAAR[-15,-1]	CAAR[1,7]	CAAR[8,15]	CAAR[1,15]	CAAR[0,0]
QBNK	0.4066%	0.4314%	0.1098%	0.1358%	0.2456%	-0.2704%
	(0.8069)	(0.6946)	(0.8803)	(0.8614)	(0.8229)	(0.3268)
QCON	1.4083%	-0.3081%	1.4480%	0.2644%	1.7124%	0.0041%
	(0.6227)	(0.8704)	(0.2494)	(0.8433)	(0.3650)	(0.9932)
QIND	1.2821%	1.2582%	-0.6749%	1.2296%	0.5547%	-0.5308%
	(0.6888)	(0.5519)	(0.6306)	(0.4119)	(0.7928)	(0.3172)
QREA	-0.2375%	-1.6798%	-0.6946%	0.6499%	-0.0448%	1.4870%**
	(0.9564)	(0.5588)	(0.7155)	(0.7492)	(0.9875)	(0.0405)
QTLC	-6.3457%	-2.9959%	-2.0823%	-2.6197%	-4.7021%	1.3523%
	(0.2199)	(0.3797)	(0.3577)	(0.2783)	(0.1686)	(0.1148)
QTRN	-3.4903%	-1.5416%	-0.4814%	-2.7666%	-3.2481%	1.2994%
	(0.5476)	(0.6874)	(0.8498)	(0.3087)	(0.3967)	(0.1774)
QINS	1.5746%	-3.4994%	4.4692%**	0.2495%	4.7186%	0.3555%
	(0.7313)	(0.2489)	(0.0277)	(0.9073)	(0.1205)	(0.6394)
Ptf CARs n 1 (7 securities)	-0.7584%	-1.1762%	0.3066%	-0.4181%	-0.1116%	0.5293%**
	(0.5805)	(0.1956)	(0.6102)	(0.5147)	(0.9018)	(0.0211)
CAAR group 1 (7 securities)	-0.6890%	-1.1418%	0.3229%	-0.4013%	-0.0784%	0.5312%**
	(0.6616)	(0.2730)	(0.6398)	(0.5857)	(0.9398)	(0.0431)

*** p-value < .01, ** p-value <.05, * p-value <.1
p-values in parentheses

Appendix K: Placebo

```
. estudy QBNK QCON QIND QREA QTLC QTRN QINS, datevar(Date) evdate(06202019) dateformat(MDY) modt(SIM) indexlist(QEAS) diagn(Norm) lb
> 1(-15) ub1(15) lb2(-15) ub2(-1) lb3(1) ub3(7) lb4(8) ub4(15) lb5(1) ub5(15) lb6(0) ub6(0) dec(4) eswlb(-135) eswub(-16) showp
```

Event study with common event date
Event date: **20jun2019**, with 6 event windows specified, under the Normality assumption

SECURITY	CAAR[-15,15]	CAAR[-15,-1]	CAAR[1,7]	CAAR[8,15]	CAAR[1,15]	CAAR[0,0]
QBNK	5.9794%**	6.0139%***	-0.7236%	0.0413%	-0.6822%	0.6478%
	(0.0272)	(0.0010)	(0.5283)	(0.9732)	(0.6933)	(0.1354)
QCON	0.0973%	0.4061%	-0.7503%	0.1682%	-0.5821%	0.2733%
	(0.9865)	(0.9150)	(0.7596)	(0.9490)	(0.8749)	(0.7673)
QIND	-7.3289%*	-4.8317%*	-0.6346%	-2.0142%	-2.6488%	0.1516%
	(0.0944)	(0.0968)	(0.7335)	(0.3150)	(0.3469)	(0.8290)
QREA	-13.5257%	-15.6301%**	3.6568%	1.9381%	5.5948%	-3.4904%**
	(0.1995)	(0.0266)	(0.4166)	(0.6880)	(0.4099)	(0.0410)
QTLC	6.0143%	0.8353%	0.0586%	4.9949%**	5.0536%	0.1254%
	(0.2176)	(0.7959)	(0.9775)	(0.0269)	(0.1093)	(0.8729)
QTRN	0.4348%	-0.9667%	1.7971%	-1.2292%	0.5678%	0.8337%
	(0.9449)	(0.8172)	(0.5052)	(0.6709)	(0.8889)	(0.4120)
QINS	-0.7497%	-0.3167%	-0.4423%	0.1445%	-0.2978%	-0.1352%
	(0.9220)	(0.9503)	(0.8926)	(0.9672)	(0.9519)	(0.9127)
Ptf CARs n 1 (7 securities)	-1.3415%	-2.0669%**	0.4005%	0.5545%	0.9549%	-0.2295%
	(0.3745)	(0.0408)	(0.5352)	(0.4240)	(0.3275)	(0.3459)
CAAR group 1 (7 securities)	-1.1424%	-1.9668%	0.4424%	0.6005%	1.0429%	-0.2184%
	(0.6395)	(0.2259)	(0.6716)	(0.5920)	(0.5078)	(0.5785)

