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Who Gains from War? The Stock Market Impact of the Russia-Ukraine Conflict on U.S. Defense and Energy Firms

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Abstract

This thesis investigates whether U.S. defense and energy firms listed on the U.S. stock market were stock market winners from the Russian invasion of Ukraine on 24 February 2022, and whether any gains they experienced persisted over the subsequent months. While the existing literature documents that geopolitical shocks generate negative aggregate market reactions, far less attention has been paid to systematically identifying which sectors benefit and for how long. This thesis addresses that gap by focusing explicitly on potential winners using a dual-method empirical framework applied to a sample of 30 U.S.-listed firms.

Two complementary methods are employed. An event study captures the immediate stock market reaction around the invasion date, estimating abnormal returns using the market model across three event windows. A difference-in-differences framework then examines whether any initial gains persisted over a ten-month horizon, comparing cumulative log returns for treated group of defense and energy firms against a control group of defensive firms (healthcare, consumer staples, and telecommunications) whose revenues are structurally insulated from the conflict's primary economic consequences.

The event study finds that treated firms earned a cumulative average abnormal return of 4.09% in the three-day window centred on the invasion date and 14.66% over the following ten trading days, compared to statistically insignificant returns for the control group across all windows. The difference between groups widened continuously, reaching 16.57 percentage points in the post-event window. The difference-in-differences analysis confirms that these gains were not reversed: treated firms maintained approximately 13.6% higher cumulative returns than the control group over the post-invasion period, with the coefficient remaining positive and statistically significant at the 5% level after controlling for firm and time fixed effects. The parallel trends assumption is supported by both a linear pre-trend test and a placebo analysis.

These findings establish that U.S. defense and energy firms were genuine and lasting beneficiaries of the conflict. Defense firms gained through the fiscal channel, as NATO military spending rose 13% in real terms in 2022 and a further 16% in 2023. Energy firms gained through the market channel, as oil prices surged above $130 per barrel and European natural gas prices increased more than fourfold. The results contribute to the literature by providing firm-level evidence on the winners of a major geopolitical shock using a formal counterfactual design, and by combining short-run and medium-run analysis within a unified framework to demonstrate that initial investor optimism was validated by subsequent fundamental developments rather than representing short-lived speculation.

Titolo in Italiano: Chi trae vantaggio dalla guerra? L'impatto del conflitto Russia-Ucraina sul mercato azionario statunitense delle imprese della difesa e dell'energia

Abstract

Questa tesi analizza se le imprese statunitensi della difesa e dell'energia quotate sul mercato azionario statunitense siano state tra le vincitrici di mercato a seguito dell'invasione russa dell'Ucraina del 24 febbraio 2022, e se gli eventuali guadagni ottenuti siano persistiti nei mesi successivi. Mentre la letteratura esistente mostra che gli shock geopolitici generano reazioni negative nei mercati azionari aggregati, minore attenzione è stata dedicata all'identificazione sistematica dei settori che possono beneficiare di tali eventi e alla durata di questi benefici. Questa tesi affronta tale lacuna concentrandosi esplicitamente sui potenziali vincitori, utilizzando un quadro empirico basato su due metodi applicato a un campione di 30 imprese quotate negli Stati Uniti.

Vengono utilizzati due metodi complementari. Un event study analizza la reazione immediata del mercato azionario intorno alla data dell'invasione, stimando i rendimenti anomali attraverso il market model su tre finestre temporali. Successivamente, un modello difference-in-differences esamina se i guadagni iniziali siano persistiti su un orizzonte di dieci mesi, confrontando i rendimenti logaritmici cumulati del gruppo trattato, composto da imprese della difesa e dell'energia, con quelli di un gruppo di controllo formato da imprese difensive, appartenenti ai settori sanitario, beni di consumo primari e telecomunicazioni, i cui ricavi sono strutturalmente meno esposti alle principali conseguenze economiche del conflitto.

L'event study mostra che le imprese trattate hanno ottenuto un rendimento anomalo medio cumulato del 4,09% nella finestra di tre giorni centrata sulla data dell'invasione e del 14,66% nei dieci giorni di negoziazione successivi. Al contrario, i rendimenti del gruppo di controllo non risultano statisticamente significativi in nessuna delle finestre considerate. La differenza tra i due gruppi si è ampliata progressivamente, raggiungendo 16,57 punti percentuali nella finestra post-evento. L'analisi difference-

in-differences conferma che questi guadagni non sono stati riassorbiti: le imprese trattate hanno mantenuto rendimenti cumulati superiori di circa il 13,6% rispetto al gruppo di controllo nel periodo successivo all'invasione, con un coefficiente positivo e statisticamente significativo al livello del 5% dopo aver controllato per effetti fissi di impresa e di tempo. L'ipotesi di trend paralleli è supportata sia da un test lineare sui trend pre-trattamento sia da un'analisi placebo.

I risultati mostrano che le imprese statunitensi della difesa e dell'energia sono state beneficiarie reali e durature del conflitto. Le imprese della difesa hanno beneficiato attraverso il canale fiscale, poiché la spesa militare della NATO è aumentata del 13% in termini reali nel 2022 e di un ulteriore 16% nel 2023. Le imprese energetiche hanno invece beneficiato attraverso il canale di mercato, poiché i prezzi del petrolio hanno superato i 130 dollari al barile e i prezzi del gas naturale europeo sono aumentati di oltre quattro volte. I risultati contribuiscono alla letteratura fornendo evidenza a livello di impresa sui vincitori di un grande shock geopolitico attraverso un disegno controfattuale formale, e combinando analisi di breve e medio periodo in un unico quadro empirico. In questo modo, la tesi mostra che l'ottimismo iniziale degli investitori è stato confermato da successivi sviluppi fondamentali, piuttosto che rappresentare una semplice speculazione di breve periodo.

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Chapter 1: Introduction

Armed conflicts are generally associated with adverse outcomes for financial markets. The onset of war heightens uncertainty about future economic conditions, disrupts international trade and supply chains which tends to increase risk aversion among investors. As a result, the overall stock market reaction to geopolitical shocks is typically negative, a pattern well documented across different conflicts and historical periods (Caldara & Iacoviello, 2022; Rigobon & Sack, 2005a).

However, this aggregate decline often masks important variation across sectors. War alters economic conditions in ways that can generate opportunities for certain industries. Military conflict increases demand for defense equipment and related services, while disruptions to global supply chains can drive up commodity prices, benefiting producers located outside the conflict zone. At the same time, governments tend to reallocate spending toward defense and energy security. Firms operating in these areas may therefore experience gains, even as the broader market declines.

This thesis investigates the winners from the Russian invasion of Ukraine among U.S. publicly traded firms. In particular, it focuses on defense and energy companies, as these sectors are theoretically well positioned to gain from the economic consequences of the conflict. The analysis evaluates whether these firms outperformed more unaffected sectors in both the immediate aftermath of the invasion and over the subsequent months. The central question is whether shareholders in U.S. defense and energy firms profit from the conflict?

1.1 The Russia-Ukraine War as a Natural Experiment

The Russian invasion of Ukraine on 24 February 2022 provides an ideal setting for this investigation. The invasion was a large unexpected geopolitical shock with clear economic implications for specific sectors. For defense firms, the war triggered a fundamental

reassessment of global security priority. NATO member states committed to substantial increases in military spending, with European defense budgets rising at their fastest pace since the Cold War. The United States expanded military aid to Ukraine while simultaneously replenishing depleted stockpiles. These developments translate directly into higher expected revenues for defense contractors.

For energy firms, the war disrupted global commodity markets. Russia which is a major exporter of oil and natural gas, faced comprehensive sanctions that constrained its ability to supply Western markets. Oil prices surged above $130 per barrel in the invasion's immediate aftermath, while European natural gas prices increased more than fourfold. For U.S. energy producers, these developments created favourable market conditions. Operating outside the scope of sanctions but within the same integrated global commodity markets, these firms were well positioned to benefit from higher prices and heightened supply uncertainty.

The theoretical case for these sectors as potential winners is strong. The empirical question is whether investors recognised this potential and bid up stock prices accordingly and whether any such gains were sustained over time rather than reflecting only short-lived market reactions

1.2 Research Questions

This thesis addresses three closely related research questions.

1. Did U.S. defense and energy firms experience positive abnormal returns around the outbreak of the war? This question examines whether investors immediately recognised these sectors as beneficiaries, reflected in stock price increases at and around the invasion date.
2. How large were the gains for defense and energy firms relative to unaffected sectors? Absolute returns are difficult to interpret without a benchmark. By comparing defense and energy firms to a control group of sectors not expected to benefit from the war, the analysis quantifies the magnitude of outperformance.

3. Did the initial gains persist in the medium term? Short-term market reactions may reflect overreaction or speculation. This question examines whether defense and energy firms sustained their advantage over subsequent months, suggesting that initial investor optimism was validated by subsequent developments.

