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An Event Study Approach to Determine the Impact of the Outbreak of the Israel-Hamas War: Evidence from Multiple Markets

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Abstract

What is the impact of the Israel-Hamas war on the performance of equity, sovereign bond, oil, gold, and Bitcoin markets? This thesis investigates the reaction of these asset classes at the onset of the conflict to assess whether investors experienced short-term abnormal losses or gains. Using a sample that includes G7 and five (three) Middle Eastern equity (sovereign bond) market indices, WTI oil and CMX gold continuous futures settlement prices, and Bitcoin daily prices, we employ an event study method to analyse whether these markets generated daily abnormal returns (ARs). We find that several Middle Eastern equity markets suffered negative and significant country-wise and aggregate ARs over the entire event window, while the adverse impact was limited to Israel in the case of sovereign bond markets. On the other hand, G7 equity markets proved to be more resilient, experiencing only heterogeneous and smaller pre-event significant country-wise abnormal losses. Furthermore, G7 sovereign bond markets exhibited contrasting performances, combining pre-event losses with mild but positive reactions afterwards. Perhaps surprisingly, the conflict's short term effect on the oil futures market is relatively negligible, while gold and Bitcoin markets enjoyed positive and significant abnormal daily returns, highlighting their plausible roles as protective investments and tools for hedging against geopolitical risk.

Keywords: Israel-Hamas War, Stock Markets, Sovereign Bond Markets, Oil Market, Gold Market, Bitcoin Market, Event Study

Contents

List of Tables

List of Figures

1 Introduction

On the 7th of October 2023, the Palestinian nationalist and Islamist militant movement Hamas launched a combined land, sea, and air assault on Israeli territories from the Gaza Strip. The October 7 attack resulted in more than 1,200 deaths, most of them being Israeli citizens, making it the deadliest day since Israel's independence in 1948. On October 8, the Israeli cabinet formally declared war on Hamas. Since the outbreak of the war, the Israel Defense Forces (IDF) have intensified raids in the West Bank and engaged in fights with the militant group Hezbollah in the northern region, near to the Lebanese border. In December 2023, South Africa filed a genocide case against Israel at the International Court of Justice (ICJ) over the ongoing Gaza conflict. By early May 2024, the Palestinian death toll related to the conflict exceeded 34,000 people, as reported by Britannica (2024).

The escalation of the conflict and the rising geopolitical uncertainty affecting the Middle East region have had a tangible effect on several financial markets. In the days following October 7, the TA-35 index, a benchmark index for the Israeli stock market, dropped by roughly 2% in five days. Furthermore, the Brent oil price increased by 5% over the following week. Moreover, according to the OCBC Monthly Commodity Outlook, gold prices surged 3.8% in October 2023, suggesting an increase in demand for safe-haven assets. In addition, given the outsized influence of Israel on the US stock market, with more than 100 Israeli companies listed on US exchanges, the JP Morgan Chase CEO Jamie Dimon addressed investors in a speech, stating "Now may be the most dangerous time the world has seen in decades" (Goodkind, 2023).

The outbreak of a war is referred to in financial academic literature as a "black swan" event. A common framework employed in the quantitative analysis of black swan events is the event study methodology. Following the research design criteria outlined by MacKinlay (1997) and Yousaf et al. (2022), this study constructs an event study framework to assess the impact of the Israeli–Palestinian conflict on major global and regional financial markets.

While academic interest regarding "black swan" events has risen due to the recent unexpected COVID-19 pandemic crisis and the outbreak of the Russia–Ukraine war, few empirical studies address the Israel-Palestine conflict and its potential effects on global financial markets. Zussman and Zussman (2006) assessed the reaction of the Tel Aviv 25 index to news about the assassination of Palestinian political or terrorist leaders. Their findings indicate that the Israeli stock market reacts significantly positively when a senior terrorist is killed, whereas the effect is consistently negative when a Palestinian political leader is involved. They conclude that the Israeli stock market responds positively to counterterrorism interventions. Moreover, most recent event studies primarily focus on the impact of wars within equity markets (Yousaf et al., 2022; Pandey et al., 2024; Goyal and Soni, 2024). Therefore, expanding the framework to include other asset classes such as sovereign bonds, commodities, and cryptocurrencies can lead to a substantially better understanding of the effects of exogenous events on countries and global financial markets. Thus, this thesis contributes to the existing literature by exploring the following three research questions:

RQ1 : *What is the impact of the outbreak of the Israel–Hamas conflict on the performance of Middle Eastern and G7 equity markets, as measured by abnormal returns?*

RQ2: *What is the impact of the outbreak of the conflict on the performance of Middle Eastern and G7 sovereign bond markets, as measured by abnormal returns?*

RQ3: *What is the impact of the outbreak of the conflict on the performance of oil, gold, and Bitcoin markets, as measured by abnormal returns?*

To address the first question, daily total return indices of the Morgan Stanley Capital International (MSCI) series are retrieved for the G7 countries, along with Israel, Saudi Arabia, Egypt, Jordan, and Turkey. The final dataset covers the period from 125 trading days before the event to 5 days afterwards. The estimation window length is set to 120 trading days ($t - 125$, $t - 6$), in accordance with the guidelines provided by MacKinlay (1997) and El Ghoul et al. (2023). Following Yousaf et al. (2022), the event window consists of 11 trading days ($t - 5$, $t + 5$), with the event date (i.e. $t = 0$) set to October 9, 2023. Normal (expected) returns for the event window are estimated using the ordinary least squares (OLS) market model, with the MSCI All Country World Index returns as the single risk factor. Finally, abnormal equity returns (ARs), cumulative abnormal equity returns (CARs), and aggregate abnormal returns (AARs and CAARs) are computed and analysed to address the research question.

A similar procedure is implemented for the second research question, with country-wide daily sovereign bond index levels from the FTSE World Government Bond Index (WGBI) series used as the main inputs. Expected daily returns for the sovereign bond markets are determined through the mean-adjusted returns (MAR) model, and the associated abnormal returns (ARs), cumulative abnormal returns (CARs), average abnormal returns (AARs), and cumulative average abnormal returns (CAARs) are computed and analysed.

Finally, the third research question requires the collection of daily prices for Bitcoin, along with WTI crude oil and CMX gold continuous futures settlement price series. Normal returns for these assets are obtained using the mean-adjusted returns (MAR) model. The estimation window length is kept constant throughout event study, while the upper bound of the event window for commodities and Bitcoin is expanded to 15 trading days after the event.

In conclusion, standard t-tests are performed to assess the significance of the abnormal returns, complemented by robustness tests aimed at enhancing the reliability of the empirical findings of the thesis. The contributions to the existing academic literature are twofold: on the one hand, to the best of our knowledge, this is the first study that comprehensively analyses market reactions to the onset of the Israel-Hamas conflict, without limiting the analysis to equity markets. On the other hand, it is the first study to perform econometric robustness checks on aggregated equity abnormal returns (i.e., AARs and CAARs) related to the outbreak of this conflict.

This study emphasises four critical pieces of evidence regarding the impact of the October 7 attack on the financial markets. First, several equity markets in the Middle East experienced significant negative abnormal returns on the event day and over the event window. Second, G7 equity market returns, when aggregated, were not systematically affected by the outbreak of the conflict. Third, G7 sovereign bond markets were more negatively impacted compared to Middle Eastern markets in the days before the attack. Fourth, investors perceived the onset of the conflict as a serious threat, which is reflected in the positive and significant abnormal returns of gold futures and Bitcoin markets. On the other hand, aside from a few daily significant spikes, the oil futures market was not significantly impacted in the short term.

The rest of the paper is organised as follows: Section 2 discusses the theoretical framework; Sections 3 and 4 cover the input variables and the research design; Section 5 presents the main empirical findings; Section 6 illustrates a series of robustness checks; Section 7 offers conclusive remarks and suggests directions for future academic research.

2 Theoretical Framework

2.1 War and Conflict Effects on Financial Markets

There is an extensive body of academic literature that documents the effect of wars and conflicts on financial markets performance through different empirical frameworks.

Frey and Kucher (2001) provide evidence on the impact of wars and conflicts on sovereign bond market prices. Based on multiple historical events that occurred during World War II, their analysis reveals that major historical events, such as conflict outbreaks, are responsible for significant drops in sovereign bond market indices. On the other hand, minor events tend to have a negligible impact on bond prices.

Leigh et al. (2003) examine the impact of the potential outbreak of the US-Iraqi war on the US and international financial markets. Using an instrumental variable based on the likelihood of a US invasion, they find that the conflict was responsible for a 15% decrease in the value of US equities, while it boosted energy and gold prices. Globally, they identified strong negative effects on the stock markets of Israel, Turkey, and several European countries.

Hudson and Urquhart (2015) analyse British stock market behaviour during World War II by applying a variety of empirical approaches, including event studies on pre-selected major historical events. Their findings show little evidence of strong links between war events and market returns, although they partially support the existence of a negative effect.

The seminal work of Muir (2017) investigated the effect of "black swan" events (e.g., financial crises, wars) on consumption and equity risk premia. He finds that, although consumption drops and its variance increases, these changes do not seem to be associated with variations in equity risk premia.

More recently, Yousaf et al. (2022) conducted an event study exploiting the outbreak of the Russia–Ukraine conflict to quantify the short-term reactions of G20+ country stock markets. They performed the analysis at both the country and regional levels. Markets reactions are evaluated through abnormal returns (ARs) and cumulative abnormal returns (CARs), where the former are defined as the difference between actual and expected equity returns, while the latter are their cumulative summations over time. They find large negative returns on the conflict outbreak day for most of the analysed countries, except for Russia and, surprisingly, Ukraine. At the regional level, the European and Asian regions were the most affected ones.

Furthermore, Obi et al. (2023) combine a standard event study with an EGARCH model to study the impact of the onset of the Russia-Ukraine war on G7 and African equities, as well as on the global commodities markets. By supplementing the event study framework with the EGARCH model, the authors compare abnormal returns across the two regions, while examining whether volatility asymmetries were present just before the outbreak of the conflict. They conclude that both G7 and African equities suffered significant abnormal losses, with G7 markets anticipating the crisis and hence exhibiting negative abnormal returns in the days before the event. In the commodity futures markets, positive and significant cumulative abnormal returns are found, suggesting abnormal mark-to-market cash inflows for traders with long positions. Finally, the EGARCH results suggest that the conflict itself did not produce a significant increase in the return variability in the post-event days.

2.2 Background of the Israeli-Palestinian Conflict

The Israel-Hamas conflict, which began on the 7th of October 2023, originates from a long-lasting, broader military and political conflict between Israel and Palestine. Since the creation of the State of Israel in 1948, hostilities between the Israeli and Palestinian communities have been recurrent and violent, often triggering wars and riots in the Middle East region. Among the large number of conflicts, it is worth recalling the First and Second Intifadas, namely two popular Palestinian uprisings that took place in the West Bank and Gaza Strip with the objective of halting the Israeli occupation of those territories (Brym, 2024). The first Intifada took place between 1987-1993 and culminated in the first Oslo Accords, which provided a preliminary framework for peace negotiations. The second Intifada, which was fiercer than the first one, lasted five years and resulted in more than 4,300 fatalities between 2000 and 2005. However, negotiations were at a standstill even after the conclusion of the second uprising. Furthermore, the increasing Israeli settlement activity in the West Bank region, along with the Palestinian Authority losing support, drove many Palestinians to turn to Hamas, which won the 2006 legislative elections and took power in Gaza in 2007 (Brym, 2024). From 2007 onwards, retaliations between Israel and Hamas have continued and eventually triggered the October 7 attack and the subsequent onset of the current conflict.

From a financial and economic perspective, few academic studies investigate the effects of Israeli-Palestinian conflicts on key financial variables. For example, Zussman and Zussman (2006), through multivariate regression analysis, assess the reactions of the Israeli equity market to news related to the assassination of Palestinian terrorists. They find positive market reactions when the assassination involved a member of the terrorist wing of a given organisation. On the other hand, if the member belonged to the political wing, the market had adverse reactions.

Nielsen et al. (2008) employ a rolling window F-test procedure that combines turning points in the Israeli-Palestinian conflict with market asset data for Israel and the Palestinian Authority. They conclude that, on average, turning points associated with an escalation in the conflict's violence (e.g., the first Intifada) lead to substantial drops in asset prices on both sides. Conversely, negotiations and peace agreements, such as the Oslo Accords, lead to substantial increases in asset prices on both sides.