*** p-value < .01, ** p-value <.05, * p-value <.1
p-values in parentheses

Appendix L: Stata Commands

This provides the core Stata syntax used to generate the empirical results. Only representative commands are displayed to maintain clarity. They document how the stationarity tests, diagnostic procedures, and event-study computations were executed, ensuring transparency and replicability of the analytical workflow.

L 1.0: Data Preparation and Log-Return Construction

This section shows how the daily index data were structured as a time series and transformed into logarithmic returns for the market and sector indices.

```
* Sort by trading date
.    sort Date
* Create sequential time index to avoid gaps from weekends/holidays
.    gen time = _n
.    tsset time
* Generate log returns for market and sector indices
.    gen logret_QEAS = ln(QEAS / L.QEAS)
.    gen logret_QBNK = ln(QBNK / L.QBNK)
.    gen logret_QCON = ln(QCON / L.QCON)
.    gen logret_QIND = ln(QIND / L.QIND)
.    gen logret_QREA = ln(QREA / L.QREA)
.    gen logret_QTLC = ln(QTLC / L.QTLC)
.    gen logret_QTRN = ln(QTRN / L.QTRN)
.    gen logret_QINS = ln(QINS / L.QINS)
```

L 2.0: Descriptive Statistics and Normality Tests

This section provides the commands used to obtain descriptive statistics, distributional plot, and Jarque-Bera tests.

L 2.1: Descriptive Statistics

```
.    tabstat logret_QEAS logret_QBNK logret_QCON logret_QIND logret_QREA logret_QTLC
     logret_QTRN logret_QINS, statistics(mean median sd skewness kurtosis min max)
     columns(statistics)
```

L 2.2: Confidence Interval for Mean Returns

```
.    ci mean logret_QEAS logret_QBNK logret_QCON logret_QIND logret_QREA logret_QTLC
     logret_QTRN logret_QINS
```

L 2.3: Jarque–Bera Normality Test

```
* Define sectoral series (market + sectors)

.   local sectors QEAS QBNK QCON QIND QREA QTLC QTRN QINS

* Loop over each series, compute JB statistic and p-value, and collate into a single summary matrix
foreach s of local sectors {

* Summary statistics (N, mean, sd, min, max, skewness, kurtosis)

.   quietly tabstat logret_`s', stat(n mean sd min max skewness kurtosis) save

    matrix stats_`s' = r(StatTotal)'

* Extract components for manual Jarque–Bera calculation

.   scalar N    = stats_`s'[1,1]

.   scalar skew = stats_`s'[1,6]

.   scalar kurt = stats_`s'[1,7]

.   scalar JB   = (N/6) * (skew^2 + 0.25*(kurt - 3)^2)

* Obtain p-value from skewness/kurtosis test

.   quietly sktest logret_`s'

.   scalar pval = r(p_chi2)

* Append JB and p-value to the stats matrix

.   matrix jb_test_`s' = (JB, pval)

.   matrix stats_`s'   = stats_`s', jb_test_`s'

* Label columns and row

.   matrix colnames stats_`s' = "N" "Mean" "StdDev" "Min" "Max" "Skewness" "Kurtosis" "Jarque–Bera"
        "p-value"

.   matrix rownames stats_`s' = "`s'"

}

* Combine all series into a single Jarque–Bera summary table

matrix finalJB = stats_QEAS \ stats_QBNK \ stats_QCON \ stats_QIND \ stats_QREA \ stats_QTLC \
        stats_QTRN \ stats_QINS
```