1.3 Empirical Strategy

To address these questions, the thesis employs two complementary empirical methods.

- **Event Study Methodology:** It helps in capturing the immediate stock market reactions around the invasion date. By comparing observed returns to expected returns which is estimated from historical market relationships. This analysis will help us identify any abnormal returns attributable to the invasion. Using multiple event windows, covering periods before, during, and after the invasion, makes it possible to examine whether markets anticipated the shock in advance, how quickly information was incorporated into prices, and whether any adjustments continued in the days following the event.
- **Difference-in-Differences (DiD) Methodology**: it examines relative performance over an extended period. This approach compares the change in cumulative returns for treated firms (defense and energy) to the change for control firms. The control group consists of firms operating in defensive sectors which are healthcare, consumer staples, and telecommunications These industries are characterized by stable, price-inelastic demand that persists regardless of geopolitical conditions.

  The control group serves a specific function: it represents the counterfactual which means what would have happened to stock returns in the absence of the invasion Defensive sectors are chosen because they are relatively insulated from both the negative aggregate effects of geopolitical uncertainty and the positive sector-specific effects which are expected for defense

and energy. They are neither expected winners nor expected losers hence they provide a neutral baseline.

Within the difference-in-differences framework, and conditional on the validity of the parallel trends assumption, if defense and energy firms significantly outperform this neutral baseline after the invasion, we can conclude these sectors were genuine winners from the conflict. Any such relative gains can be interpreted as a causal effect of the war rather than the result of pre-existing trends or unrelated market dynamics.

1.4 Contribution of the Thesis

This thesis contributes to the literature on geopolitical risk and financial markets in several ways.

First, it provides firm-level evidence on the beneficiaries of geopolitical conflict. While existing research documents negative aggregate market responses to wars, less attention has been paid to systematically identifying which sectors gain. By focusing explicitly on potential winners, this study complements the literature on aggregate effects.

Second, it combines short-term and medium-term analysis within a unified framework. Event studies capture immediate reactions but cannot assess persistence. Panel methods assess persistence but may miss important short-term dynamics. By employing both approaches, the thesis provides a complete picture of how winning sectors performed from the invasion date through subsequent months.

Thirdly it focusses on U.S. firms and providing evidence from the world's largest and most liquid equity market, where price discovery is efficient and results are broadly representative of sophisticated investor behaviour.

1.5 Thesis Structure

The remainder of this thesis is organised as follows. Chapter 2 reviews the background literature and develops the theoretical framework. Chapter 3 describes the data and sample construction. Chapter 4 explains the empirical methodology in detail. Chapter 5 presents the results, and Chapters 6 and 7 discuss the findings and conclude.

Chapter 2: Background & Literature Review

This chapter provides the historical, economic, and theoretical context necessary to evaluate whether U.S. defense and energy firms can be considered beneficiaries of the Russian invasion of Ukraine. Rather than offering a purely descriptive overview, the chapter links geopolitical developments to firm-level financial outcomes by identifying the key economic transmission mechanisms through which the conflict affects different sectors.

The chapter has two main objectives. First, it develops a theoretical and economic basis for why defense and energy firms are expected to benefit, despite the generally negative impact of war on aggregate financial markets. Second, it critically reviews the existing empirical literature on geopolitical shocks and stock market responses, highlighting both its contributions and its limitations, particularly the lack of firm-level analysis, limited evidence on persistence, and insufficient use of counterfactual comparisons.

The chapter is structured as follows. Section 2.1 outlines the origins of the Russia–Ukraine conflict, while Section 2.2 describes the invasion and the international response. Section 2.3 examines the key economic transmission channels, distinguishing between the fiscal channel affecting defense firms and the market-based channel affecting energy firms. Section 2.4 develops the theoretical framework linking geopolitical shocks to asset prices. Sections 2.5 and 2.6 review empirical evidence on defense and energy sector responses, respectively.

Section 2.7 evaluates the methodological approaches used in the literature, while Section 2.8 synthesises the main findings and identifies the research gap. Finally, Section 2.9 concludes the chapter by linking these insights to the empirical strategy adopted in this thesis.

2.1 Origins of the Russia-Ukraine Conflict and International Response

Since the end of the Cold War, Europe has experienced a period of relatively lower levels of interstate conflict compared to earlier decades, with large-scale wars between major powers becoming increasingly rare. However, tensions between Russia and Ukraine have persisted since Ukraine's independence in 1991 and significantly intensified after Russia's annexation of Crimea in 2014 and the outbreak of armed conflict in eastern Ukraine. These developments represented a major rupture in the post-Cold War European security order and worsened relations between Russia and Western countries over several years and eventually led to Russia's large-scale invasion of Ukraine in 2022 (Mearsheimer, 2014).

2.2 The February 2022 Invasion and International Response

2.2.1 The February 2022 Invasion

Beginning in late 2021, Russia assembled a substantial military force near Ukraine's borders. By February 2022, satellite imagery documented over 150,000 troops, along with tanks, artillery, and support equipment, positioned in Russia and Belarus. Russian officials denied intentions to invade, characterising the deployments as exercises. On 24 February 2022, Russia launched a full-scale invasion with coordinated attacks across multiple fronts. The assault targeted Kyiv from the north, the Donbas from the east, and southern Ukraine from Crimea. Initial Western assessments anticipated rapid Russian success, with some analysts predicting Kyiv could fall within days. However Ukrainian resistance proved far more effective than expected. By early April, Russian withdrew from the Kyiv region to concentrate on eastern and

southern Ukraine. The conflict evolved into a protracted war of attrition, with intense fighting in the Donbas and shifting front lines over subsequent months.

The evolution of the war is important for understanding stock market behaviour. While the initial phase was characterised by high uncertainty, it soon became clear that the conflict would be prolonged, with lasting implications for defense spending and energy markets. As new information emerged, investors were required to continuously revise their expectations, leading to ongoing adjustments in stock prices.

2.2.2 Sanctions and Military Support

Western nations responded to the invasion with comprehensive economic sanctions and military support for Ukraine.

Sanctions on Russia

The sanctions targeted Russia's financial system, energy sector, and technology access:

- Financial sanctions: Major Russian banks were disconnected from SWIFT. Approximately $300 billion in Central Bank of Russia foreign exchange reserves were frozen. These measures severely constrained Russia's ability to conduct international transactions and defend its currency (European Commission, 2022; Moiseienko, 2023).
- Energy sanctions: The European Union committed to phasing out Russian energy imports, with embargoes on coal from August 2022 and seaborne crude oil from December 2022. The United States also prohibited Russian energy imports starting in March 2022.(European Council, 2022)
- Technology and defense restrictions: Export controls prohibited sales of advanced semiconductors, technology, and defense-related goods to Russia.

The timing of sanctions matters for understanding market dynamics. Initial sanctions announced on 24-25 February were followed by escalating measures over subsequent weeks. Each new sanctions package provided additional information about the economic isolation Russia would face and the duration of energy market disruptions.

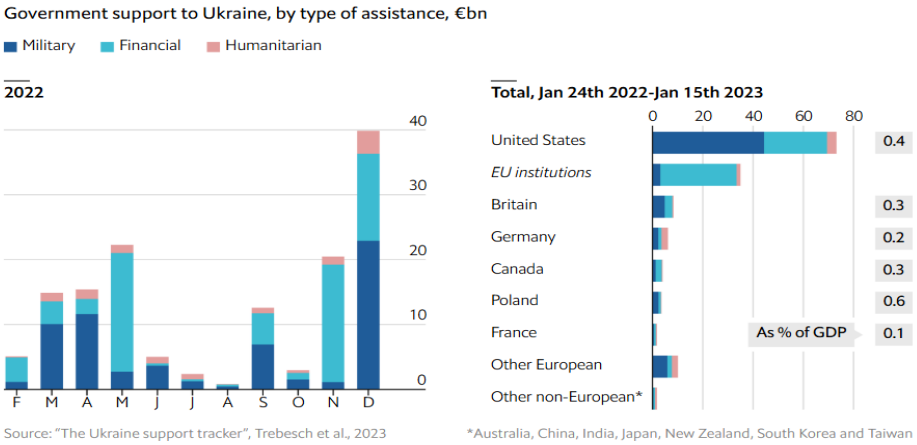
Military and Financial Support for Ukraine

Western nations provided substantial support to Ukraine:

- The United States committed over $75 billion in assistance by early 2024, including weapons systems, ammunition, training, and financial support (Trebesch, 2023).
- European nations provided military equipment from existing stockpiles while committing to replenishment.
- NATO enhanced its eastern flank presence, deploying additional forces to member states bordering Russia (NATO, 2022).