More recently, Pandey et al. (2024) perform the first event study on the October 7 using a sample of 71 country-wise market benchmark indices. They also conduct a cross-sectional multivariate regression to identify the determinants of cumulative abnormal returns across countries. Overall, they highlight a general adverse equity markets reaction, with the Middle East being the most vulnerable region. Moreover, they find that equity markets in happier nations tend to be more resilient to such geopolitical events.

Finally, Goyal and Soni (2024) conducted an event study analysing the effect of the October 7 Hamas attack on equity markets across different countries. By applying the framework of Yousaf et al. (2022), they found that there were heterogeneous reactions across countries, but observed a prevailing negative trend in abnormal returns in the days following the attack.

2.3 Event Study: Literature Review

Event study methodology is a statistical tool used to assess the impact of a certain event on financial security prices (Peterson, 1989). As pointed out by MacKinlay (1997), nowadays the event study framework has several applications in various fields of research: from accounting and finance, where mergers and acquisitions and earnings announcements are often analysed, to law and economics, where it measures the impact of changes in the regulatory environment on a firm's value. As a consequence, there is a broad financial and econometric literature covering event studies and their correct applications to different research designs.

One of the first applications of this framework dates back to Dolley (1933). The paper addresses the price effects of stock splits by analysing the nominal stock price changes. However, the event study models gained remarkable momentum after the seminal works of Ball and Brown (1968) and Fama et al. (1969), which essentially constructed the modern event study methodology.

In the years following these seminal contributions, the related econometric literature has expanded to deal with a variety of statistical violations that have arisen in specific research contexts. Brown and Warner (1985) proved that event studies are correctly specified and reliable in their inferences when an event has an identical effect on all securities. If this assumption is not met, the model becomes misspecified, and the inferences can be biased. Building on these issues, a plethora of new testing frameworks have been proposed (Corrado, 1989; Boehmer et al., 1991; Corrado and Zivney, 1992; Kolari and Pynnönen, 2010; Kolari and Pynnonen, 2011)

Moreover, several equilibrium models for the computation of normal (expected) asset returns have been designed and implemented in event studies. For example, when analysing a sample of firms' returns, expected returns can be determined either through single- or multi-factor models. Examples of the former are the OLS market model, firstly employed by Fama et al. (1969) and the capital asset pricing model (CAPM) by Sharpe (1964). The latter include the Arbitrage Pricing Theory (APT) by Ross (1976) and the Fama-French three-factor model by Fama and French (1993). On the other hand, when the event study aims at assessing the performance of securities besides equity (e.g., commodities), the mean-adjusted return model (MAR) is often implemented, as demonstrated to be efficient by Brown and Warner (1985)

Finally, MacKinlay (1997) and El Ghoul et al. (2023) provide two remarkable and comprehensive literature reviews of the event study methodology. They both discuss in depth the requirements for correctly specified models, while also offering extensive discussions on the advantages and drawbacks associated with each benchmark model for normal returns and for testing abnormal returns' statistical significance. In conclusion, Pacicco et al. (2018) introduce the STATA command "estudy", a community-contributed statistical package that allows users to easily perform event studies with multiple event windows. The package includes most of the previously discussed models for normal returns and for testing the statistical significance of abnormal returns.

2.4 Main Hypothesis

Section 2.1 and 2.2 describe the most relevant literature related to the effects of war and conflicts on global financial markets and specifically on the Israeli-Palestinian conflict. Based on the empirical findings highlighted by Frey and Kucher (2001), Pandey et al. (2024), and Goyal and Soni (2024), we formulate the following hypothesis regarding equity and bond market analysis:

H1: *The outbreak of the Israel-Hamas war had a negative impact on Middle Eastern and G7 stock and sovereign bond markets, resulting in negative and significant abnormal returns over the event window.*

Moreover, as this thesis also investigates the short-term effect of the onset of the conflict on the oil market, we formulate a second hypothesis based on the discussion and results provided by Obi et al. (2023):

H2: *The outbreak of the Israel-Hamas war had a negative impact on expectations regarding the oil market, resulting in positive and significant abnormal returns for WTI futures contracts .*

Finally, gold is a well-documented safe haven asset during periods of financial distress (Baur and McDermott, 2010). On the other hand, there is contrasting evidence on the properties of Bitcoin as either hedge, diversifier, or safe haven asset (Bouri et al., 2017; Baur et al., 2018; Umar et al., 2021). Moreover, Aysan et al. (2019) found that Bitcoin returns are positively correlated with global geopolitical risk factors, suggesting its role as hedging tool against such risks. Therefore, we formulate the following third and last hypothesis:

H3: *The outbreak of the Israel-Hamas war had a positive impact on the expectations and performance of the gold futures and Bitcoin markets, resulting in positive and significant abnormal returns for both assets.*

3 Data

In this section, the relevant details regarding the data selection and gathering process are discussed. Since this study aims to comprehensively assess the reaction of several financial markets to the onset of the Israel-Hamas conflict, the dataset includes daily data on the equity, sovereign bond, oil, gold, and Bitcoin markets. The sample encompasses the G7 and the following Middle Eastern countries: Israel, Jordan, Egypt, Saudi Arabia, and Turkey. The rationale for selecting these markets lies in the primary objective of the research to shed light on the effect of a potential black swan event on both regional and most developed financial markets. According to a report by Statista (2024), the US, Japan, the UK, and Canada host four of the top ten largest stock markets by capitalisation. On the other hand, according to the Morgan Stanley Capital International (MSCI) market classifications, the five Middle Eastern countries included in the sample represent a mix of market types: developed markets (Israel), emerging markets (Egypt, Saudi Arabia, and Turkey) and frontier markets (Jordan). Hence, these countries provide a diverse sample in terms of geographical location and development level. The data were retrieved from the Refinitiv Eikon database and cover the period from April 2023 to October 2023.

3.1 Stock Markets Data

The equity market dataset comprises daily observations on the MSCI Standard Total Return Indices for all the countries included in the sample. These are value-weighted indices that track the performance of large and medium-sized listed enterprises in the respective markets. Moreover, MSCI has designed a global equity index, namely the MSCI All World Country Index (ACWI). The index captures large- and mid-capitalization representation across 47 equity markets, classified as 23 developed markets and 24 emerging markets. Given its wide coverage of equity markets, the MSCI ACWI is widely used as a global equity benchmark and it is estimated to currently cover approximately 85% of the global investable equity set (MSCI, 2024).

The rationale for relying on MSCI equity indices lies in two main advantages: on the one hand, this choice guarantees a high degree of homogeneity in terms of index construction methodology. This is particularly relevant as the primary goal of the research is to assess the potential negative impact of an event on the short-term performances of equity markets located in different regions and showing heterogeneous levels of market development. Therefore, the employment of a single-family index fosters comparability across different geographical and market contexts by excluding possible fluctuations driven by different index construction methodologies. On the other hand, MSCI is the only source that has made available the gross total return indices for the analysed countries as denominated in US dollars. While the indices are influenced by fluctuations in foreign exchange rates, they capture both the capital gains and dividend yields. Thus, compared to standard price indices – which exclusively capture the capital gains – they provide a better estimate of returns by accounting for income from regular cash distributions, such as cash dividend payments and capital repayments.

The collected data consist of daily closing total return index levels for each country for the period from April 2023 to October 2023. Therefore, excluding non-trading days, the equity dataset counts 153 observations for each analysed country and for the MSCI ACW Index.

3.2 Sovereign Bond Markets Data

The sovereign bond markets dataset comprises daily observations on the FTSE World Government Bond Index (WGBI) series. The FTSE WGBI includes more than 20 sub-indices at the country level, while the main index is considered the leading benchmark for global treasury exposure. The FTSE WGBI aims to measure the performance of fixed-rate, local currency, investment-grade sovereign bonds from a plethora of countries and is denominated in as many currencies as countries included. Eligibility for the WGBI varies according to several criteria regarding the local currency government bond market. The assessment of eligibility is primarily based on market size (with a minimum entry threshold of outstanding market issues of at least USD 50 billion), credit rating (entry threshold: A- by S&P, A3 by Moody's; exit threshold: below BBB- by S&P, Baa3 by Moody's), and a market accessibility level of at least 2 as defined by the FTSE Fixed Income Country Classification process (FTSE, 2022). Moreover, the index and related sub-indices include only fixed-rate treasury bonds with a maturity of more than one year. Finally, the eligibility assessment takes place on a semi-annual basis, and the indices are rebalanced on a monthly basis.

The selection of treasury bond indices from the FTSE WGBI series at the country level comes with both advantages and drawbacks. On the one hand, the FTSE WGBI series provides country-level indices that track the total return for each included security by accounting for price changes, principal payments, and accrued interest. This standard methodology is uniformly applied across all covered countries and the global benchmark index. Consequently, differences arising from varying index construction methodologies across countries are minimised compared to selecting different index series. Moreover, all the selected indices are denominated in US dollars, facilitating comparisons across indices even before computing the daily rate of returns. On the other hand, the eligibility criteria for the WGBI reduce the number of covered countries and the available observations for the analysis. As a result, data coverage for Saudi Arabia and Jordan is missing, while data for Egypt data are limited to the period from July 2023 onwards.

Therefore, the sovereign bond market dataset comprises daily closing total return levels for the FTSE Treasury Bond indices for the G7 countries, Israel, Egypt, and Turkey. The available observations for the sample period from April 2023 to October 2023 total 153 for G7 countries, Israel, and Turkey, while there are only 85 for Egypt.

3.3 Oil and Gold Futures Markets Data

In the commodities market, crude oil and gold have been included in the analysis as they exhibit remarkable potential exposure to the onset of the Israel-Palestine conflict. On the one hand, crude oil is one of the most traded commodities in the world, and the main global suppliers – the OPEC+ countries – are geographically and politically interconnected with Israel and Palestine. During times of political instability affecting the Middle East region, OPEC+ countries may adjust oil supply, which, in turn, is likely to drive changes in oil prices. In order to quantitatively analyse the impact of the conflict on the oil prices and returns for investors, daily data on the settlement price of West Texas Intermediate (WTI) continuous futures contracts have been collected for the period from April 2023 to October 2023. The choice of employing futures contract prices is aligned with previous academic research that has conducted event studies on commodities (Obi et al., 2023).

Furthermore, settlement prices of futures contracts tend to incorporate investors' and companies' expectations about the evolution of the commodity's price. In the specific case of crude oil, futures prices are mainly determined by supply-demand dynamics, along with companies' and investors' expectations. It follows that companies tend to enter futures contracts primarily for hedging purposes, insuring themselves against possible price fluctuations that are more likely to be observed during periods of geopolitical uncertainty. Finally, Brent crude oil futures contracts were also considered as potential candidates. However, WTI and Brent futures prices exhibit a high correlation coefficient of 0.97. Therefore, both series capture almost the same variation in contract settlement prices and are suitable for the purpose of the analysis. Hence, the dataset on WTI oil futures contracts comprises 153 daily observations on the settlement prices denominated in US dollars.

Turning to gold futures market data, these were included due to the well-established and recognised role of gold as a safe-haven asset during periods of financial distress and geopolitical instability (Baur and McDermott, 2010). To assess the impact of the October 7 attack on gold futures markets, daily data on the settlement prices of the CMX Gold continuous futures contracts have been collected for the same period, from April 2023 to October 2023, totalling 153 observations. The use of futures contract prices allows for a detailed examination of short-term market reactions and investor behaviour in response to the conflict.

3.4 Bitcoin Market Data

Daily data on Bitcoin real-time price index have been extracted for the period from April 2023 to October 2023. Bitcoin stood out as a potential candidate for studying the effect of the event on cryptocurrency market as there is a growing academic literature addressing Bitcoin's reaction to exogenous events, such as the outbreak of the Covid-19 pandemic Yarovaya et al. (2021). Moreover, there is increasing financial literature investigating whether this digital asset may exhibit hedging or safe-haven properties in response to exogenous shocks (Bouri et al., 2017; Baur et al., 2018; Umar et al., 2021). The inclusion of this asset in the analysis aligns with the goal of assessing the effect of potential black swan event on markets that may not be directly correlated with stock markets. The Bitcoin price index is denominated in US dollars, and the final sample comprises 153 daily observations.

4 Methodology

This section aims to describe and present the econometric methodology associated with the conducted event study. Since different methodologies are applied to estimate the normal returns for the various markets, the section is organised as follows: First, we provide details about the theoretical framework, Second, we present the operationalisation of abnormal returns, and finally the tests of significance are derived and discussed.