L 2.4: Identification of Peaks, Troughs, and Smoothed Cycles

```
* Peak and trough markers for QEAS log returns

. gen peak_QEAS = (logret_QEAS > logret_QEAS[_n-1] & logret_QEAS > logret_QEAS[_ n+1])

. gen trough_QEAS = (logret_QEAS < logret_QEAS[_n-1] & logret_QEAS < logret_QEAS[_n+1])

* Localised smoothing using a centred 6-period window

. gen rollmean3 = (L3.logret_QEAS + L2.logret_QEAS + L1.logret_QEAS + F1.logret_QEAS +
          F2.logret_QEAS + F3.logret_QEAS)/6

* Peak indicator relative to local smoothed mean

. gen peak_smooth = (logret_QEAS > rollmean3)

* Moving-average smoothing using Stata's tssmooth command (30-period MA)

. tssmooth ma rollmean30 = logret_QEAS, window(29 1)

* Plot raw and smoothed series

. tsline logret_QEAS rollmean30

* Save graph

. graph save "Graph" "D:\OneDrive\Oryx Assessments\7707_Dissertation\Graph\Roll Mean_Graph.gph"
```

L 2.5: Stationarity Tests

This section presents an example of Stata commands used to confirm stationarity.

M 3.1: Augmented Dickey–Fuller (ADF) tests

```
. dfuller logret_QEAS, lags(1)
. dfuller logret_QBNK, lags(1)
. dfuller logret_QCON, lags(1)
. dfuller logret_QIND, lags(1)
. dfuller logret_QREA, lags(1)
. dfuller logret_QTLC, lags(1)
. dfuller logret_QTRN, lags(1)
. dfuller logret_QINS, lags(1)
```

L 3.0: Weak-Form Efficiency Diagnosticss

This appendix presents the full statistical outputs for all weak-form efficiency tests: autocorrelation Q-statistics, runs tests, and variance-ratio matrices. The graphical representations (ACF plots) have already been presented in the main results chapter and are therefore not repeated here.

L 3.1: Autocorrelation Q-Statistic Output (Lags 1–10)

```
==============================================================
* Dataset variables:
* logret_QEAS logret_QBNK logret_QCON logret_QIND logret_QREA logret_QTLC logret_QTRN logret_QINS
==============================================================
* Define sectoral log-return suffixes
. local sectors QEAS QBNK QCON QIND QREA QTLC QTRN QINS
* Loop through each sector
. foreach s of local sectors {
.     di as txt "=================================================="
.     di as txt " Autocorrelation Tests for Sector: `s'"
.     di as txt "=================================================="
* --- Autocorrelation Plot ---
.     ac logret_`s',title("Autocorrelation of `s' Log Returns") name("`s'_ACF", replace)
* --- Initialize matrix flag ---
.     local first = 1
* --- Ljung–Box Q tests for lags 1–10 ---
.     foreach n of numlist 1/10 {
.         quietly wntestq logret_`s', lag(`n')
.         if `first' == 1 {
.             matrix ac_`s' = (r(stat) \ r(p))
.             matrix rownames ac_`s' = "`s' Q-statistic" "`s' p-value"
.             matrix colnames ac_`s' = "Lag `n'"
.             local first = 0
.         }
.             matrix ac_`s' = ac_`s', helper
.         }
.     }
. putexcel A1 = matrix(ac_all), names
```