This support directly affects defense firm prospects. Aid packages funded by government appropriations translate into procurement contracts. Stockpile replenishment requires new production orders. Enhanced NATO deployments increase demand for equipment and services.

Figure 1- Government Supports to Ukraine by type of assistance (€bn)



Note: The Ukraine support Tracker

2.3 Economic Transmission Channels

2.3.1 Defense Spending

The invasion catalysed the largest increase in Western military spending since the Cold War. This shift represents the primary channel through which defense firms are expected to benefit (SIPRI 2022, 2023).

European Defense Spending

The most dramatic changes occurred in Europe. Germany announced a €100 billion special fund for military modernisation within days of the invasion a historic reversal of post-World War II restraint. Germany also committed to meeting NATO's 2% of GDP defense spending target, a threshold it had consistently missed.

According to the Stockholm International Peace Research Institute (SIPRI), military spending by European NATO members increased by 13% in real terms in 2022 and a further 16% in 2023. These represent the largest year-on-year increases in decades. Eastern European countries, perceiving the most acute threat, increased spending most rapidly. Poland's military budget doubled between 2021 and 2024.

U.S. Defense Spending

The United States, already the world's largest defense spender at over $800 billion annually, expanded budgets and military aid to Ukraine. While percentage increases were smaller than in Europe, the absolute dollar amounts were substantial. Ukraine supplemental appropriations totalled tens of billions of dollars, with significant portions flowing to U.S. defense contractors for equipment and production.

Implications for Defense Firms

These spending increases translate into tangible business opportunities for defense contractors

Channel	Mechanism	Timeline
Direct aid to Ukraine	Equipment transfers funded by appropriations	Immediate
Stockpile replenishment	New production orders to replace transferred equipment	Short to medium term
Budget increases	Higher baseline procurement across NATO	Medium to long term
Modernisation programs	Major new platforms and systems	Long term

The diversity of these channels suggests that defense firms could benefit across multiple time horizons, immediate gains from announced aid packages, followed by sustained benefits from structural budget increases.

2.3.2 Energy Markets

The invasion caused severe disruptions to global energy markets. These disruptions represent the primary channel through which energy firms outside Russia are expected to benefit.

Oil Market Disruptions

Russia is one of the world's largest oil producers, accounting for approximately 10% of global output prior to the invasion. Sanctions and supply uncertainty caused immediate price increases:

Date	Brent Crude Price	Context
1 February 2022	$89/barrel	Pre-invasion
24 February 2022	$99/barrel	Invasion date
8 March 2022	$133/barrel	Peak
2022 average	$101/barrel	Annual average
2021 average	$71/barrel	Prior year comparison

Oil prices remained elevated throughout 2022, averaging over 40% higher than the prior year. For U.S. oil producers, higher prices directly increase revenues and profit margins. Production costs are largely fixed in the short term, so price increases flow substantially to the bottom line.

Natural Gas Market Disruptions

Natural gas markets experienced even more dramatic disruptions, particularly in Europe. Russia supplied approximately 40% of European natural gas imports prior to the invasion. Pipeline deliveries declined sharply as Russia curtailed supplies in apparent retaliation for sanctions.

European natural gas prices (Dutch TTF benchmark) increased from approximately €80/MWh in early February 2022 to over €340/MWh in August 2022 which is more than a fourfold increase. While U.S. natural gas prices are partially insulated from European markets, U.S. liquefied natural gas (LNG) exporters benefited directly from elevated international prices.

Implications for Energy Firms

U.S. energy firms benefited through several channels:

- Higher commodity prices: Elevated oil and gas prices increase revenues for producers with existing production.
- Increased strategic importance: Energy security concerns enhanced the political and economic position of domestic producers.
- Investment incentives: Higher prices improved the economics of new drilling and production expansion
- LNG exports: European demand for non-Russian gas created opportunities for U.S. LNG suppliers.

Unlike defense spending, which operates through government fiscal decisions, energy firm gains operate through market mechanisms. Price increases are immediate and observable, providing clear signals to investors about profitability implications.

2.3.3 Comparison of Channels

The Russian invasion of Ukraine created favourable conditions for two sectors through distinct mechanisms:

Sector	Primary Channel	Mechanism	Timeline
Defense	Fiscal	Government budget decisions increase procurement	Medium to long term
Energy	Market	Commodity prices rise due to supply disruption	Immediate to medium term

Both sectors are hypothesised to be winners, but the transmission channels differ in important ways. Energy firm gains are driven by market prices that respond immediately to supply-demand conditions. Defense firm gains depend on government decisions that may take longer to materialise but could prove more durable.

The empirical analysis that follows tests whether investors recognised these sectors as winners, both in the immediate aftermath of the invasion and over the subsequent months.

2.4 Theoretical Framework

2.4.1 Geopolitical shocks and Asset Prices

According to standard asset pricing theory, the value of a security is determined by the present value of its expected future cash flows, discounted at a rate which reflects both the time value of money and the level of risk involved (Cochrane, 2009). Geopolitical events can influence these valuations by affecting both the discount rate and the expected future cash flows.

Beyond the discount rate, geopolitical events also influence stock prices by changing expectations about firms' future profitability. Wars can affect demand, disrupt supply chains, increase input costs, and alter the competitive environment. These impacts are not uniform across sectors. There are firms which experience negative revisions on expected cash flows due to economics disruption and while as there are firms in other industries that benefit from conflict related demand and may see positive revisions that can offset or even outweigh the effects of higher discount rates (Berkman et al., 2011).

Geopolitical shocks also lead to behavioural responses in financial markets. During periods of heightened uncertainty, investors tend to become more risk-averse and shift their investments away from risky assets like equities toward safer options such as government bonds and gold (Baur & Lucey, 2010; Baur & McDermott, 2010). This reallocation of portfolios can create

selling pressure on stock prices, even when there are no immediate changes in underlying fundamentals.

2.4.2 The Efficient Market Hypothesis

The event study methodology used in this thesis is based on the efficient market hypothesis (EMH) (Fama, 1970). He classified market efficiency into three forms depending on the type of information reflected in asset prices:

Form	Information Set	Implication
Weak	Historical prices and volume	Past prices cannot predict future returns
Semi-strong	All public information	Public news is rapidly incorporated into prices
Strong	All information including private	Even insider information cannot generate excess returns

For event study analysis, the semi-strong form of market efficiency is the most relevant. Under semi-strong efficiency, stock prices rapidly adjust to publicly available information. The outbreak of war represents a major public information shock. If markets are efficient, stock prices should respond immediately or shortly after the event, and any abnormal returns observed can be interpreted as the market's evaluation of the economic impact of that event (Mackinlay, 1997).

The efficient market hypothesis does not imply that price adjustments are always immediate or that investors behave with perfect rationality. In the case of complex events with uncertain outcomes, it may take time for information to be fully understood and reflected in prices (Hong & Stein, 1999). So Investors need to collect information, evaluate its implications, and update their expectations, which are processes that do not happen instantly, even in well-developed markets. This consideration motivates the use of multiple event windows spanning different time horizons.

Empirical studies generally support the semi-strong form of market efficiency in liquid and developed markets such as U.S. equities (Malkiel, 2003). Although some anomalies have been identified, it is still reasonable to assume that major public information is quickly reflected in stock prices for actively traded securities. The defense and energy firms analysed in this thesis are large, highly liquid, and closely followed by investors, which makes the efficiency assumption especially suitable in this context.

2.4.3 Sector-Specific Transmission Channels

While aggregate market responses to geopolitical shocks are typically negative, theory predicts positive effects for specific sectors through distinct transmission channels.

Defense sector: The fiscal channel

Defense firms derive revenue primarily from government contracts for military equipment, weapons systems, and services. Demand is determined by government budget decisions rather than private consumption or investment (Dunne et al., 2005). When geopolitical tensions rise, governments typically increase military spending in response to security concerns, which can lead to higher demand for defense-related products and services (Hartley & Sandler, 1995).

Table 1-Transmission Mechanism through Fiscal Policy

This channel also has important timing implications. Changes in defense spending do not occur immediately, as they depend on political processes such as legislative approvals, executive decisions, and the approval of contracts, which can take weeks or even months. However, because financial markets are forward-looking, investors are likely to start incorporating

expectations of higher defense spending as soon as the security environment changes, even before any actual contracts are finalized (Goldman et al., 2013b).

Energy sector: The market channel

Energy firms benefit through commodity market mechanisms rather than fiscal decisions. (Kilian, 2009) identifies three types of oil price shocks:

Shock Type	Source	Example
Supply shock	Physical disruption to production	Pipeline damage, sanctions
Aggregate demand shock	Global economic conditions	Economic boom or recessio
Precautionary demand shock	Inventory building due to supply concerns	War risk, geopolitical uncertainty

Geopolitical events affecting major energy-producing countries can lead to both supply and demand shocks. Supply disruptions occur when production is affected, while precautionary demand increases as buyers stockpile in response to uncertainty about future availability. Both of these effects contribute to rising energy prices.