4.1 The Event Study Framework

The main settings required to perform an event study comprise the establishment of three time periods: the estimation window, the event date, and the event window. The length and delineation of these periods are subject to variation within the academic literature, as they mainly depends on the type of event being analysed, data availability, and whether the assessment horizon is short- or long-term. The estimation window is generally defined as a period of time prior to the event date. It is mainly used to estimate the normal returns model parameters, as it is assumed to be a time window that is not affected by the event itself. On the other hand, the event window comprises the days surrounding the event date, and it used to determine the response of asset returns to the occurrence of the event. Finally, the event date is defined as the day when the event takes place.

Denoting the event day by t, we follow the framework of Yousaf et al. (2022) and define an event window of 11 trading days, from $t-5$ to $t+5$. For commodities and Bitcoin, the event window is extended to $t+15$, as in accordance with previous event studies on these assets (Obi et al., 2023). Furthermore, MacKinlay (1997) explains that when dealing with daily observations on asset returns, an estimation window of 120 trading days is sufficient to establish a benchmark for normal returns. Accordingly, the estimation window in our study goes from $t-125$ to $t-6$, and counts exclusively trading days. Finally, we encounter a challenge in defining the event day: while the Hamas attack on Israel took place on October 7, 2023, and the official declaration of war by Israel followed on October 8, these were not trading days. Therefore, following MacKinlay (1997) and El Ghoul et al. (2023), the event date is set to October 9, 2023, which is the first trading day following the official onset of the conflict. Figure 1 depicts the timeline of the event study framework.

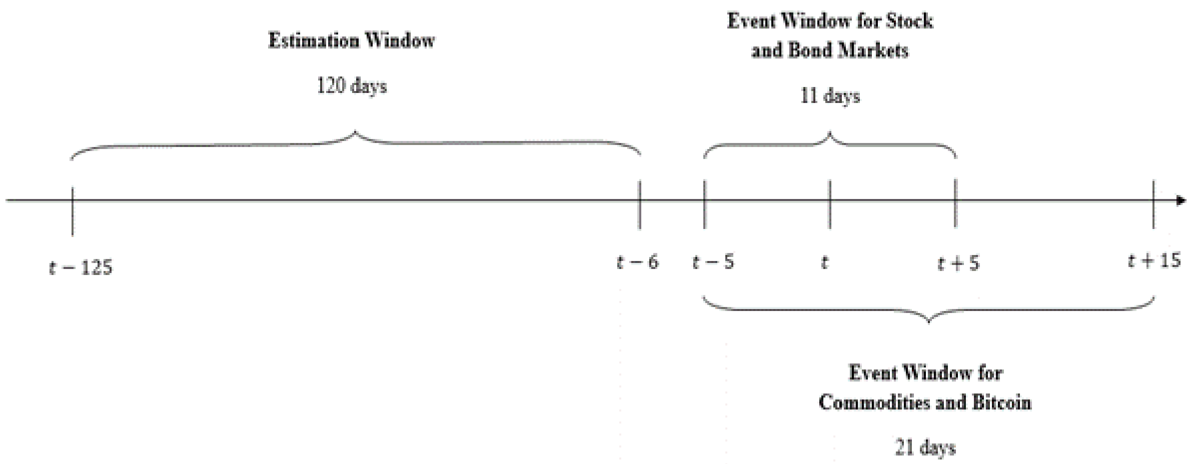

Figure 1: Timeline of the Event Study

Since daily asset returns are the primary inputs in an event study, it is noteworthy to briefly discuss their derivation. Given the stock and bond total return market indices, oil and gold continuous futures contract settlement prices, and Bitcoin price index, daily returns are computed by taking their first logarithmic differences. Formally, a daily return is given by:

$$R_{i,\tau} = \ln\left(P_{i,\tau}\right) - \ln\left(P_{i,\tau-1}\right) \tag{1}$$

Where $P_{i,\tau}$ is the price or index level of asset i on day τ and $P_{i,\tau-1}$ is the price or index level of asset i on day before τ.

The choice of computing daily log-returns offers two main advantages for the purpose of this thesis. First, by taking the first logarithmic difference of price or index levels, we address potential unit root problems that are typical of these data series. Second, log-returns are additive across time periods, which facilitates the aggregation of returns over the event window. These properties make log-returns particularly suitable for event studies.

4.2 Abnormal Returns Operationalisation

Given the log-returns for each asset category, our framework requires the computation of normal (expected) asset returns, which are needed to determine the abnormal returns (ARs). Normal returns are defined as the expected returns of a certain security or index in the absence of an event. In the academic literature, a plethora of models exists for calculating normal returns. MacKinlay (1997) provides a comprehensive categorisation of these methodologies into two main groups, namely statistical and economic models. The former follow from statistical assumptions regarding the behaviour of asset returns, while the latter introduce economic arguments about investors' behaviours. However, it is important to note that economic models also require additional statistical assumptions to be correctly specified.

In the context of this research, two statistical models – the OLS Market Model and the Mean-Adjusted Return Model (MAR) – are implemented to determine the normal (expected) returns for the stock, government bond, commodities, and Bitcoin markets. The underpinning assumption for these models is that asset returns are jointly multivariate normal and independently and identically distributed over time. MacKinlay (1997) and El Ghoul et al. (2023) discuss this assumption and conclude that, while strong, it is empirically reasonable. Consequently, inferences using these models tend to be robust in short-term event studies.

On the one hand, we employ the OLS market model to determine the normal returns for each country's stock market index. In statistical terms, the OLS market model specification is denoted as:

$$E(R_{i,\tau}|\Omega_\tau) = \alpha_i + \beta_i R_{MKT,\tau} + \varepsilon_{i,\tau} \tag{2}$$

Where $E(R_{i,\tau}|\Omega_\tau)$ is the normal return for the MSCI total return index for country i on day τ, given the set of information Ω_τ for the normal performance model; α_i is a constant term; β_i is the regression coefficient; $R_{MKT,\tau}$ is the day-τ log-return for the MSCI ACWI, and $\varepsilon_{i,\tau}$ is the zero-mean disturbance term.

Given the estimated normal returns, daily ARs for stock indices are operationalised as follows:

$$AR_{i,\tau} = R_{i,\tau} - \hat{\alpha}_i - \hat{\beta}_i R_{MKT,\tau} \tag{3}$$

Where $\hat{\alpha}_i$ and $\hat{\beta}_i$ are estimated through OLS regression with observations from the estimation window.

Since the OLS market model accounts for the variation in global market returns, the variance of the ARs is reduced. Consequently, it leads to a superior reliability in the detection of the event effect as compared to a constant-mean model.

On the other hand, the MAR model is employed to estimate the normal returns for the FTSE sovereign bond indices, oil and gold continuous futures contracts, and Bitcoin real-time price index. This model allows the estimation of expected returns without including any return factors in the specification. Therefore, this methodology is widely used in event study where assets' returns are likely to exhibit little to no correlation with risk factors, such as the market risk. Formally, the MAR specification is as follows:

$$E(R_{i,\tau}|\Omega_\tau) = \mu_i + \lambda_{i,\tau} \tag{4}$$

Where $E(R_{i,\tau}|\Omega_\tau)$ is the normal return for asset i on day τ, subject on the information set Ω; μ_i is the constant-mean term for asset i; $\lambda_{i,\tau}$ is the zero-mean disturbance term.

The ARs for all the analysed assets except the stock indices are operationalised as follows:

$$AR_{i,\tau} = R_{i,\tau} - \bar{R}_i \tag{5}$$

where $\bar{R}_i$ is the mean return for asset i estimated with data from the estimation window.

Despite its simplicity, Brown and Warner (1985) demonstrate the robustness of the MAR model in a great variety of circumstances, proving its reliability in the detection of abnormal performances of assets.

4.3 Aggregation of Abnormal Returns

Once the ARs for each asset are determined, the next step consists of the cross-sectional and time-series aggregation of abnormal returns into further performance measures. Starting from the lowest level of aggregation, we identify the cumulative abnormal returns (CARs). The CAR for asset i over the event window from day τ_1 to τ_2 is operationalised as follows:

$$CAR_i(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} AR_{i,\tau} \tag{6}$$

We calculate the CARs for each analysed asset over the entire event window and for specific sub-event window periods. They provide an overview of the aggregate temporal effect of the event on each market.

Moving to the cross-sectional aggregation level, one way to measure the common reaction of stock or bond indices across different countries is by averaging the abnormal returns (AARs) on a given day. The equal-weighted day-τ AAR is determined by the following equation:

$$AAR_\tau = \frac{1}{N} \sum_{i=1}^{N} AR_{i,\tau} \tag{7}$$

Where N is the number of indices being aggregated on day τ.

Finally, it is possible to cross-sectionally combine the CARs of the different stock and bond indices to obtain a measure that captures both the temporal and cross-sectional dimensions. This aggregation yields the so-called cumulative average abnormal returns (CAARs), which are operationalised as follows:

$$CAAR_i(\tau_1, \tau_2) = \frac{1}{N} \sum_{i=1}^{N} CAR_i(\tau_1, \tau_2) \tag{8}$$

Where N is the number of indices being aggregated over the period from day τ_1 to τ_2.

4.4 Statistical Tests of Significance

The final step in an event study addresses whether the abnormal returns – as individually and aggregately considered – provide statistically significant evidence of any effects from the analysed event.

The academic literature classifies tests of significance as either parametric or nonparametric. The former require statistical assumptions regarding the distribution of data, while the latter do not. However, previous academic papers on similar event studies rely on parametric tests, such as t-tests, to draw inferences on abnormal returns (Yousaf et al., 2022; Obi et al., 2023; Pandey et al., 2024; Goyal and Soni, 2024). Under the main assumption of assets' returns being normally distributed, the ARs follow a normal distribution centred on zero and with variance σ^2_{AR}. It follows that a series of t-statistics can be constructed for ARs, CARs, AARs, and CAARs.

Under the null hypothesis of no impact of the outbreak of the conflict on the behaviour of assets' returns, the distribution of the sample ARs over the event window is:

$$AR_{i,\tau} \sim N(0, \sigma^2_{AR}) \tag{9}$$

Formally, if ARs are independent and identically distributed, inference can be made using the following t-statistic:

$$t(AR_{i,\tau}) = \frac{AR_{i,\tau}}{\hat{\sigma}_{AR,i}} \tag{10}$$

Where $\hat{\sigma}_{AR,i}$ is the abnormal returns sample standard deviation for asset i over the estimation window.

Under the null hypothesis of zero abnormal performance ($H_0 : AR_{i,\tau} = 0$), $t(AR_{i,\tau})$ follows a Student's t distribution with $L - K$ degrees of freedom, where L is the length of the estimation window , and K is the number of parameters estimated for the normal return model. The alternative hypothesis is two-sided ($H_a : AR_{i,\tau} \neq 0$).

When dealing with CARs, we rely on the significance test explained by MacKinlay (1997). Under the null hypothesis of no abnormal aggregate performance ($H_0 : CAR_i(\tau_1, \tau_2) = 0$), the cumulative abnormal returns follow the distribution:

$$CAR_i(\tau_1, \tau_2) \sim N(0, \sigma^2_{CAR}(\tau_1, \tau_2)) \tag{11}$$

With $\sigma^2_{CAR}(\tau_1, \tau_2)$ being asymptotically (as the estimation window length L becomes large [1]) equal to:

$$\sigma^2_{CAR}(\tau_1, \tau_2) = (\tau_2 - \tau_1 + 1)\sigma^2_{AR,i} \tag{12}$$

Where τ_2 is the upper bound of the event window; τ_1 is the lower bound of the event window. The associated t-statistic is operationalised as follows:

$$t(CAR_i(\tau_1, \tau_2)) = \frac{CAR_i(\tau_1, \tau_2)}{\hat{\sigma}_{CARi}(\tau_1, \tau_2)} \tag{13}$$

Where the asset-i CAR standard deviation is estimated as:

$$\hat{\sigma}_{CARi}(\tau_1, \tau_2) = \sqrt{(\tau_2 - \tau_1 + 1)} * \hat{\sigma}_{AR,i} \tag{14}$$

Under the null hypothesis H_0, $t(CAR_i(\tau_1, \tau_2))$ follows a Student's t distribution with $L - K$ degrees of freedom. The alternative hypothesis is two-sided ($H_a : CAR_i(\tau_1, \tau_2) \neq 0$).