L 3.2: Runs Test of Randomness

```
. ssc install runtest, replace
. which runtest
. tsset time
* --- Define sector indices and interval tag (for matrix naming) ---
. local indices logret_QEAS logret_QBNK logret_QCON logret_QIND logret_QREA logret_QTLC logret_QTRN logret_QINS
. local interval D
*--- Loop through each index and run the Runs Test ---*
. foreach index of local indices {
.     preserve
.         quietly runtest `index', m

* Store test output in a labelled results matrix
.         matrix `index'_`interval'_runs_test = (r(N), r(N_below), r(N_above), r(z), r(p))
.         matrix colnames `index'_`interval'_runs_test = "N" "N <= mean" "N > mean" "Z" "p-value"
.         matrix rownames `index'_`interval'_runs_test = "`index' `interval'"

* Display formatted Runs Test output
.         di as text "Runs Test for `index' (`interval')"
.         matlist `index'_`interval'_runs_test, format(%9.4f)
.         di "----------------------------------------"
.     restore
. }
```

L 3.3: Lo-MacKinlay Variance-Ratio Test

```
. ssc install lomackinlay, replace

* Replace missing values (example for QINS)
. foreach v in logret_QINS {
.     replace `v' = 0 if missing(`v')
. }
. tsset time

*--- Loop through all log-return indices and compute VR tests ---*
. foreach index in logret_QEAS logret_QBNK logret_QCON logret_QIND logret_QREA logret_QTLC logret_QTRN logret_QINS {

.     quietly lomackinlay `index'
```

** Collect VR, R-statistic and p-values for lags 2, 4, 8, 16*

```
.   matrix `index'_VR = (r(v_2),  r(v_4),  r(v_8),  r(v_16))
.   matrix `index'_R  = (r(R_2),  r(R_4),  r(R_8),  r(R_16))
.   matrix `index'_p  = (r(p_2),  r(p_4),  r(p_8),  r(p_16))
```

** Combine into one summary matrix*

```
.   matrix `index'_ratio_test = (`index'_VR \ `index'_R \ `index'_p)
.   matrix colnames `index'_ratio_test = "Lag2" "Lag4" "Lag8" "Lag16"
.   matrix rownames `index'_ratio_test = "VR" "R-stat" "p-value"
```

** Display formatted results*

```
.   di "Variance Ratio Test for `index'"
.   matlist `index'_ratio_test, format(%9.4f)
.   di "----------------------------------------"
. }
```

L 4.0: Event-Study Estimation Syntax

This section reproduces the Stata commands used to estimate abnormal returns and compute sector-level CAR and CAAR values under the market-model framework. The example below correspond to the structure applied uniformly across all events in the study.

L 4.1 Loading the Event-Study Dataset

```
. ssc install estudy, replace
. which estudy
. use "estudy.dta", clear
```

L 4.2 Illustrative Example - Exporting Event Results Statisitcs

```
.   estudy QBNK QCON QIND QREA QTLC QTRN QINS, datevar(Date) evdate(01122016) dateformat(MDY) modt(SIM) indexlist(QEAS) diagn(Norm) lb1(-15) ub1(15) lb2(-15) ub2(-1) lb3(1) ub3(7) lb4(8) ub4(15) lb5(1) ub5(15) lb6(0) ub6(0) dec(4) eswlb(-135) eswub(-16) showp outputfile(Oil_Crash_eventstudy_results)
```

L 4.3 Illustrative Example - Exporting Graphs of Event CARs (Oil Price Crash)

```
.   estudy QBNK QCON QIND QREA QTLC QTRN QINS, datevar(Date) evdate(01122016) dateformat(MDY) modt(SIM) indexlist(QEAS) diagn(Norm) lb1(-15) ub1(15) lb2(-15) ub2(-1) lb3(1) ub3(7) lb4(8) ub4(15) lb5(1) ub5(15) lb6(0) ub6(0) dec(4) eswlb(-135) eswub(-16) showp outputfile(Oil_Crash_eventstudy_results)
```