For energy producers located outside the conflict zone, rising energy prices lead directly to higher revenues. In the short run, production costs tend to remain relatively fixed, meaning that increases in prices largely translate into higher profits. The transmission mechanism is:

Table 2- Transmission Mechanism through Market

Unlike the fiscal channel, the market channel operates immediately. Commodity prices respond within hours to geopolitical news. Investors can observe price changes in real time, allowing rapid revaluation of energy firm stocks.

Comparing the channels

The two channels differ in important ways:

Dimension	Defense (Fiscal Channel)	Energy (Market Channel)
Price signal	Indirect (budget announcements)	Direct (commodity prices)
Speed	Slower (political process)	Faster (market prices)
Uncertainty	Higher (depends on political decisions)	Lower (prices are observable)
Persistence	Potentially high (budgets are sticky)	Variable (prices can reverse)

These differences lead to clear, testable implications. Gains for energy firms are likely to appear more quickly, but they may reverse if commodity prices fall. In contrast, gains for defense firms may develop more slowly, yet they are more likely to persist over time if increases in government spending are sustained.

2.5 Aggregate Market Responses to Conflicts

Before examining sector-specific evidence, it is important to establish the baseline: aggregate stock markets respond negatively to wars and geopolitical shocks.

2.5.1 Measuring Geopolitical Risk

Measuring geopolitical risk requires the use of indices that track how the intensity of such risk changes over time. (Caldara & Iacoviello, 2022)) develop a geopolitical risk (GPR) index using automated text analysis of major newspapers. The index is constructed by identifying articles that mention geopolitical threats, military tensions, and conflict-related events. The index captures both actual events and threats of future conflict.

Using this index, (Caldara & Iacoviello, 2022) document that increase in geopolitical risk are associated with:

- Lower stock returns in both developed and emerging markets
- Higher stock market volatility
- Increased corporate risk premia
- Reduced investment and economic activity

These effects are found to be consistent across different countries and time periods, suggesting that geopolitical risk acts as a systematic factor influencing asset prices. Importantly, its impact is not limited to immediate market reactions, as geopolitical risk has also been shown to predict future returns and volatility over longer horizons, often lasting several months.

Empirical studies focusing on specific wars that support the general finding of negative overall market reactions. (Rigobon & Sack, 2005b) analyse U.S. financial markets during the 2003 Iraq War. Using high-frequency data and an approach based on the timing of key news events, they show that rising war risk led to significant declines in equity prices. A 10-percentage point increase in the probability of war was associated with a 1.5% decline in the S&P 500.

(Schneider & Troeger, 2006) examine stock market responses across multiple conflicts. Their findings show that markets tend to decline consistently when geopolitical tensions escalate, with the strongest effects occurring around events that significantly raise the likelihood of military confrontation.

(Boungou & Yatié, 2022) provide the most directly relevant evidence. Examining global stock market responses to the Ukraine invasion, they document significant negative returns worldwide following 24 February 2022. Effects were heterogeneous:

- Countries geographically closer to Ukraine experienced larger declines
- Countries with greater trade exposure to Russia experienced larger declines

- Countries that condemned the invasion at the United Nations experienced larger declines than those remaining neutral

  The (Boungou & Yatié, 2022) findings establish that the Ukraine invasion conforms to the general pattern: wars are bad for aggregate stock markets. This leads to the next question of whether some sectors were able to perform differently and benefit despite the overall market decline.

2.6 Defense Sector Evidence

2.6.1 Short-Term Evidence: Event Studies

Event study evidence consistently documents positive abnormal returns for defense firms around conflicts and military spending announcements.

Political connections and contract allocation

In the study done by (Eitan Goldman et al., 2013) shows how political connections influence stock returns for U.S. defense contractors. They measure these connections based on board members with prior government experience and find that firms with stronger political ties earn higher abnormal returns around defense-related policy announcements. Their results suggest that investors closely track factors that affect defense contract opportunities and quickly incorporate such information into stock prices.

Response to the Ukraine invasion

(Martins, 2024) provide direct evidence on defense firm responses to the Ukraine invasion. Examining the 100 largest global defense firms, they employ event study methodology with three windows around 24 February 2022. Their key findings

Event Window	CAAR	Statistical Significance
(-1, +1)	+2.8%	$p < 0.01$
(-1, +5)	+5.1%	$p < 0.01$
(-1, +10)	+7.4%	$p < 0.01$

The positive abnormal returns are economically and statistically significant across all windows. Moreover, these gains build up over time, indicating that information was incorporated gradually as the implications of the war became clearer to investors.

Heterogeneity by defense exposure

(Martins et al., 2025) study shows heterogeneity based on defense revenue share. Firms generating more than 66% of their revenue from defense activities experienced the highest gains. Firms with moderate exposure (33–66%) also saw positive returns, although to a lesser extent. In contrast, firms with less than 33% defense exposure recorded negative abnormal returns, suggesting that for these firms, the benefits from defense-related demand were not strong enough to offset the broader negative effects on the market.

This finding highlights the importance of sector exposure. Only firms with a significant share of their operations in defense were able to benefit, whereas more diversified companies with relatively small defense segments did not experience the same positive effects.

Evidence from other conflicts

Earlier event study evidence supports the pattern. (Capelle-Blancard & Couderc, 2008) examine defense firm returns around military interventions and find positive abnormal returns during times of conflict escalation. Similarly (Berger et al., 2013) show that returns in the U.S. defense sector are positively associated with the country's military involvement abroad.

2.6.2 Medium-Term Evidence: Panel and DiD Studies

Event studies capture immediate reactions but cannot assess whether gains persist. Panel data methods address this limitation.

(Federle et al., 2022) employ difference-in-differences methodology to examine stock market responses to the Ukraine invasion over several months. They measure treatment intensity based on each country's geographic distance from Ukraine. Their results show that countries located closer to Ukraine experienced significantly worse stock market performance, with larger cumulative losses that persisted for several months after the invasion.

For defense firms, the study finds the opposite pattern. Defense companies located in countries closer to Ukraine performed better than those in more distant countries. This indicates that geographic proximity strengthened the positive impact on defense firms, likely because nearby countries responded with larger increases in defense spending.

The (Federle et al., 2022) study is methodologically relevant because it demonstrates that DiD methods can identify persistent sector-specific effects. However, their comparison is between defense firms in different locations rather than between defense and non-defense firms in the same location.

Summary: Defense Sector as Winner

The evidence consistently indicates that defense firms benefit from geopolitical conflicts:

- Event studies show positive abnormal returns at conflict onset
- Effects are larger for firms with greater defense exposure
- Panel evidence suggests gains persist beyond immediate reactions
- Geographic proximity to conflict amplifies the positive effect

The transmission mechanism operates through investor expectations of increased government defense spending. These expectations appear to form rapidly around conflict onset and tend to remain persistent over the following months.

2.7 Energy Sector Evidence

2.7.1 Short-Term Evidence: Event Studies

Event study evidence documents positive abnormal returns for energy firms around geopolitical events that disrupt commodity markets.

Response to the Ukraine invasion

(Nerlinger & Utz, 2022) examine energy firm responses to the Ukraine invasion using standard event study methodology. They find statistically significant positive cumulative abnormal returns for energy-producing firms in the days following 24 February 2022. Their findings:

- Oil and gas producers experienced positive abnormal returns.
- Returns were proportional to commodity price exposure.
- Effects materialized within the first few trading days.

The interpretation is straightforward: investors quickly incorporated expectations of rising commodity prices into the valuations of energy firms. The sharp increase in oil and gas prices provided a clear and immediate signal regarding the potential impact on firms' revenues.

Evidence from other geopolitical events

(Charles M. Jones & Gautam Kaul, 1996) analyse the impact of oil price shocks on stock returns across different countries. Their findings show that increases in oil prices tend to have a positive effect on the stock markets of oil-exporting countries, while negatively affecting those of oil-importing countries. This contrasting impact highlights the redistributive nature of changes in commodity prices.

(Driesprong et al., 2008) show that changes in oil prices can predict future stock returns, with energy sector returns being especially sensitive to movements in oil prices. This strong relationship between commodity prices and energy firm valuations allows markets to quickly incorporate new information.

2.7.2 Commodity Price Transmission

Understanding energy firm gains requires examining the commodity price channel in detail.

Oil price shock decomposition: (Kilian, 2009) provides key evidence for distinguishing between different types of oil price shocks. Using a structural vector autoregression approach, he breaks down oil price movements into the following categories:

- Supply shocks: physical disruptions to production
- Aggregate demand shocks: global economic conditions affecting oil consumption
- Precautionary demand shocks: inventory accumulation driven by supply uncertainty.