We use a similar approach when defining the statistical testing procedure for average abnormal returns (AARs). Since these are cross-sectionally aggregated ARs, under the null hypothesis (H_0: $AAR_\tau = 0$) they exhibit the following distribution:

$$AAR_\tau \sim N(0, \sigma^2_{AAR}) \tag{15}$$

Where the variance of the distribution, for a large L, is:

$$\sigma^2_{AAR} = \frac{1}{N^2}\sum_{i=1}^{N}\sigma^2_{AR} \tag{16}$$

Where N is the number of aggregated cross-sectional events. It follows that the t-statistic is obtained from the following equation:

$$t(AAR_\tau) = \frac{AAR_\tau}{\hat{\sigma}_{AAR}} \tag{17}$$

[1] According to MacKinlay (1997), when using daily data, an estimation window of 120 days is large.

with the AAR estimated standard deviation being:

$$\hat{\sigma}_{AAR} = \frac{1}{N}\sum_{i=1}^{N}\hat{\sigma}_{AR,i} \tag{18}$$

Under the null hypothesis H_0, $t(AAR_\tau)$ follows a Student's t distribution with $N-1$ degrees of freedom. The alternative hypothesis is two-sided ($H_a : AAR_\tau \neq 0$).

Finally, cumulative average abnormal returns (CAARs) are examined and tested. Given the cross-sectional and temporal aggregation, under the null hypothesis ($H_0 : CAAR_i(\tau_1, \tau_2) = 0$) these observations are distributed as follows:

$$CAAR_i(\tau_1, \tau_2) \sim N(0, \sigma^2_{CAAR}(\tau_1, \tau_2)) \tag{19}$$

with the population variance being:

$$\sigma^2_{CAAR}(\tau_1, \tau_2) = \frac{1}{N^2}\sum_{i=1}^{N}\hat{\sigma}^2_{CAR} \tag{20}$$

The associated t-statistic is then obtained from:

$$t(CAAR(\tau_1, \tau_2)) = \frac{CAAR(\tau_1, \tau_2)}{\hat{\sigma}_{CAAR}(\tau_1, \tau_2)} \tag{21}$$

Where the estimated standard deviation is:

$$\hat{\sigma}_{CAAR}(\tau_1, \tau_2) = \frac{1}{N}\sum_{i=1}^{N}\hat{\sigma}_{CARi}(\tau_1, \tau_2) \tag{22}$$

Under the null hypothesis, $t(CAAR(\tau_1, \tau_2))$ follows a Student's t distribution with $N-1$ degrees of freedom. The alternative hypothesis is two-sided ($H_a : CAAR_i(\tau_1, \tau_2) \neq 0$).

5 Results

In this section, we present and discuss the empirical results. Since we conducted an empirical analysis of the stock, bond, oil, gold, and Bitcoin markets to address the three research questions, this section is organised as follows: first, we illustrate the results regarding the stock markets. Second, we present the results concerning sovereign bond performance, and finally we provide a joint discussion of the main findings on the oil, gold, and Bitcoin markets.

5.1 Stock Markets Results

Table 1 illustrates the country-wise abnormal returns on the event date, namely October 9, 2023. It is organised into two panels, namely Panel A and Panel B, where the former comprises Middle Eastern countries, while the latter the G7 countries. At first inspection, it appears that Israel, which is militarily involved in the conflict, suffered the largest negative abnormal return (-6.51%) among the entire sample of countries. This abnormal return, which is as large as six and a half times its standard error, is reliably different from zero at the 1% significance level. In the same geographical region, similar performances are observed for Saudi Arabia and Egypt, with significant abnormal losses of -2.02% and -1.81%, respectively. Finally, at the cross-sectional level, the Middle East region exhibited an AAR of -2.71% on the event day, with an associated t-value of -4.67. This significant abnormal negative return suggests a strong and adverse reaction by the active investors in those countries, which is aligned with previous academic research (Pandey et al., 2024; Goyal and Soni, 2024).

Moving to G7 countries, although the majority of observed daily ARs are negative, none appear to be statistically different from zero. When cross-sectionally aggregated, the G7 countries neither outperform nor underperform their normal returns, exhibiting a non-significant AAR of -0.29%. The flat reaction of the US stock market is surprising, considering its level of financial integration with Israel. Overall, investors in most developed markets had a considerably less severe reaction to the official news about the onset of the conflict, at least on the event date.

Table 1: Country wise Stock Markets ARs and Region wise AARs on Event Day.
ARs are reported in percentages. $*p < 0.10$; $**p < 0.05$; $***p < 0.01$. $H_0 : AR = 0$; $H_a : AR \neq 0$.

Stock Markets	Abnormal Returns (ARs)	t-statistic
Panel A. Middle East		
Israel	-6.51***	-6.50
Saudi Arabia	-2.02***	-3.19
Jordan	-0.74	-0.95
Egypt	-1.81*	-1.71
Turkey	-2.54	-1.11
AAR – Middle East region	-2.71***	-4.67
Panel B. G7 Countries		
USA	0.18	0.70
Italy	-0.77	-0.95
Canada	0.20	0.38
France	-0.89	-1.20
Germany	-0.99	-1.48
UK	-0.09	-0.14
Japan	0.33	0.43
AAR – G7 countries	-0.29	-1.17

Tables 2 and 3 outline country-wise abnormal performances of indices over the days surrounding the event date. The rationale for analysing daily ARs before and after the event is twofold: on the one hand, the analysis sheds light on whether equity markets anticipated the outbreak of the war; on the other hand, the post-event period performances are useful for assessing the so-called efficient market hypothesis (Fama, 1970). According to this hypothesis, asset prices adjust rapidly to new information, making it difficult to systematically benefit from the abnormal returns related to that information.

From Table 2 (Panel A), we acknowledge that Middle Eastern markets did not comprehensively anticipate the occurrence of the event. Specifically, we observe only one positive and significant AR for Jordan (1.38%) and a cross-sectional AAR of 0.98% on day $t-5$. On day $t-3$, Saudi Arabia suffered a negative AR of -1.21%, significant at the 10% level. These performances are inconsistent with a potential markets' anticipation of the event as in that case we would observe a remarkable negative pattern in ARs and AARs. On the other hand, such pattern appears to be more plausible for G7 countries. From Panel B, we observe substantial negative abnormal returns at the aggregate level for days $t-5$ and $t-3$, with AARs of -1.15% and -0.50%, respectively. More specifically, these aggregate performances are driven by the significant and negative ARs of Italy (-1.86%), Canada (-2.17%), France (-1.27%), Germany (-1.17%), and the UK (-1.53%) on day $t-5$, and by Japan (-2.58%) at $t-3$. Nonetheless, it is noteworthy that the US market had two positives daily ARs (0.46% and 0.55%) over the pre-event window, and Japan's index bounced back with a 2.11% AR on day $t-2$. We conclude that the empirical findings partially support the hypothesis of anticipation of the event by the G7 markets, but there may be other factors contributing to the overall negative performance of these market indices which would require further investigation.

Moving to the days following the beginning of the conflict (Table 3), we notice that overall, both Middle Eastern and G7 countries quickly incorporate the news of the event, with their abnormal returns rapidly returning to non-significant values at the conventional significance levels. More specifically, Middle Eastern markets experience a few significant negative ARs on day $t+2$, with Israel and Jordan losing 2.24% and 1.64%, respectively. These negative ARs together yield a reliably negative regional AAR of -1.42% on the same day. On the other side, G7 markets had contrasting reactions on the day after the event, with US equity plunging to -0.58%, while the other indices gain positive and significant ARs, with the sole exception of Canada. After day $t+1$, G7 market ARs almost normalise, with non-significant abnormal returns. This evidence suggests that developed markets quickly reacted to the adverse event and resulted barely affected on the following days, indicating an efficient reaction.

Table 2: Pre-Event Daily Stock Markets ARs and AARs.
ARs are reported in percentages. t-values are in parenthesis. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.
$H_0 : AR = 0$; $H_a : AR \neq 0$

Stock Markets	$t-5$	$t-4$	$t-3$	$t-2$	$t-1$
	AR	AR	AR	AR	AR
Panel A. Middle East					
Israel	0.57	-0.65	-0.75	-0.02	0.41
	(0.57)	(-0.64)	(-0.75)	(-0.03)	(0.40)
Saudi Arabia	-0.07	-0.11	-1.21*	-0.66	-0.21
	(-0.12)	(-0.18)	(-1.89)	(-1.03)	(-0.33)
Jordan	1.38*	0.61	0.74	0.97	-0.05
	(1.80)	(0.78)	(0.97)	(1.27)	(-0.07)
Egypt	1.46	0.80	0.24	-0.08	-0.19
	(1.37)	(0.74)	(0.23)	(-0.08)	(-0.18)
Turkey	1.53	-0.70	-2.46	1.64	-0.47
	(0.67)	(-0.30)	(-1.07)	(0.72)	(-0.20)
AAR – Middle East Region	0.98*	-0.01	-0.68	0.37	-0.10
	(1.68)	(-0.02)	(-1.17)	(0.64)	(-0.18)
Panel B. G7 Countries					
USA	0.46*	0.05	0.55**	-0.39	0.12
	(1.80)	(0.19)	(2.14)	(-1.52)	(0.48)
Italy	-1.86**	0.04	-0.43	0.35	-0.04
	(-2.28)	(0.04)	(-0.53)	(0.43)	(-0.05)
Canada	-2.17***	0.41	-0.59	0.67	-0.45
	(-4.19)	(0.77)	(-1.13)	(1.30)	(-0.86)
France	-1.27*	0.25	0.06	0.26	-0.02
	(-1.72)	(0.34)	(0.08)	(0.35)	(-0.03)
Germany	-1.17*	0.23	0.10	-0.06	0.19
	(-1.76)	(0.37)	(0.15)	(-0.08)	(0.28)
UK	-1.53**	0.37	-0.63	0.73	0.00
	(-2.55)	(0.61)	(-1.05)	(1.23)	(0.00)
Japan	-0.53	-0.48	-2.58***	2.11***	-1.16
	(-0.68)	(-0.60)	(-3.30)	(2.70)	(-1.46)
AAR – G7 countries	-1.15***	0.12	-0.50**	0.53**	-0.19
	(-4.67)	(0.50)	(-2.04)	(2.15)	(-0.78)

Table 3: Post-Event Daily Stock ARs and regional AARs.
ARs are reported in percentages. t-values are in parenthesis. * $p < 0.10$; **$p < 0.05$; ***$p < 0.01$.
$H_0 : AR = 0$; $H_a : AR \neq 0$

Stock Markets	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$
	AR	AR	AR	AR	AR
Panel A. Middle East					
Israel	-0.42	-2.24**	-0.39	-0.34	-0.75
	(-0.42)	(-2.23)	(-0.39)	(-0.33)	(-0.75)
Saudi Arabia	0.71	-0.56	0.09	0.20	-0.01
	(1.11)	(-0.87)	(0.15)	(0.32)	(-0.01)
Jordan	-0.95	-1.64**	1.10	0.20	-0.71
	(-1.22)	(-2.12)	(1.43)	(0.26)	(-0.91)
Egypt	0.15	-1.71	0.66	0.06	-1.23
	(0.14)	(-1.60)	(0.62)	(0.05)	(-1.16)
Turkey	1.74	-0.96	-0.98	-1.90	-1.95
	(0.74)	(-0.42)	(-0.43)	(-0.82)	(-0.85)
AAR – Middle East Region	0.25	-1.42**	0.10	-0.35	-0.93
	(0.43)	(-2.45)	(0.17)	(-0.60)	(-1.59)
Panel B. G7 Countries					
USA	-0.58**	-0.14	-0.24	0.31	0.33
	(-2.23)	(-0.54)	(-0.95)	(1.21)	(1.30)
Italy	1.58*	0.02	0.07	-0.22	0.15
	(1.93)	(0.02)	(0.09)	(-0.27)	(0.18)
Canada	0.43	0.40	-0.70	0.73	0.33
	(0.83)	(0.78)	(-1.35)	(1.41)	(0.63)
France	1.51**	-0.75	-0.54	-1.14	0.12
	(2.02)	(-1.02)	(-0.74)	(-1.53)	(0.16)
Germany	1.46**	-0.14	-0.40	-1.06	0.11
	(2.17)	(-0.21)	(-0.61)	(-1.58)	(0.16)
UK	1.28**	-0.08	-0.05	-0.41	0.27
	(2.12)	(-0.14)	(-0.09)	(-0.68)	(0.45)
Japan	1.46*	-0.54	1.39*	-0.96	-1.89**
	(1.84)	(-0.68)	(1.78)	(-1.21)	(-2.41)
AAR – G7 countries	1.02***	-0.18	-0.05	-0.39	-0.08
	(4.12)	(-0.71)	(-0.21)	(-1.57)	(-0.33)

Furthermore, Figure 2 depicts the AARs trend by region over the event window. The overall AAR trend for the Middle East region appears to be negative. Over the pre-event window, the AAR values are, on average, close to zero. On the event date, it drops to as low as -2.71%, and then it partially bounces back in the post-event period, though it remains predominantly negative. Conversely, the AAR for G7 countries is slightly negative, on average, prior to the conflict date, and becomes flat afterwards.

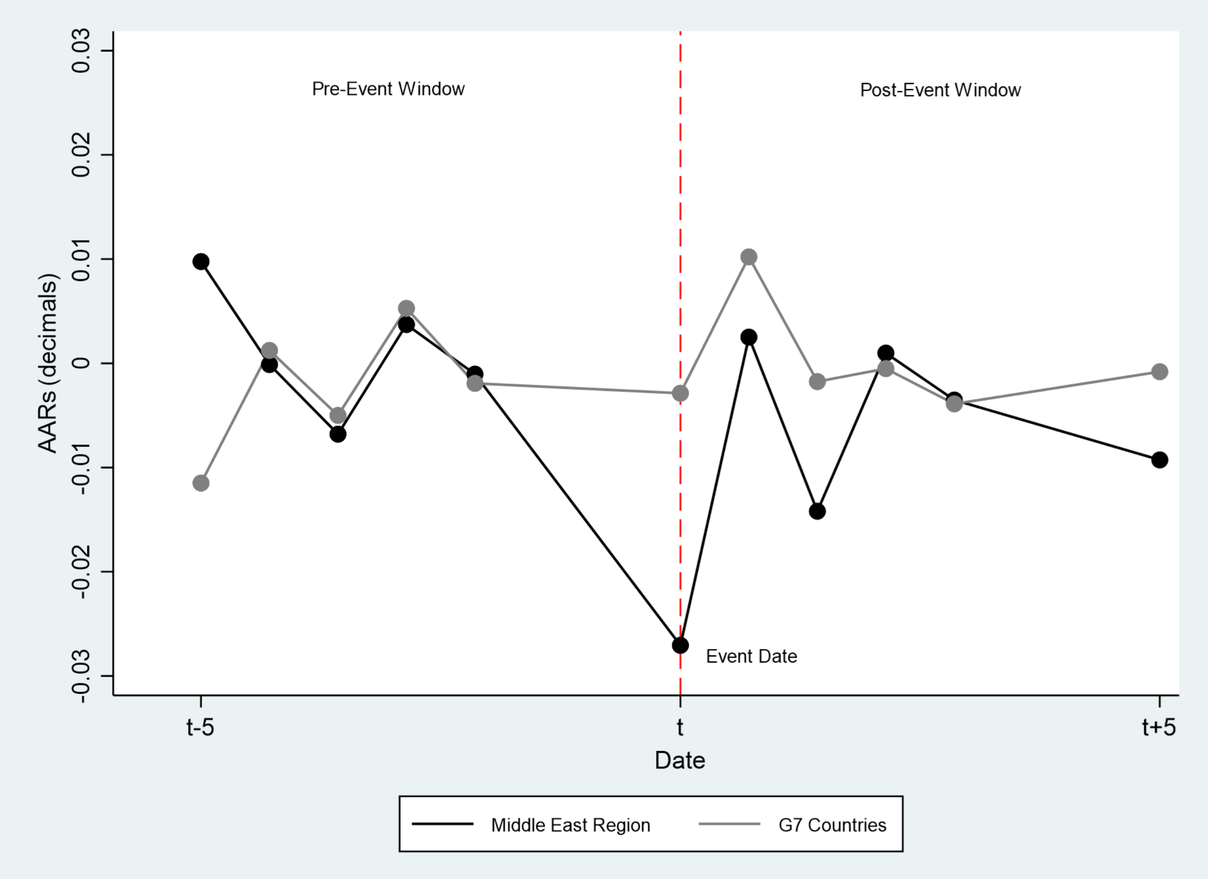

Figure 2: Stock Markets Average Abnormal Returns (AARs), by region.

Note. Average Abnormal Returns are reported in decimals and depicted over the 11-day event window that runs from five trading days prior to five trading days after the event date. The event date is denoted by t.

Finally, we address the results obtained from the temporal and cross-sectional aggregation of abnormal returns, namely CARs and CAARs. Table 4 showcases the results from three different aggregation windows: pre-event ($t-5$, $t-1$), post-event ($t+1$, $t+5$), and the entire period ($t-5$, $t+5$). Panel A shows that Israel experienced a cumulative significant abnormal loss of -11.10% during the whole event window, driven by a post-event CAR of -4.13%. These results indicate that the short-term effect of the war was statistically significant and economically substantial on the Israeli equity market. Among the other Middle Eastern markets, Saudi Arabia suffered a negative and significant CAR over the event window of -3.85%, mainly driven by the negative AR on the event date. It is also noteworthy that Jordan exhibited positive abnormal performance in the days leading up to the first attack, with a significant 3.66% CAR. Finally, the region-wide CAARs are negative and significant in the post-event days and over the entire period, suggesting a an overall sentiment of scepticism among regional investors.

When examining G7 countries, we find a significant negative cumulative reaction in the pre-event period at the aggregate level, evidenced by a CAAR of -1.19%. However, the CARs become non-significant in the other two windows, supporting the hypothesis of a quick and efficient recovery to the event.

Table 4: Pre, Post, and Total Event Window Stock Markets CARs and regional CAARs. CARs are reported in percentages. t-values in parenthesis. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$. $H_0 : CAR = 0$; $H_a : CAR \neq 0$

Stock Markets	CAR $[-5, -1]$	CAR $[+1, +5]$	CAR $[-5, +5]$
Panel A. Middle East			
Israel	-0.45	-4.13*	-11.10***
	(-0.20)	(-1.82)	(-3.21)
Saudi Arabia	-0.23	0.44	-3.85*
	(-1.56)	(0.31)	(-1.74)
Jordan	3.66**	-1.99	0.94
	(2.09)	(-1.14)	(0.35)
Egypt	2.22	-2.08	-1.67
	(0.92)	(-0.86)	(-0.46)
Turkey	-0.46	-4.05	-7.05
	(-0.09)	(-0.78)	(-0.89)
CAAR – Middle East Region	0.55	-2.35*	-4.50**
	(0.42)	(-1.78)	(-2.25)
Panel B. G7 Countries			
USA	0.79	-0.31	0.66
	(1.37)	(-0.53)	(0.75)
Italy	-1.94	1.59	-1.12
	(-1.05)	(0.86)	(-0.40)
Canada	-2.13*	1.20	-0.74
	(-1.81)	(1.17)	(-0.41)
France	-0.72	-0.80	-2.41
	(-0.43)	(-0.48)	(-0.95)
Germany	-0.71	-0.03	-1.73
	(-0.47)	(-0.02)	(-0.75)
UK	-1.05	1.10	-0.03
	(-0.77)	(0.81)	(-0.02)
Japan	-2.64	-0.53	-2.84
	(-1.48)	(-0.30)	(-1.05)
CAAR – G7 Countries	-1.19**	0.33	-1.15
	(-2.13)	(0.59)	(-1.36)

In conclusion, Figure 3 plots the trend of regional CAARs over the event window. The graph indicates a negative trend over time for the Middle East region, with CAARs becoming increasingly negative as we move away from the event. Conversely, G7 countries exhibit a nearly flat negative trend during the pre-event period, which then reverses to a flat positive trend afterwards.

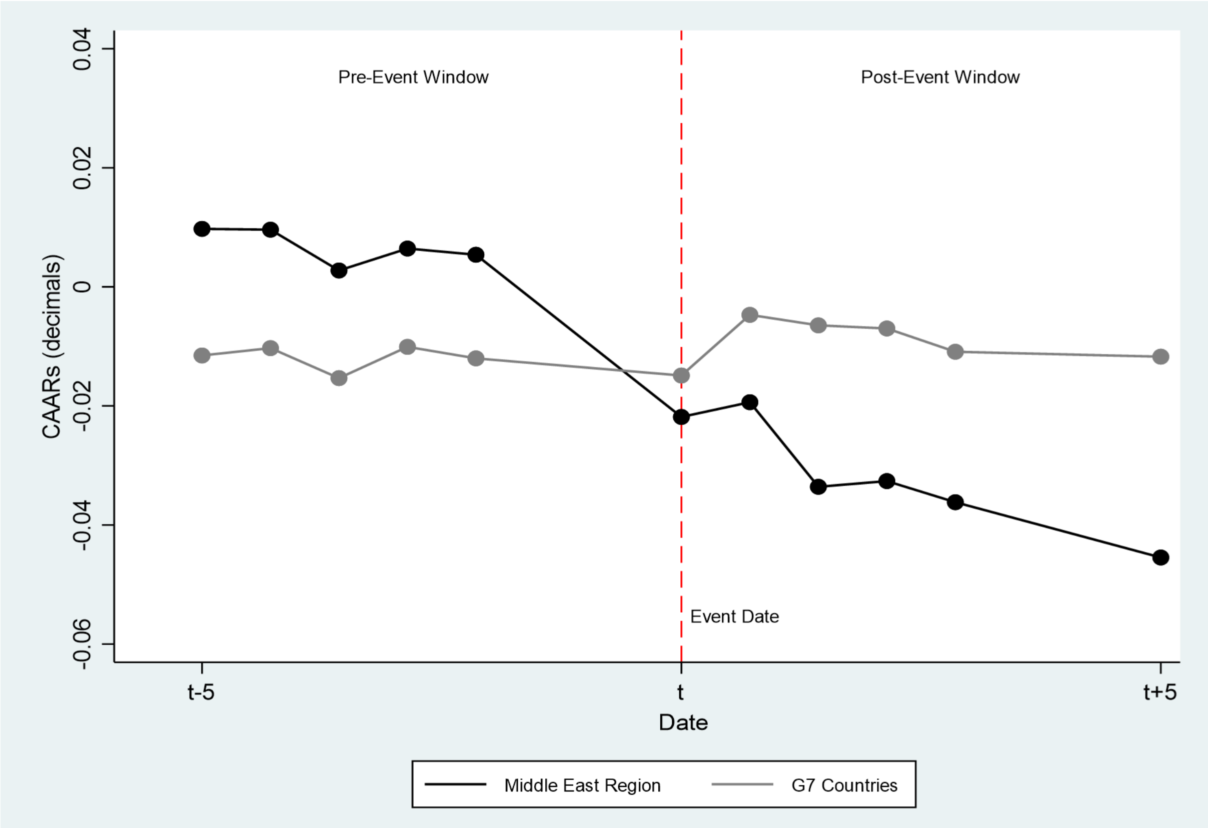

Figure 3: Stock Markets Cumulative Average Abnormal Returns (CAARs), by region.

Notes. Cumulative Average Abnormal Returns are reported in decimals and depicted as cumulative sum over the 11-day event window that runs from five trading days prior to five trading days after the event date. The event date (i.e., October 9, 2023) is denoted by *t*.

5.2 Sovereign Bond Markets Results

Table 5 illustrates the sovereign bond market returns for the sample of analysed countries on October 9, 2023 (i.e., the event date). Panel A, which displays Middle Eastern markets, shows a negative AR for Israel (-3.57%), which is statistically significant at the 1% level. Surprisingly, there are no further significant abnormal performances in the other markets in the region, with Egypt and Turkey closing the trading day with statistically non-significant ARs of -0.34% and 0.48%, respectively.

On the other hand, slightly more positive returns are observed in the G7 sovereign debt markets. At the country level, none of the markets significantly outperformed or underperformed their expected daily returns; however, at the aggregate level, they generated a 0.70% AAR, significant at the 1% level. These results – highlighting a positive reaction at the aggregate level by the most developed financial markets – are even more encouraging than the non-significant equity results of Table 1, Panel B). Thus, we find that on the event date, the most developed equity and sovereign debt markets did not particularly suffer from the outbreak of the conflict.