Geopolitical events trigger primarily supply and precautionary demand shocks. The Ukraine invasion is a clear example of both effects. Sanctions on Russia disrupted actual oil supply, while uncertainty about future availability led to increased stockpiling, reflecting precautionary demand.

Kilian shows that different shock types have different macroeconomic effects and persistence. Supply shocks typically cause sharp initial price increases that partially reverse as markets adjust. Precautionary demand shocks may persist longer if underlying uncertainty remains unresolved.

Evidence on persistence

The persistence of gains for energy firms depends largely on the behaviour of commodity prices. (Baumeister & Kilian, 2016) show that forecasting oil prices is challenging, as prices are highly volatile and tend to revert to their long-term levels over time. This implies that gains for energy firms may be less sustained compared to defense firms, especially if commodity prices eventually stabilize or decline.

(Caldara & Iacoviello, 2022) show that geopolitical risk shocks lead to sustained increases in oil price volatility, even when price levels begin to stabilize. This higher volatility can also

benefit energy firms, as it creates opportunities for trading and increases the value of flexibility in production and investment decisions.

Summary: Energy Sector as Winner

Evidence indicates that energy firms benefit from geopolitical disruptions:

- Event studies show positive abnormal returns following conflicts affecting energy supply
- The transmission mechanism operates through commodity prices
- Returns materialize rapidly given observable price signals
- Persistence depends on commodity price dynamics

The market channel differs from the fiscal channel for defense firms. Energy gains are driven by market prices that respond immediately but may reverse. Defense gains depend on budget decisions that materialize gradually but may prove durable.

2.8 Methodological Approaches in the Literature

Event Study Methodology

The event study, formalized by (Fama et al., 1969) and refined by (Mackinlay, 1997), is the dominant method for assessing short-term market reactions to discrete events.

Strengths:	Limitations
Clean identification when events are discrete and unanticipated Well-established statistical properties (Brown & Warner, 1985) Straightforward interpretation of abnormal returns Allows examination of anticipation and adjustment dynamics through multiple windows	Restricted to short windows (days to weeks) Cannot assess whether effects persist or reverse Vulnerable to confounding events in longer windows Relies on efficient market assumptions

Difference-in-Differences Methodology

The DiD approach, rooted in epidemiological studies (Snow, 1856)and formalized in econometrics (Angrist & Pischke, 2009), compares treated and control groups over time.

Strengths	Limitations
Can assess persistence of effects over months or years	Requires valid control group not affected by treatment
Controls for common time trends and time-invariant heterogeneity	Parallel trends assumption is fundamentally untestable
Supports causal interpretation under parallel trends assumption	Longer horizons increase exposure to confounding factors
Flexible specification allowing for fixed effects and controls	May miss short-term dynamics

The Case for Combining Approaches

Given complementary strengths and limitations, combining event study and DiD methods provides a more complete picture than either alone:

Question	**Best Method**
Did investors react immediately?	Event study
How large was the short-term reaction?	Event study
Did gains persist over months?	Difference-in-differences
What is the causal effect on firm performance?	Difference-in-differences

This complementarity provides the rationale for using a dual-method empirical approach in this thesis.

2.9 Research Gap and Contribution

Summary of Key Findings

- Aggregate markets decline following wars : A large body of evidence shows that geopolitical shocks lead to negative overall market responses (Boungou & Yatié, 2022; Caldara & Iacoviello, 2022; Rigobon & Sack, 2005b).
- Defense firms gain: Event studies document positive abnormal returns for defense firms around conflicts (Eitan Goldman et al., 2013; Martins et al., 2025)
- Energy firms gain: Energy producers benefit from commodity price increases following geopolitical supply disruptions (Kilian, 2009; Nerlinger & Utz, 2022).

- Panel data evidence suggests that these effects can extend beyond the immediate event window, although firm-level evidence remains limited (Federle et al., 2022).

Research Gaps and Limitations in the Literature

Despite significant progress, several important gaps remain in the existing literature:

Magnitude relative to counterfactual: Most studies examine sectors in isolation without formal comparison to control groups. Without a counterfactual benchmark, the magnitude of outperformance is difficult to assess. Did defense firms simply avoid losses, or did they generate substantial absolute gains?

Persistence of gains: Event studies capture reactions over days or weeks but cannot assess durability. Did initial optimism prove justified, or did prices subsequently correct? Firm-level evidence on persistence is limited.

U.S.-specific evidence: A large portion of the existing evidence focuses on European or global samples. Given the depth and liquidity of U.S. financial markets, as well as the global importance of U.S. defense and energy firms, a dedicated analysis in the U.S. context is warranted.

Chapter 3: Data, Sample Construction, and Descriptive Statistics

3.1 Sample Design and Overview

This chapter describes how the dataset used in this study was built, which firms were selected, why they were chosen, how all key variables were defined and measured, and what the data looks like in terms of its basic statistical properties. The same firm-level dataset is used across both empirical methods employed in this study.

The study examines the impact of the Russian invasion of Ukraine on the stock market performance of U.S. defense and energy firms using two complementary empirical approaches.

The event study focuses on the immediate reaction of the stock market around the time of the invasion, showing how investors quickly adjusted their expectations for these companies after the shock (Mackinlay, 1997). The difference-in-differences (DiD) analysis takes a broader view by tracking cumulative stock performance over a longer window before and after the invasion to helping in identifying medium-term effects that may not be fully visible within a short event window(Angrist & Pischke, 2009).When both these approaches are taken together it gives us a complete picture of how the geopolitical shock affected firm-level stock performance across different time horizons.

The overall sample is divided into two groups: a **treatment group** of defense and energy firms, which are expected to be directly and systematically affected by the invasion through well-defined economic transmission channels, and a **control group** of firms from stable, defensive sectors, which are expected to be far less exposed to those same channels (Boungou & Yatié, 2022; Caldara & Iacoviello, 2022)

3.2 Treatment Group: Defense and Energy Firms

The treatment group consists of U.S.-listed firms which operate in the defense and energy sectors. These sectors were selected as treated because their revenues, costs, and expected future cash flows are directly linked to the economic channels through which a geopolitical conflict of this scale transmits into financial markets(Boungou & Yatié, 2022; Caldara & Iacoviello, 2022; Pástor & Veronesi, 2012).

The following criteria were applied to the treatment group:

- The firm must be headquartered in the United States.
- The firm must be publicly listed and actively traded on a U.S. stock exchange.
- The firm must operate primarily in the defense or energy sector, with revenues directly tied to military activity, government defense contracts, or the production and distribution of energy commodities.

Applying these criteria consistently resulted in a treatment group of 14 firms. A full list of these firms is provided in the Appendix.

Why Defense Firms Are Treated

Defense firms are selected as treated because government spending tends to shift in their favour during major conflicts. When large-scale wars occur, especially those affecting NATO or Western security, countries typically raise military budgets, speed up procurement, and move forward with long-term defense investments that were earlier delayed or underfunded (Dunne & Tian, 2013; SIPRI 2022, 2023). This increase in defense spending was visible after Russia invaded Ukraine, in the weeks and months following February 24, 2022, NATO countries, including the United States, announced sharp increases in defense spending. Several governments also committed to reaching or exceeding the NATO guideline of allocating 2% of GDP to defense, a target that had previously been largely aspirational for many members (SIPRI 2022, 2023).

From an economic perspective, this shift in government behaviour acts as a demand shock for the defense sector. Defense contractors rely heavily on government orders and due to that the rise in military spending directly increases their expected future income (Dunne & Tian, 2013). Stock markets respond to expectations rather than the current performance. Prices reflect what investors believe companies will earn in the future, not only what they are earning now. So when investors expect defense firms to benefit from higher budgets, new contracts, and expanded procurement, share prices adjust quickly to reflect those expectations within hours or days of the news (Fama, 1970).

There is strong empirical support for this mechanism. Research on stock market reactions to past conflicts and periods of geopolitical tension shows that defense firms tend to earn positive abnormal returns during such events, as investors anticipate higher future earnings driven by increased government spending (Goldman et al., 2013a; Martins, 2024). This pattern appears

across different types of conflict, ranging from regional wars to terrorist attacks and major geopolitical confrontations and across various samples of defense companies, suggesting it is a consistent feature of how markets respond to geopolitical risk in this sector. The Russia–Ukraine war stands out as a particularly strong example, given its scale, the speed of policy responses, and its implications for NATO security, all of which reinforced expectations of higher defense spending (Boungou & Yatié, 2022; Caldara & Iacoviello, 2022; SIPRI 2022, 2023).