Table 5: Country wise Sovereign Bonds ARs and Region wise AARs on Event Day.
ARs are determined through the MAR model and reported in percentages. The estimation window for Egypt is shorter and runs from July 2023 onwards due to limited data availability. * $p < 0.10$; **$p < 0.05$; ***$p < 0.01$. $H_0 : AR = 0$; $H_a : AR \neq 0$.

Sovereign Bond Markets	Abnormal Returns (ARs)	t-statistic
Panel A. Middle East		
Israel	-3.57***	-5.10
Egypt	-0.34	-0.95
Turkey	0.48	0.22
AAR – Middle East region	-1.13	-1.46
Panel B. G7 Countries		
USA	0.06	0.16
Italy	0.62	1.05
Canada	0.68	1.29
France	0.88	1.52
Germany	0.90	1.62
UK	1.04	1.36
Japan	0.69	1.25
AAR – G7 countries	0.70***	3.21

Table 6 reports the daily abnormal returns and the average of abnormal returns by region over the days prior to the event. Over the five days, there were no meaningful reactions from the countries in the Middle East, as highlighted in Panel A. In contrast, Panel B reveals a different scenario for the G7 countries. On day $t-5$, the AAR for the developed market is as low as -1.09%, significant at the 1% level. This abnormal negative performance is driven by the poor performances of Italy and Canada (-1.02%), France and Germany (-1.37%), and the UK (-1.79%). On day $t-4$, the overall negative aggregate trend becomes milder at -0.57%, though it remains significant at the 1% level. In this case, the negative performance is mainly caused by the Canadian market, which witnessed a -1.69% abnormal return. Finally, the G7 countries gained a 0.55% AAR on day $t-2$ which partially revers the previously observed negative trend. It is noteworthy that the losses in the G7 sovereign debt markets occurred on days when the equity indices also plunged. This observation partially supports the hypothesis that the most developed financial countries may anticipated the outbreak of the conflict.

Table 6: Pre-Event Daily Sovereign Bonds ARs and AARs.
ARs are determined through the MAR model and reported in percentages. t-values are in parenthesis. The estimation window for Egypt is shorter and runs from July 2023 onwards due to limited data availability. * $p < 0.10$; **$p < 0.05$; ***$p < 0.01$. $H_0 : AR = 0$; $H_a : AR \neq 0$.

Sovereign Bond Markets	$t-5$	$t-4$	$t-3$	$t-2$	$t-1$
	AR	AR	AR	AR	AR
Panel A. Middle East					
Israel	-0.53	-0.35	-0.47	-0.09	0.21
	(-0.76)	(-0.50)	(-0.68)	(-0.14)	(0.31)
Egypt	-0.36	-0.15	-0.15	-0.22	-0.19
	(-1.02)	(-0.43)	(-0.42)	(-0.63)	(-0.54)
Turkey	0.03	1.42	0.45	0.43	0.39
	(0.02)	(0.65)	(0.21)	(0.20)	(0.18)
AAR – Middle East Region	-0.29	0.31	-0.06	0.04	0.14
	(-0.37)	(0.40)	(-0.07)	(0.05)	(0.18)
Panel B. G7 Countries					
USA	-0.52	-0.58	0.54	-0.05	-0.37
	(-1.43)	(-1.59)	(1.48)	(-0.15)	(-1.02)
Italy	-1.02*	-0.74	0.23	0.62	-0.21
	(-1.74)	(-1.27)	(0.39)	(1.06)	(-0.36)
Canada	-1.02*	-1.69***	0.39	0.50	0.09
	(-1.93)	(-3.20)	(0.73)	(0.94)	(0.18)
France	-1.37**	-0.53	0.28	0.74	0.00
	(-2.35)	(-0.91)	(0.48)	(1.28)	(0.01)
Germany	-1.37**	-0.49	0.32	0.82	0.09
	(-2.45)	(-0.88)	(0.57)	(1.46)	(0.17)
UK	-1.79**	-0.58	0.38	0.83	-0.24
	(-2.35)	(-0.76)	(0.49)	(1.09)	(-0.31)
Japan	-0.53	0.63	-0.30	0.31	-0.14
	(-0.96)	(1.15)	(-0.55)	(0.56)	(-0.25)
AAR – G7 countries	-1.09***	-0.57***	0.26	0.55**	-0.11
	(-5.03)	(-2.62)	(1.21)	(2.56)	(-0.50)

Furthermore, we analysed the returns on these markets in the days following the onset of the conflict. These results are presented in Table 7 and cover the five trading days after October 9, 2023. Once again, Panel A shows that there are no significant underperformances at either country or aggregate level. Therefore, except for an abnormal negative return for the Israeli market on the event date, we conclude that the sovereign bond markets in the Middle East region were not widely affected in the short term by the conflict. Turning to Panel B., we observe an abnormal positive performance by G7 markets on the day after the event, with a 0.72% regional AAR, significant at the 1% level. At country level, the US (0.82%), Italy (1.04%), and Canada (1.22%) exhibited particularly significant ARs. This positive trend was followed on day $t+2$, with a positive and significant G7 AAR of 0.73%, mainly driven by the UK's abnormal market return of 1.83%. Finally, on day $t+3$, we observe a significant reversal with negative ARs for the US (-0.75%), Italy (-1.04%), Canada (-1.17%), France (-1.00%), Germany (-1.00%), and the UK (-1.53%). These returns contributed to a daily AAR of -0.92%, significant at the 1% level. Overall, the post-event window was marked by days of positive and significant abnormal returns for G7 countries, yet with a significant downturn on the third day after the event.

Table 7: Post-Event Daily Sovereign Bonds ARs and AARs.
ARs are determined through the MAR model and reported in percentages. t-values are in parenthesis. The estimation window for Egypt is shorter and runs from July 2023 onwards due to limited data availability. * $p < 0.10$; **$p < 0.05$; ***$p < 0.01$. $H_0 : AR = 0$; $H_a : AR \neq 0$

Sovereign Bond Markets	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$
	AR	AR	AR	AR	AR
Panel A. Middle East					
Israel	0.47	0.51	1.00	-0.13	-1.03
	(0.67)	(0.72)	(1.42)	(-0.19)	(-1.47)
Egypt	-0.50	-0.47	-0.18	-0.21	-0.13
	(-1.41)	(-1.34)	(-0.50)	(-0.59)	(-0.36)
Turkey	0.24	1.08	0.56	0.07	0.35
	(0.11)	(0.49)	(0.26)	(0.03)	(0.16)
AAR – Middle East Region	0.07	0.37	0.46	-0.09	-0.27
	(0.09)	(0.48)	(0.60)	(-0.11)	(-0.35)
Panel B. G7 Countries					
USA	0.82**	0.48	-0.75**	0.52	-0.42
	(2.25)	(1.32)	(-2.06)	(1.42)	(-1.14)
Italy	1.04*	0.76	-1.04*	-0.55	0.54
	(1.77)	(1.30)	(-1.79)	(-0.93)	(0.92)
Canada	1.22**	0.42	-1.17**	0.48	-0.08
	(2.31)	(0.80)	(-2.21)	(0.91)	(-0.15)
France	0.64	0.79	-1.00*	-0.35	0.22
	(1.11)	(1.36)	(-1.73)	(-0.61)	(0.38)
Germany	0.48	0.71	-1.00*	-0.20	0.16
	(0.86)	(1.27)	(-1.79)	(-0.37)	(0.28)
UK	0.96	1.83**	-1.53**	-0.39	-0.30
	(1.25)	(2.39)	(-2.00)	(-0.51)	(-0.39)
Japan	-0.15	0.11	0.03	0.05	-0.11
	(-0.28)	(0.20)	(0.05)	(0.09)	(-0.19)
AAR – G7 countries	0.72***	0.73***	-0.92***	-0.06	0.03
	(3.31)	(3.37)	(-4.26)	(-0.29)	(0.16)

Finally, Table 8 reports the cumulative abnormal returns (CARs) over two inner windows and the entire event window. At the country level, the Israeli market is the only one exhibiting a negative and significant CAR of -3.99% over the full event window. In contrast, Panel B shows a -0.95% CAAR for the G7 countries in the pre-event window. This finding, together with the results of Table 6, supports the hypothesis that most developed markets foresaw the conflict. However, we emphasise that none of the individual G7 CARs is significant at the conventional significance levels, indicating that the reaction was overall mild and potentially driven by factors not directly linked to the outbreak of the conflict.

Table 8: Pre, Post, and Total Event Window Country wise CARs and regional CAARs. CARs are determined through the MAR model and reported in percentages. t-values are in parenthesis. The estimation window for Egypt is shorter and runs from July 2023 onwards due to limited data availability. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$. $H_0 : CAR = 0$; $H_a : CAR \neq 0$.

Sovereign Bond Markets	CAR $[-5, -1]$	CAR $[+1, +5]$	CAR $[-5, +5]$
Panel A. Middle East			
Israel	-1.23	0.81	-3.99*
	(-0.78)	(0.51)	(-1.66)
Egypt	-1.07	-1.48	-2.88
	(-1.11)	(-1.53)	(-1.64)
Turkey	2.72	2.31	5.51
	(0.55)	(0.47)	(0.73)
CAAR – Middle East Region	0.14	0.55	-0.43
	(0.08)	(0.31)	(-0.16)
Panel B. G7 Countries			
USA	-0.88	0.65	-0.17
	(-1.06)	(-0.79)	(-0.13)
Italy	-1.12	0.75	0.24
	(-0.84)	(0.56)	(0.12)
Canada	-1.73	0.88	-0.17
	(-1.44)	(0.74)	(-0.09)
France	-0.87	0.29	0.30
	(-0.66)	(0.22)	(0.15)
Germany	-0.63	0.15	0.42
	(-0.50)	(0.11)	(0.22)
UK	-1.40	0.57	0.21
	(-0.80)	(0.33)	(0.08)
Japan	-0.03	0.14	0.80
	(-0.02)	(0.11)	(0.42)
CAAR – G7 Countries	-0.95*	0.49	0.24
	(-1.93)	(1.01)	(0.32)

5.3 Oil, Gold, and Bitcoin Results

Lastly, we present the results related to the oil, gold and Bitcoin markets. These markets provide further insights into the global investors' reactions as the conflict date approached and in the subsequent days. Table 9 shows the abnormal returns on the event date for the three assets. The AR on WTI crude oil futures contracts is as high as 4.10% and significant at the 5% significance level. This positive excess return is associated with abnormal mark-to-market cash inflows for investors holding a long position and equal outflows for short position holders. Overall, this market reaction can be interpreted as the expectation for higher oil prices due to the rising uncertainty in the Middle East region caused by the outbreak of the war. On the same day, there was no significant evidence of abnormal returns in the gold and Bitcoin markets.

Table 9: Oil, Gold, and Bitcoin Abnormal Returns (ARs) on Event Date.
ARs are determined through the MAR model and reported in percentages. $*p < 0.10$; $**p < 0.05$; $***p < 0.01$. $H_0 : AR = 0$; $H_a : AR \neq 0$.

Asset	Abnormal Returns (ARs)	t-statistic
WTI Crude	4.10**	2.13
CMX-Gold 100 oz.	1.08	1.54
Bitcoin	-1.47	-0.61

Table 10 and 11 dive deeper into the evolution of abnormal returns in the pre-event and post-event days, respectively. In the five trading days prior to October 9, we only report a negative AR for WTI Crude oil futures contracts on day $t-3$. This notable significant -5.92% AR may not be directly related to the event itself, but most likely a reflection of changes in other determinants of the oil supply and futures contracts prices. On the other hand, the analysis of the days following the first attack reveals relevant insights into investors behaviour and their expectations. From Table 11, we highlight a significantly positive AR for WTI Crude oil futures contracts of 5.47% four days after the event. This result supports the hypothesis of rising futures prices due to a possible increase in geopolitical uncertainty affecting key oil suppliers located in the Middle East. Furthermore, we find a positive AR of 3.09% on the same day for the CMX Gold futures contracts. This finding is the first evidence supporting a positive association between value of gold the outbreak of the Israel-Hamas conflict. Finally, a similar behaviour is observed in the Bitcoin market, with a positive and significant AR of 5.19% on day $t+5$.

Table 10: Pre-Event Oil, Gold, and Bitcoin Daily Abnormal Returns (ARs).
ARs are determined through the MAR model and reported in percentages. $*p < 0.10$; $**p < 0.05$; $***p < 0.01$. $H_0 : AR = 0$; $H_a : AR \neq 0$.