Why Energy Firms Are Treated

Energy firms are treated for a different reason as Russia is a major global supplier of oil and natural gas. At the time of the invasion, it accounted for about 40% of the European Union's gas supply and was among the top three exporters of crude oil worldwide (IEA, 2022). As a result, the invasion immediately raised concerns about supply disruptions due to damage to infrastructure, international sanctions on Russian energy exports, or Russia itself limiting gas flows to Europe. These risks quickly turned into reality, as disruptions to Russian energy supply began to appear within days and weeks after the invasion (Caldara & Iacoviello, 2022).

In economic terms, this is called a large supply shock. When a supplier as important as Russia is disrupted, global energy supply falls while demand stays mostly the same in the short run, which increases the price of oil and gas (Kilian, 2009). For energy firms outside Russia, this leads to higher revenues and wider profit margins. The prices of what they sell oil, gas, LNG, and refined products increase, while their production costs do not change much in the short term (Mohamed, 2012; Nerlinger & Utz, 2022). This is why energy firms are classified as treated, the invasion created conditions that directly improved their financial outlook, at least in the near to medium term.

There are many research done on geopolitical risk and energy markets which strongly supports this mechanism and its effects on financial markets. Many studies show that supply disruptions

involving major energy producers are a key driver of energy price increases and broader economic impacts (Baumeister, 2013; Caldara & Iacoviello, 2022; Hamilton, 2009; Kilian, 2009) Several other studies which focusing on the Russia–Ukraine conflict, as well as earlier events, find similar results. Energy firms tend to experience positive abnormal returns during such periods, as higher commodity prices raise expected revenues and investors adjust stock prices accordingly (Nerlinger & Utz, 2022) .

While defense and energy firms are affected through economically distinct channels but both sectors share a fundamental and defining characteristic that makes them jointly appropriate for the treatment group. Firstly, their valuations are expected to respond systematically, positively, and persistently to a geopolitical shock of this specific type. Second both the sectors have direct, first-order links to the primary economic consequences of the Russian invasion of Ukraine, and both are therefore expected to experience meaningful and sustained changes in expected cash flows as a result of the invasion.

3.3 Control Group: Defensive Sector Firms

The role of control group in a casual analysis has a clear purpose, it helps in estimating what would have happened to the treated firms if the event had not occurred. This "what if" scenario cannot be directly observed as we cannot rewind time and see how defense and energy firms would have behaved without the Russian invasion of Ukraine. Instead, we can choose a set of firms that behave similarly to defense and energy firms before the invasion but we not directly exposed to the same economics effects of the conflict. This allows us to approximate the missing counterfactual as closely as possible (Angrist & Pischke, 2009)

The control group consists U.S.-listed firms operating in defensive sectors, where revenues and business models tend to be stable and predictable, and are generally resilient during periods of

economic stress, heightened uncertainty, or geopolitical disruption. The three sectors selected for the control group are healthcare, consumer staples, and telecommunications.

The following criteria were applied to the control group:

- The firm must be headquartered in the United States
- The firm must be publicly listed and actively traded on a U.S. stock exchange
- The firm must have no direct exposure to defense or energy-related activities
- The firm must belong to one of the three designated defensive sectors: healthcare, consumer staples, or telecommunications

Applying these criteria resulted in a control group of 16 firms. A full list is provided in the Appendix.

Why Demand Stays Stable in Defensive Sectors

One of the most fundamental reasons for selecting these three sectors as the control group is that the goods and services they provide are essential, the demand for them persists at relatively stable levels regardless of what is happening in the broader economy or geopolitical environment. This makes demand in these sectors largely price-inelastic and income-inelastic, which means during periods of financial stress or geopolitical tension, people continue to rely on these goods and services, so consumption does not fall sharply(Ang et al., 2006).

In the healthcare sector, demand does not fall because of a geopolitical conflict. People do not delay essential treatments, medicines, or hospital care due to events like the war in Ukraine. Healthcare needs are driven by biology, illness and chronic conditions continue regardless of economic or political conditions. Even during the most severe economic downturns, financial crises, and periods of extreme market stress, healthcare utilization and pharmaceutical consumption have remained remarkably resilient, and the revenues of healthcare firms consistently reflect this underlying demand stability (Getzen, 2000).

A similar argument applies to consumer staples. Firms in this sector provide everyday essentials such as food, beverages, cleaning products, and basic household items. These are important purchases that the household cannot reduce regardless of the economic or geopolitical conditions. Research shows that revenues in this sector are relatively stable during downturns, as spending on basic goods is maintained even when people reduce discretionary purchases(Aït-Sahalia et al., 2004; Ang et al., 2006). Importantly, demand for these goods is not tied to oil prices, defense spending, or geopolitical events. It is driven by daily needs, which makes the sector largely unaffected by the main economic effects of the Russian invasion of Ukraine.

In the telecommunications sector, demand is supported by the essential role of communication services in everyday life. Internet access, mobile networks, and broadband have become basic utilities that households, businesses, and governments rely on continuously, with little scope to reduce usage even during uncertain period. Telecom firms additionally operate under long-term subscription contracts that lock in substantial portions of their revenue well in advance, providing a structural buffer against short-term demand fluctuations driven by external shocks(Gruber & Verboven, 2001; Waverman et al., 2005).

Firms in these three sectors also benefit from regulatory and institutional support that helps keep their revenues stable. During periods of geopolitical stress, governments tend to ensure that essential services continue without disruption, using policies, funding, and support measures to maintain healthcare, food supply, and communication systems (Baker et al., 2016). From a financial perspective, the stability in the revenue leads to lower volatility in returns and less exposure to broader market risks. As a result, stocks in these sectors tend to react less sharply to economic or geopolitical shocks compared to sectors that are more sensitive to such events (Ang et al., 2006; Fama, 1970; Pástor & Veronesi, 2012).

Why Defensive Sectors Are Less Exposed to the War's Transmission Channels

From a financial perspective, the stability in revenue leads to lower volatility in returns and less exposure to broader market risks. As a result, stocks in these sectors tend to react less sharply to economic or geopolitical shocks compared to sectors that are more sensitive to such events. Defense and energy firms are directly connected to these channels due to higher military expenditure which translates into increased demand for defense contractors, while rising oil and gas prices directly improve revenues and margins for energy producers. These represent strong, first-order effects on expected cash flows and firm valuation. By contrast, firms that are in defensive sectors are not structurally linked to either channel. Their revenues are driven by essential and relatively stable sources of demand, healthcare needs, basic consumption, and communication services. As a result, their financial performances are stable as compared to other sectors.

This does not mean that defensive sectors were completely unaffected by the invasion. A shock of this scale raises overall uncertainty and risk aversion in financial markets, and this tends to influence asset prices across almost all sectors, even those not directly linked to the conflict. However, these changes are driven by general market sentiment, portfolio adjustments, and uncertainty and not by any direct economic impact of the war. They are indirect effects that reflect broader market reactions(Baker et al., 2016; Caldara & Iacoviello, 2022).

Crucially, these second-order effects are expected to be weaker, shorter-lived, and less systematic than the direct effects experienced by defense and energy firms. This asymmetry is central to the empirical strategy of the study, while both groups may react to broad market movements, only the treated sectors are expected to exhibit additional, persistent changes in returns driven by direct exposure to the war's economic consequences. This difference enables a credible identification of the causal impact of the geopolitical shock in the difference-in-differences framework.

Sample Composition Summary

	Description	Number of Firms
Treatment group	U.S. defense and energy firms	14
Control group	U.S. healthcare, consumer staples, and telecom firms	16
Total sample	—	30

Full firm-level details, including individual company names and sector classifications, are provided in the Appendix.

3.4 Variable Construction

Dependent and Independent Variables

Two dependent variables are employed in this study, corresponding to the two empirical approaches used.

For the event study analysis, the dependent variable is the abnormal return (AR), defined as the difference between the actual stock return and the expected return estimated using the market model. Abnormal returns are aggregated over event windows to compute cumulative abnormal returns (CAR) and cumulative average abnormal returns (CAAR).

For the difference-in-differences (DiD) analysis, the dependent variable is the cumulative logarithmic stock return. First, daily log returns are calculated using adjusted closing prices. These daily returns are then summed over time for each firm to obtain cumulative log returns. Using cumulative log returns makes it possible to capture medium-term performance differences between treated and control firms in a way that is appropriate for linear regression analysis.

The main independent variables used in the Difference in Difference framework are

defined as follows:

- $Treatment_i$ is a binary indicator equal to 1 if firm i belongs to the treated group (defense or energy sector), and zero otherwise.
- $Post_t$ is a binary indicator equal to 1 for observations after 24 February 2022, and zero for observations prior to the invasion.
- $Treatment_i x\ Post_t$ is an interaction term capturing the differential effect post-invasion period on treated firms relative to control firms.

  This interaction term is the main focus of the DiD analysis because it shows how the total cumulative log returns of defense and energy firms change compared to defensive-sector firms after the Russian invasion of Ukraine.