Asset	$t-5$	$t-4$	$t-3$	$t-2$	$t-1$
	AR	AR	AR	AR	AR
WTI Crude	-2.33	0.32	-5.92***	-2.43	0.44
	(-1.21)	(0.17)	(-3.07)	(-1.26)	(0.23)
CMX-Gold 100 oz.	-0.49	-0.26	-0.31	-0.11	0.79
	(-0.70)	(-0.37)	(-0.44)	(-0.16)	(1.12)
Bitcoin	3.45	-1.57	1.03	-0.62	1.89
	(1.44)	(-0.65)	(0.43)	(-0.26)	(0.79)

Table 11: Post-Event Oil, Gold, and Bitcoin Daily Abnormal Returns (ARs).
ARs are determined through the MAR model and reported in percentages. $*p < 0.10$; $**p < 0.05$; $***p < 0.01$. $H_0 : AR = 0$; $H_a : AR \neq 0$.

Asset	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$
	AR	AR	AR	AR	AR
WTI Crude	-0.62	-3.07	-0.84	5.47***	-1.32
	(-0.32)	(-1.59)	(-0.43)	(2.83)	(-0.69)
CMX-Gold 100 oz.	0.64	0.67	-0.18	3.09***	-0.31
	(0.91)	(0.96)	(-0.25)	(4.41)	(-0.45)
Bitcoin	-0.59	-2.48	0.11	0.94	5.19**
	(-0.25)	(-1.03)	(0.04)	(0.39)	(2.16)

Finally, the daily abnormal returns are aggregated to obtain the cumulative abnormal returns for the three assets. Table 12 and Figure 4 illustrate the CARs over the standard pre-event window, the extended 15-day post-event window, and the total extended event window. Consistent with daily results, we find positive and significant CARs for gold futures contracts and Bitcoin over both the post-event and the entire event window. The 15-day gold CAR is 8.03%, significant at the 1% level, while the CAR for the entire window is 8.73%, significant at the 5% level. These results support the hypothesis of gold being a popular investment asset among global investors during period of rising uncertainty. Bitcoin also exhibited a significantly positive performance of 22.85% over the 15 days following October 9, 2023. Over the entire event window, the Bitcoin CAR was as high as 25.56%, significant at the 5% level. These findings highlight Bitcoin's role as a potential store of value during uncertain periods, or at least in the context of the Israeli-Palestinian war. In contrast, the CARs for oil futures contracts present counter-intuitive results compared to the daily ARs. In the pre-event window, the WTI Crude oil futures contracts suffered a -9.92% CAR, significantly different from zero at the 5% level.

Moreover, in the other windows, WTI futures did not generate substantial abnormal returns, suggesting that there were no consistent excess cash inflows for investors holding a long position.

Table 12: Pre, Post, and Total Extended Event Window CARs.
CARs are determined through the MAR model and reported in percentages. $*p < 0.10$; $**p < 0.05$; $***p < 0.01$. $H_0 : CAR = 0$; $H_a : CAR \neq 0$.

Asset	CAR $[-5, -1]$	CAR $[+1, +15]$	CAR $[-5, +15]$
WTI Crude	-9.92**	-6.93	12.75
	(-2.27)	(-0.88)	(-1.34)
CMX-Gold 100 oz.	-0.38	8.03***	8.73**
	(-0.24)	(2.81)	(2.53)
Bitcoin	4.18	22.85**	25.56**
	(0.78)	(2.34)	(2.16)

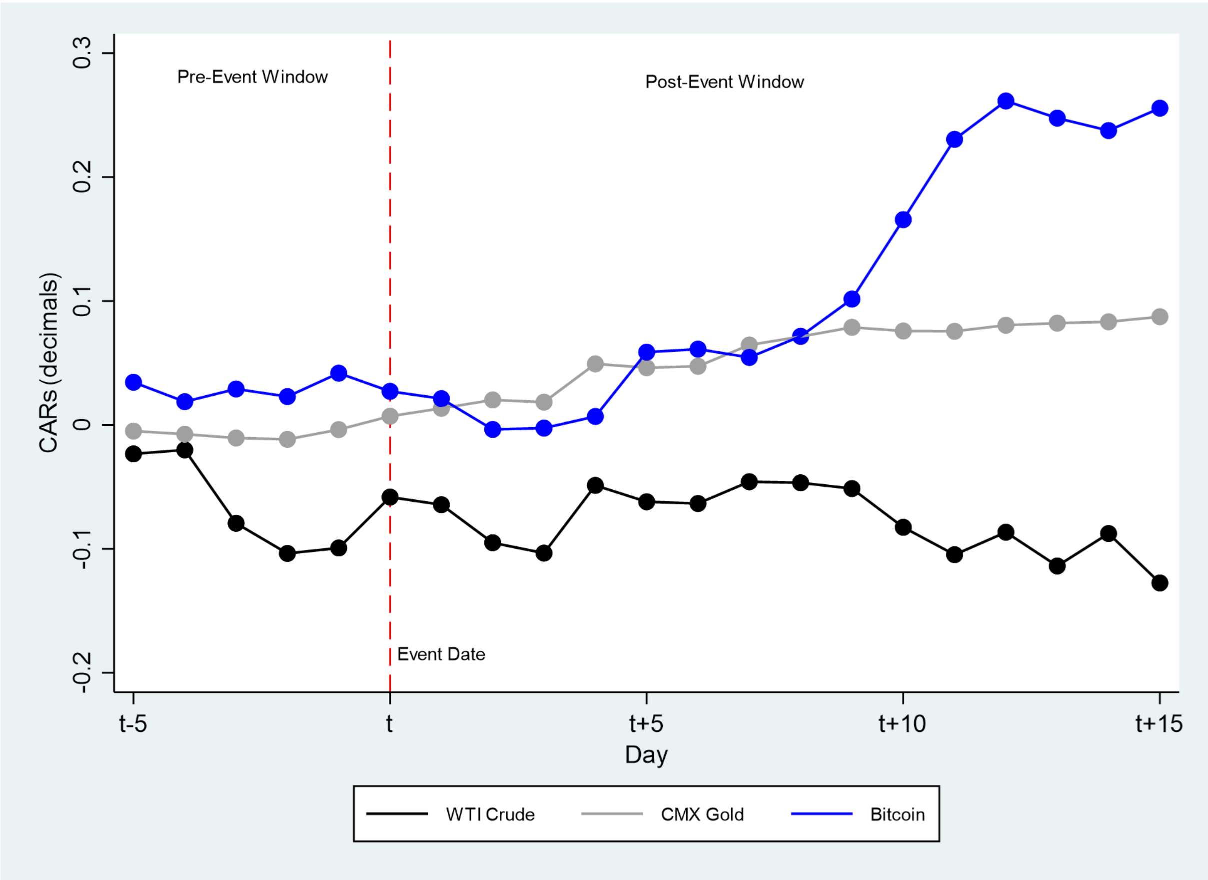

Figure 4: Cumulative Abnormal Returns (CARs) for Oil, Gold, and Bitcoin.
Notes. Cumulative Average Abnormal Returns are reported in decimals and depicted as cumulative sum over the 21-day event window that runs from five trading days prior to five trading days after the event date. The event date (i.e., October 9, 2023) is denoted by t.

6 Robustness Checks

In this section, we address several potential issues related to the empirical analysis performed in the study. These issues are discussed because they could lead to biased estimates and undermine the reliability of the significance tests. We also illustrate and implement a series of econometric tests designed to tackle these issues and make the empirical findings more robust.

6.1 Event-Induced Volatility and Cross-Sectional Correlation of Abnormal Returns

In the econometric literature, Brown and Warner (1985) is one of the first studies that comprehensively analyse whether event studiy tests of significance are, in general, well-specified. They conclude that, on average, classical t-tests are reasonably powerful and well-specified. However, they also highlight that variances might be underestimated when there is an event-induced increase in variances. If this underestimation occurs, the standard t-ratios become upwardly inflated, leading to an excessive rejection of the null hypothesis and resulting in a Type I error. To address this issue, Boehmer et al. (1991) propose a standardized cross-sectional test (hereafter BMP test) that corrects for misspecification by accommodating event-induced variance changes and incorporating information from the estimation period. In multiple simulations, the BMP test significantly outperformed alternative testing frameworks in context of event-induced increase in variances and returns autocorrelation. Formally, the BMP test statistic on the event-day is:

$$t(BMP) = \frac{\bar{AR}}{s}\sqrt{n} \tag{23}$$

Where $\bar{AR}$ is the average of standardized ARs (i.e., standardized AAR) on event day; n is the number of aggregated securities; s is the cross-sectional standard deviation operationalised as the square root of the event-day variance:

$$S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(AR_i - \bar{A})^2 \tag{24}$$

Subsequently, Kolari and Pynnönen (2010) improved the BMP test statistic by adding a correction for cross-correlation of abnormal returns. Their correction applies to event studies with event-date clustering (i.e., the event date is the same for several securities) and, more specifically, when there is a cross-sectional aggregation of ARs (i.e., AARs and CAARs). Under the assumption of asset returns being serially independent multivariate normally distributed random variables and assuming equal variance among scaled abnormal returns, Kolari and Pynnönen (2010) proved that Equation 24 is a biased estimator of the variance, as:

$$E[S^2] = (1-\rho)\sigma_A^2 \tag{25}$$

Where ρ is the average of the population ARs cross-correlations. Equation 25 can be operationalised to provide an unbiased estimator of the population variance σ_A^2:

$$S_A^2 = \frac{S^2}{1 - \bar{r}} \tag{26}$$

Where $\bar{r}$ is the average of sample cross-correlations of the estimation period abnormal returns.

In the context of this study, we believe that event-induced volatility and cross-correlations of ARs could pose a threat to the validity of the stock markets' empirical findings. On the one hand, the outbreak of the conflict could potentially affect both returns and risk within a stock market, leading to a significantly different variance of returns in the event window compared to the estimation window. On the other hand, positive cross-correlations of country-wise abnormal returns are likely to be in place, especially when aggregating the G7 stock indices to obtain AARs and CAARs. Therefore, we perform a BMP test with the Kolari and Pynnonen adjustment over Middle Easter and G7 stock markets' AARs and CAARs. The objective is to check whether these values remain significant when accounting for possible event-induced increases in variance and cross-correlations. The results are presented in the Appendix A.1.

Tables 13, 14, 15 illustrate the regional AARs and CAARs for the Middle East region and the G7 countries, along with the associated adjusted BMP test statistics. Overall, when applied to Middle Eastern markets, this alternative testing framework seems to confirm the results from simple t-tests, with a few shifts in the levels of significance (e.g., the $t-5$ AAR changes from a 10% level to a 5% level, the event date AAR goes from a 1% to a 5% level, the $t+2$ AAR significance level changes from 5% to 1%, the post-event CAR changes drops from 10% to a 5% level, and the total event window CAR switches from 5% to a 10% level of significance). Finally, it is noteworthy that the $t+5$ AAR becomes reliably different from zero at the 1% level, while it was found non-significant when performing the ordinary t-test. The BMP test with Kolari and Pynnonen adjustment confirms the results for the Middle East region and highlights a more significant negative reaction in the post-event period, reporting more systematic regional abnormal losses compared to the ordinary testing framework (i.e., Tables 2, 3, and 4).

On the other hand, as we expected, the G7 countries' results are more affected, probably, due to the high cross-correlations among the ARs. The G7 aggregated results in Table 13, 14, and 15 are all non-significantly different from zero, challenging the presence of the event shock. The anticipation hypothesis, as proposed in the Section 5, seem now unlikely to hold, at least at the aggregate level. Nonetheless, these results do not threat the validity of the inferences made at the country level, which are negative and significant for several countries in the days prior to the event (Table 2, Panel B.).

In conclusion, the BMP test with Kolari and Pynnonen adjustment proved that, overall, there was a significant and negative impact of the event on the Middle Eastern stock markets. These aggregate negative effects, however, appear to be less reliable for G7 countries.

6.2 Nonparametric Testing Framework.

The traditional t-test and the BMP test with the Kolari and Pynnonen adjustment are parametric in nature, as they require specific statistical assumptions regarding the distributions of abnormal returns. More specifically, these tests tend to be sensitive to the presence of outliers or in cases where the distributions of abnormal returns may depart from normality (El Ghoul et al., 2023). As further suggested by MacKinlay (1997), nonparametric tests can be implemented to check the robustness of conclusions based on parametric tests. If remarkable differences arise, and the assumptions related to the alternative nonparametric framework hold, then it is likely that the parametric tests suffers from specification issues.