3.5 Descriptive Statistics

This section summarizes the key statistical properties of all variables used across both empirical analyses.

Event Study Variables

Table 1 presents the descriptive statistics for the variables used in the event study analysis, computed across all firm-day observations within the event window.

Table 3- Descriptive Statistics - Event Study

Variable	Mean	SD	Min	Median	Max
Stock Return (%)	0.22	2.36	-8.11	-0.01	19.67
Market Return (%)	-0.28	1.54	-3.00	-0.53	2.54
Abnormal Return (%)	0.33	2.47	-8.39	0.12	18.24
Cumulative Abnormal Return (%)	3.26	8.24	-14.95	1.27	41.45

The mean daily stock return over the event window is 0.22%, while the standard deviation of 2.36% indicates substantial cross-firm variation. This is unsurprising given that the sample

includes both treated firms with direct war-related exposure and control firms with more limited exposure. The market return averaged -0.28% during the event window, indicating a generally negative market environment around the invasion, consistent with the broader increase in uncertainty and risk aversion documented in the literature (Baker et al., 2016; Caldara & Iacoviello, 2022).

The mean abnormal return of 0.33% per day and the mean CAR of 3.26% are both positive, suggesting that, on average, firms in the sample earned returns above those predicted by the market model during the event period. The dispersion in CARs is substantial, ranging from -14.95% to 41.45%, which points to considerable heterogeneity in market reactions across firms. The median CAR of 1.27% is below the mean, indicating a right-skewed distribution in which a subset of firms experienced particularly large positive cumulative abnormal returns. This pattern likely reflects stronger abnormal performance among firms more directly exposed to the economic consequences of the invasion, which is consistent with the broader empirical literature on sectoral heterogeneous reactions to geopolitical shocks (Goldman et al., 2013a; Nerlinger & Utz, 2022).

Difference in Differences (DID) Analysis Variables

Table 2 presents descriptive statistics for the variables used in the DiD analysis, computed across all firm-day observations in the full sample period covering both the pre- and post-invasion windows.

Table 4- Descriptive Statistics - DID

Variable	Mean	SD	Min	Median	Max
Cumulative Log Return	0.0959	0.2394	-0.9964	0.0597	0.9516
Daily Log Return	0.0006	0.0188	-0.3213	0.0007	0.1967
Treatment	0.4667	0.4989	0	0	1

Post	0.6399	0.4801	0	1	1
Treatment × Post	0.2986	0.4577	0	0	1

The mean daily log return is 0.0006, which is close to zero, as would be expected when averaging across all firms and trading days. The standard deviation of 0.0188 indicates the typical day-to-day variation in returns across the sample, while the range from -0.3213 to 0.1967 reflects the presence of several extreme trading days, likely associated with the invasion itself and subsequent major geopolitical or policy developments.

The mean cumulative log return is 0.0959 log points, indicating that firms in the sample accumulated positive returns on average over the full period. The standard deviation of 0.2394 and the range from -0.9964 to 0.9516 in cumulative log returns indicate substantial dispersion in firm performance across the sample. Expressed in simple-return terms, these endpoints correspond approximately to -63.1% and 159.0%, respectively. This wide spread is consistent with the expectation that firms differ in their response to the invasion.

The treatment variable has a mean of 0.4667, reflecting that 14 of the 30 firms in the sample belong to the treated group. The post variable has a mean of 0.6399, indicating that approximately 64% of all firm-day observations fall in the post-invasion period, as determined by the chosen sample window. The interaction term Treatment × Post has a mean of 0.2986, reflecting the share of total observations corresponding to treated firms in the post-invasion period. This is the cell of the DiD design that contains the identifying variation used to estimate the average treatment effect on the treated.

Chapter 4: Empirical Methodology

This chapter outlines the empirical methods employed to examine the impact of the

Russia's invasion of Ukraine on the stock prices of U.S. defense and energy firms. Two complementary approaches are used: an event study methodology to capture short- term market reactions and a difference-in-differences framework to analyse medium- term effects.

The rationale for employing both methods lies in their complementary strengths. Event studies are useful for capturing how markets react immediately to new information, but they are limited to short time windows. The DiD approach, on the other hand, is better for examining longer-term effects by comparing changes between treated and control groups over time. Taken together, the two methods allow for a clear view of both the initial market reaction and the more sustained changes that followed the invasion.

4.1 Event Study Approach

The event study approach, which was developed by (Fama et al., 1969) is based on the idea that financial markets quickly reflect to publicly available information. In a semi-strong efficient market, new information is incorporated into prices without delay. By comparing actual returns with expected returns around a specific event, researchers can assess how important that event is from the perspective of investors (Mackinlay, 1997).

The objective of event study is estimating abnormal returns which is the difference between observed returns and returns that would have been expected in the absence of the event. This requires a model of expected returns. Three approaches dominate the literature:

1. **Constant Mean Return Model:** This model assumes that expected returns of stock are equal to its past average return. It is easy to use, but it does not consider market-wide movements or the overall risk in the market. Due to this, the model may give biased results, especially when the market is highly volatile during the event period (Brown & Warner, 1985).
2. **Capital Asset Pricing Model (CAPM):** This model estimates a stock's expected return based on the risk-free rate and its risk compared to the overall market (beta). Although it is based on

strong theory, the model makes strict assumptions about how investors behave. In practice, it has been criticized because beta is not always stable, and the model does not always explain stock returns accurately (Fama & French, 1997).

3. **Market Model:** This model assumes that a stock's return moves in line with the overall market. It estimates how much of the stock's return is linked to market movements and how much is specific to the firm. It captures market-related risk but does not depend on any specific financial theory.

   In this study I've chosen the **market model** to estimate expected returns for a few reasons. First, it has been widely shown to work well in event studies, producing reliable results under different conditions (Brown & Warner, 1985). Second, unlike the CAPM, it does not require assumptions about the risk-free rate or a fixed relationship between risk and return. Also, as (Mackinlay, 1997) points out, more complex models often add only little improvement in event study settings, especially when the event window is short and clearly defined. Since the Russian invasion is a distinct and well-identified event, the market model offers a good balance between simplicity and accuracy.

   Model Specification

   The market model is specified as:

$$\boldsymbol{R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}}$$

   Where:

- R_{it} = Logarithmic return on security i at time t
- R_{mt} = Logarithmic return on the market index (S&P 500) at time t
- α_i = Firm-specific intercept (average return not explained by the market)
- β_{it} = Sensitivity of security i to market returns.

- ε_{it} = Error Term (firm specific shocks) where:
  - $E(\varepsilon_{\{it\}}) = 0$
  - $Var(\varepsilon_{\{it\}}) = \sigma^2_{\{\varepsilon_i\}}$

The use of logarithmic returns is standard in financial econometrics. They can be easily added over time, are usually more normally distributed for short periods, and help avoid issues like negative values that can occur when calculating cumulative simple returns. The S&P 500 is used as a proxy for the overall market because it represents a wide range of U.S. companies and is commonly used in event studies.

Estimation Window

The parameter α_i and β_i are estimated using the Ordinary Least Squares (OLS) method over an estimation window spanning $(-250, -10)$trading days relative to the event date. This specification is adopted based on the following considerations:

- Length of the Estimation Window: A 240-day estimation window provides us enough data to estimate reliable parameters while avoiding older data that may not reflect the current relationship between the firm and the market. This choice is consistent with the literature, as (Mackinlay, 1997) suggests windows between 120 and 250 days for daily data to balance accuracy and stability.
- Gap Between Estimation and Event Windows: A 5-day gap is introduced between the end of the estimation window and the start of the event window. This helps ensure that the parameter that are to be estimated are not affected by any early price movements or information leakage just before the invasion. This approach is standard in event study methodology (S.P. Kothari & Jerold Warner, 2007) and is especially relevant in geopolitical settings where tensions can build gradually before the actual event.

Using the estimated parameters $\hat{\alpha}_i$and $\hat{\beta}_i$, the expected return during the event window is calculated as:

$$\boldsymbol{E(R_{it}) = \alpha_i + \beta_i R_{mt}}$$

Where:

- $E(R_{it})$ = Expected returns on security i at time t
- α_i = Estimated intercept obtained from the estimation window.
- β_i = Estimation sensitivity of the security to market returns
- R_{mt} = Return on the market index at time t

Event Definition and Window Selection

The event date is defined as **24 February 2022**, the date on which Russian military forces launched a full-scale invasion of Ukraine. This date is widely recognised in the literature examining the financial consequences of the conflict (Boungou & Yatié, 2022; Federle et al., 2022).

I employ three distinct event windows, each designed to capture a different phase of market response:

Pre-Event Window (−5, −1)

This window covers the five trading days before the invasion and is used to check if the market reacted early. If abnormal returns are seen in this period, it may indicate information leakage or that investors were already expecting the event. A five-day window is a good balance, as it is long enough to capture early reactions but short enough to avoid unnecessary noise. This approach is commonly used in studies of geopolitical events (Rigobon & Sack, 2005c).