The underlying assumptions related to parametric tests are likely to hold for daily abnormal stock returns when the estimation window is large. When the ARs are cross-sectionally and temporally aggregated into AARs and CAARs, parametric tests perform better as the number of aggregated indices increases. While we selected a large estimation window of 120 observations, we included only 5 Middle Eastern market indices and the G7 markets. For this reason, we checked whether AARs and CAARs in the equity markets are subject to changes when applying the generalised rank (GRANK) test proposed by Kolari and Pynnonen (2011). The decision to apply this test relies on its properties, which make it superior to other popular nonparametric testing frameworks. First, the GRANK test is not sensitive to event-induced volatility. Second, there is evidence that the power of this test dominates previously proposed frameworks in the literature (Wilcoxon, 1945; Corrado, 1989; Corrado and Zivney, 1992). Third, the test is suitable when event-day clustering occurs as it exhibits robustness to cross-sectional correlation of ARs.

Tables in Appendix A.2 illustrate the regional AARs and CAARs over the event window and the associated test statistics as determined through the GRANK test. When looking at the aggregate measure of Middle Eastern markets, we notice that the significance of AARs and CAARs has not changed as compared to the BMP test with Kolari and Pynnonen adjustment (Appendix A.1). Therefore, it follows that the overall negative and significant impact of the event on these stock markets is also confirmed by a nonparametric testing framework. On the other hand, inferences for G7 countries are also mostly consistent with those made using parametric frameworks, suggesting a negligible impact of the event on these markets at the aggregate level.

6.3 WTI Crude versus Brent Oil Futures Contracts

The last robustness check is performed on the oil futures market. In the context of this research, we relied on the WTI continuous futures settlement prices and the associated logarithmic daily returns to infer the oil market reaction to the onset of the conflict. The West Texas Intermediate is often used in research as global benchmark for the light-oil market (Obi et al., 2023). However, over the last few years, the Brent crude has been consistently employed as regional benchmark for the light-oil European, African, and Middle Eastern markets. Although we reported a high correlation coefficient in Section 3 between WTI and Brent settlement price series, this section replicates the event study using the Brent crude continuous futures contract settlement price series. The rationale behind this is to address potential deviations from the empirical inferences drawn from the WTI futures contracts.

Appendix A.3 displays the results for the Brent crude futures abnormal returns. Daily ARs in the pre- and post-event windows are identical in sign and significance and close in size to those found for the WTI contracts, confirming the results previously drawn from the WTI returns. When aggregated over the days, the CARs for Brent crude contracts are again identical in sign and significance and similar in size to those for WTI. Therefore, the entire set of empirical findings based on WTI contact prices is exactly replicated when using the Brent crude futures market as a global oil benchmark.

7 Conclusion

This thesis investigated the effect of the outbreak of the Israel-Hamas war on equity, sovereign bond, oil, gold, and Bitcoin markets. While oil, gold, and Bitcoin are studied at global market level, equity (sovereign bond) analysis comprises the G7 and five (three) Middle Eastern countries. Previous research on the topic highlighted a heterogeneous impact of the event on several developed and developing equity markets. However, this is the first study that performs robustness checks on equity results while also expanding the analysis to several financial markets that had previously remained unaddressed. Therefore, this research has contributed to the existing literature by exploring three research questions, which can be summarized in a single broader research question: *"What is the impact of the outbreak of the Israel–Hamas war on the performance of equity, sovereign bond, oil, gold, and Bitcoin markets as measured by abnormal returns?"*

We addressed the research questions by conducting an event study using the OLS market model to determine normal returns for the equity market indices, while the MAR model was employed for assessing sovereign bond, oil, gold, and Bitcoin data. Furthermore, along with standard t-tests, stock market results were subjected to robustness tests by means of the BMP test with Kolari and Pynnonen adjustment and the nonparametric GRANK test. Finally, while the main oil analysis is based on WTI futures continuous contracts, the event study is also replicated on Brent crude futures continuous contacts to address potential deviations from the main empirical findings.

The main empirical findings and robustness checks reveal heterogeneous reactions in equity markets, with Middle Eastern markets such as Israel, Saudi Arabia, and Egypt suffering significant abnormal losses on the event day and over the 11-day event window. Conversely, G7 markets suffered mild country wide abnormal losses in the days preceding the event, while the aggregate results are not statistically significant after performing the BMP test with Kolari and Pynnonen adjustment. The sovereign bond market results outline significant and negative abnormal returns for Israel, but not for Egypt and Turkey. Instead, we found an overall negative and significant reaction of the G7 sovereign bond markets over the pre-event days. These pieces of evidence might suggest an anticipated but overall weak negative reaction from the most developed financial markets. Finally, the WTI oil futures abnormal returns were not systematically significant, highlighting exclusively a limited reaction on the event day. Therefore, at the outbreak of the event, global investors with long oil futures positions did not systematically realise abnormal mark-to-market inflows. On the other hand, positive and significant ARs associated with CMX gold futures contracts highlighted a possible increase in demand at the event time for this safe haven asset by global investors. This, in turn, rewarded investors with long futures gold positions as they experienced above-normal mark-to-market cash inflows. In conclusion, similar post-event positive and significant ARs are reported for Bitcoin.

Therefore, this thesis concludes that the Israel–Hamas conflict had, in the short-term, consistently and adversely affected Middle Eastern equity markets both at the country and aggregated regional levels. In contrast, we report a limited short-term impact on equity and sovereign bond markets in most developed countries, which proved to be more resilient in this case. These markets mainly suffered small country-wide negative market returns in the days leading up to October 9, suggesting a mild anticipated reaction to the event. Furthermore, investors perceived the attack as a serious threat to financial markets, increasing their demand for safe haven assets such as gold. Surprisingly, the fear of possible disruptions in the oil market appeared weak, with positive and significant WTI futures ARs only on the event day and four days later. Finally, we shed light on the role of Bitcoin as possible hedging or safe investment tool for investors during periods of geopolitical uncertainty, as it exhibited positive and significant abnormal returns in the days following the attack.

Albeit three robustness checks were performed, this study faces some limitations. First, the amount of available data for sovereign bond market indices is limited. For this reason, Saudi Arabia and Jordan were not included in the sovereign bond analysis, while results for Egypt are derived from a shorter estimation window, making them less reliable. Second, while the event study framework is designed to capture short-term market reactions to an event, the long-term effects are not investigated in this study. Finally, although we meticulously developed the event study framework to make it suitable for this specific event and the analysed assets, we cannot completely rule out the possibility that other shocks may overlap with the outbreak of the conflict, introducing a potential bias in our inferences.

While this study revealed reliable insights on the short-term consequences of the conflict on a broader set of markets, it also paves the way for future academic research. Further event studies might be performed at firm or industry level to better disentangle the short-term effects of the conflict. Moreover, given the ongoing escalation of the conflict, a long-term analysis is necessary to better identify the weaker and most resilient markets, as well as to cumulatively quantify investors' losses over the conflict. Finally, this study exclusively focused on the impact of the conflict on asset returns, while it is also crucial to understand to what extent the event impacted the return volatility in these markets.

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A Appendix

A.1 BMP Test with Kolari and Pynnonen Adjustment

Table 13: Pre-Event and Event Day Stock Markets Regional AARs, using the BMP test with Kolari Pynnonen Adjustment.
AARs are reported in percentages. t-values are in parenthesis. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$. $H_0 : AAR = 0$; $H_a : AAR \neq 0$.

Region	$t-5$	$t-4$	$t-3$	$t-2$	$t-1$	t
AAR – Middle East	0.98**	-0.01	-0.68	0.37	-0.10	-2.71**
	(2.29)	(-0.02)	(-0.89)	(0.39)	(-0.53)	(-2.31)
AAR – G7 Countries	-1.15	0.12	-0.50	0.53	-0.19	-0.29
	(-1.64)	(1.02)	(-0.59)	(0.90)	(-0.64)	(-0.69)

Table 14: Post-Event Stock Markets Regional AARs, using the BMP test with Kolari Pynnonen Adjustment.
AARs are reported in percentages. t-values are in parenthesis. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$. $H_0 : AAR = 0$; $H_a : AAR \neq 0$.

Region	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$
AAR – Middle East	0.25	-1.42***	0.10	-0.35	-0.93***
	(0.15)	(-3.65)	(0.71)	(-0.44)	(-3.38)
AAR – G7 Countries	1.02	-0.17	-0.05	-0.39	-0.08
	(1.45)	(-0.83)	(-0.44)	(-0.57)	(0.11)

Table 15: Pre, Post, and Total Event Window Stock Markets CAARs, using the BMP test with Kolari and Pynnonen Adjustment.
CAARs are reported in percentages. t-values are in parenthesis. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$. $H_0 : CAAR = 0$; $H_a : CAAR \neq 0$.

Region	CAR $[-5, -1]$	CAR $[+1, +5]$	CAR $[-5, +5]$
CAAR – Middle East	0.55	-2.35**	-4.50*
	(0.34)	(-2.21)	(-1.73)
CAAR – G7 Countries	-1.19	0.33	-1.15
	(-1.21)	(0.53)	(-1.22)

A.2 Nonparametric GRANK Test

Table 16: Pre-Event and Event Day Regional AARs, using the Generalised Rank Test (GRANK).
Test statistics are in parenthesis. AARs are reported in percentages. $*p < 0.10$; $**p < 0.05$; $***p < 0.01$. $H_0 : AAR = 0$; $H_a : AAR \neq 0$.

Region	$t-5$	$t-4$	$t-3$	$t-2$	$t-1$	t
AAR – Middle East	0.98**	-0.01	-0.68	0.37	-0.10	-2.71**
	(2.07)	(0.18)	(-0.72)	(0.37)	(-0.53)	(-2.46)
AAR – G7 Countries	-1.15*	0.12	-0.50	0.53	-0.19	-0.29
	(-1.74)	(1.26)	(-0.43)	(0.98)	(-0.42)	(-0.64)

Table 17: Post-Event Regional AARs, using the Generalised Rank Test (GRANK).
Test statistics are in parenthesis. AARs are reported in percentages. $*p < 0.10$; $**p < 0.05$; $***p < 0.01$. $H_0 : AAR = 0$; $H_a : AAR \neq 0$.

Region	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$
AAR – Middle East	0.25	-1.42***	0.10	-0.35	-0.93***
	(0.40)	(-2.99)	(0.74)	(0.10)	(-2.73)
AAR – G7 Countries	1.02*	-0.17	-0.05	-0.39	-0.08
	(1.71)	(-0.91)	(-0.65)	(-0.61)	(0.47)

Table 18: Pre, Post, and Total Event Window CAARs, using the Generalised Rank Test (GRANK).
Test statistics are in parenthesis. CAARs are reported in percentages. $*p < 0.10$; $**p < 0.05$; $***p < 0.01$. $H_0 : CAAR = 0$; $H_a : CAAR \neq 0$.

Region	CAR $[-5, -1]$	CAR $[+1, +5]$	CAR $[-5, +5]$
CAAR – Middle East	0.55	-2.35**	-4.50*
	(0.42)	(-2.07)	(-1.75)
CAAR – G7 Countries	-1.19	0.33	-1.15
	(-1.28)	(0.55)	(-1.28)

A.3 Brent Crude Continuous Futures

Table 19: Brent Crude Futures Contracts ARs and CARs.
ARs and CARs are determined through the mean-adjusted return model (MAR) and reported in percentages. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$. $H_0 : AR = 0$; $H_a : AR \neq 0$. $H_0 : CAR = 0$; $H_a : CAR \neq 0$.

Day	Abnormal Returns	t-statistic
$t-5$	-1.74	-0.99
$t-4$	0.12	0.07
$t-3$	-5.89***	-3.35
$t-2$	-2.16	-1.23
$t-1$	0.49	0.28
t	4.02**	2.29
$t+1$	-0.68	-0.39
$t+2$	-2.22	-1.26
$t+3$	0.10	0.06
$t+4$	5.42***	3.08
$t+5$	-1.48	-0.84
CAR$[-5,-1]$	-9.18**	-2.30
CAR$[+1,+15]$	-3.72	-0.52
CAR$[-5,+15]$	-8.87	-1.02