In the context of the Ukraine invasion, some pre-event movement is expected, as tensions were already visible. Diplomatic talks had broken down, and reports of Russian troop buildups were

widely covered. This window helps separate what markets anticipated from the actual impact of the invasion.

Immediate Event Window (−1, +1)

This three-day window covers the event date and helps in capturing the immediate market reaction to the invasion. It includes one day before and after the event to account for timing and adjustment effects. First, time zone differences matter. The invasion began early morning in Moscow, which was late evening on 23 February in the U.S., so some reactions may have appeared just before or after the official event date. Second, markets may take a short time to process such a complex event. Investors need to assess its impact on energy prices, defense spending, sanctions, and broader risks.

Finally, using a (−1, +1) window is standard in event studies and allows comparison with existing research Short windows like this are also preferred because they focus on the period when the event is most likely to influence prices (Brown & Warner, 1985).

Post-Event Window (0, +10)

This window includes the event day and the following ten trading days, and it is meant to capture how markets adjust after the invasion rather than just the initial reaction.

Unlike simple events, the impact of the invasion did not become clear immediately. In the days after 24 February, new information kept coming in about sanctions, energy supply disruptions, military developments, and policy responses. Investors needed time to process each update and adjust their expectations, so stock prices did not fully reflect the impact on day one. Also, even when information is available, prices may not adjust instantly because different investors react at different speeds, and trading frictions can slow down the process. Because of this, part of the market response often appears gradually over several days (Hong, 1999). There are previous researches also that are on major geopolitical events also supports using longer windows, as market effects often unfold over one to three weeks (Chesney et al., 2011). The ten-day window

is practical balance as it is long enough to capture these gradual adjustments but not so long that unrelated news starts affecting the results.

Calculating Abnormal Returns

With expected returns estimated, abnormal returns for each firm on each day within the event windows are calculated as:

$$\boldsymbol{AR_{it} = R_{it} - (\alpha_i + \beta_i R_{mt})}$$

Summing the daily AR's individually for each company, Cumulative Abnormal Returns (CAR) are obtained:

$$\mathbf{CAR_i(\tau_1, \tau_2) = \sum_{\{t=\tau_1\}}^{\{\tau_2\}} AR_{\{it\}}}$$

Where:

- $CAR_i(\tau_1, \tau_2)$= Cumulative abnormal return for firm *i* over the event window
- τ_1, τ_2= Start and end of the event window
- AR_{it}= Abnormal return of firm i at time t

From the firm-specific CARs, Cumulative Average Abnormal Returns (CAAR) can be calculated by taking the average of each firm's individual CARs.

$$\mathbf{CAAR(\tau_1, \tau_2) = \backslash frac\{1\}\{N\} \sum_{\{i=1\}}^{\{N\}} CAR_{i(\tau_1,\tau_2)}}$$

Where:

- $CAAR(\tau_1, \tau_2)$= Cumulative Average Abnormal Return over the event window
- N= Total number of firms
- $CAR_i(\tau_1, \tau_2)$= Cumulative abnormal return for firm i
- τ_1, τ_2= Start and end of the event window

The CAAR represents the overall effect of the Russian invasion of Ukraine on our sample of US firms in the defense and energy industry for the specified event window. My hypothesis for the CAARs is that the estimate will be positive and statistically significant for defense and energy firms, particularly in the immediate and post-event windows. The pre-event window is included to test for the absence of anticipation or information leakage prior to the invasion.

Statistical Inference

To assess whether the observed abnormal returns are statistically significant, a cross-sectional t-test is applied to the distribution of firm-level CARs:

$$t_{CAAR} = \frac{CAAR(\tau_1, \tau_2)}{S_{CAR}/\sqrt{N}}$$

where $S_{CAR}$is the cross-sectional standard deviation of firm-level CARs, and $N$is the number of firms.

This test evaluates whether the average abnormal return is significantly different from zero.

4.2 Difference-in-Differences Framework

While the event study captures immediate market responses, it is less suited to estimating persistent treatment effects over longer horizons. The difference-in-differences (DiD) methodology addresses this limitation by comparing changes in outcomes between treated and control groups before and after an intervention.

The DiD approach has a distinguished history in applied econometrics, dating to John Snow's 1854 analysis of cholera mortality in London (Angrist & Pischke, 2009). Difference-in-Differences (DiD) is a widely used method in modern research, especially when random experiments are not possible. In such cases, researchers use real-world events or policy changes to study causal effects (Cunningham, 2021).

The fundamental logic of DID is simple, it compares the change in the outcome of a treated group to the change in the outcome for an untreated group. By doing this, it removes differences that are constant over time between the groups and also removes common changes that affect both groups and the additional change that is experienced by the treated group is attributed to the intervention.

Research Design

In this study, the treatment is the Russian invasion of Ukraine, an exogenous geopolitical shock that plausibly affects certain sectors more than others. The treatment group consists of US. Defense and energy firms which are expected to benefit from the increased defense expenditure and in increase in energy prices. The control group consists of firms' defensive sectors such as healthcare, consumer staples and telecommunication. These sectors are less directly exposed to geopolitical shock and commodity price volatility. The outcome variable is the cumulative logarithmic stock return, which captures overall stock price performance while allowing for interpretable percentage-based treatment effect estimates.

Model Specification

The baseline Difference in Difference (DID) model is specified as follows:

$$\boldsymbol{Y_{it} = \beta_o + \beta_1(Treatment_i) + \beta_2(After_t) + \beta_3(Treatment_i \times After_t) + \epsilon_{it}}$$

Where:

- Y_{it} denotes the cumulative log return for firm i at time t.
- $Treatment_i$ is a binary indicator equal to1 for firms in the defense and energy sectors, and 0 for firms in the control group.
- $After_t$ is a binary indicator equal to 1 for observations on or after 24th February 2022, and 0 otherwise.
- ϵ_{it} represents the error term.

The coefficients are interpreted as follows:

- β_0 captures the mean outcome for the control group in the pre-treatment period.
- β_1 measures the time-variant difference in outcome between the treatment and control groups.
- β_2 reflects the common time effect, that is the change in outcome for the control group in the post-treatment period.
- β_3 is the coefficient of primary interest and identifies the average treatment effect on the treated (ATT), called the additional change in cumulative log returns for the treatment group attributed to the Russian invasion of Ukraine.

The ATT can be understood through the following decomposition:

	Before 24 Feb 2022	**After 24 Feb 2022**	**Difference**
Control Group	β_0	$\beta_0 + \beta_2$	β_2
Treatment Group	$\beta_0 + \beta_1$	$\beta_0 + \beta_1 + \beta_2 + \beta_3$	$\beta_2 + \beta_3$
Difference	β_1	$\beta_1 + \beta_3$	β_3

The final cell, β_3, represents the Difference-in-Differences estimator. It captures the differential change in cumulative log returns for the treatment group relative to the control group after 24 February 2022, and is interpreted as the causal effect of the Russia–Ukraine invasion under the parallel trend assumption.

Extended Model with Fixed Effects

While the baseline model provides conceptual clarity, the preferred specification incorporates firm and time fixed effects:

$$\boldsymbol{Y_{it} = \alpha_i + \delta_t + \beta\,(Treatment_i \times After_t) + \epsilon_{it}}$$

Where:

- α_i denotes firm fixed effects, capturing all time-invariant characteristics specific to firm i.
- δ_t denotes time fixed effects, capturing shocks common to all firms at time t .

- β represents the Difference-in-Differences estimator of the treatment effect.
- ϵ_{it} is the idiosyncratic error term.

The inclusion of firm fixed effects is particularly important. These controls absorb permanent differences across firms which includes industry characteristics, size, historical performance, and other unobserved factors that might confound the treatment effect estimate. When firm fixed effects are included, the main effect $Treatment_i$ is absorbed and drops out of the model, as it is perfectly collinear with the firm indicators.

Similarly time fixed effects control for aggregate shocks affecting all firms simultaneously such as changes in monetary policy, macroeconomic conditions, or broad market sentiment. This ensures that the coefficient β measures the true impact of the Russia invasion of Ukraine on the treatment group compared to the control group, after removing effects that are common to all firms over time.

Standard errors are clustered at the firm level to account for serial correlation within firms over time, ensuring robust statistical inference.

With the difference-in-differences model specification complete, my hypothesis for main variable of interest namely the interaction term, is that the interaction term will take on a statistically significant positive value. If this is the case, it would imply that the war in Ukraine has had a positive effect on our treatment group consisting of US defense and energy firms.

Chapter 5: Results

5.1 Event Study Results

This chapter presents the empirical findings from the event study analysis examining whether U.S. Defense and energy firms were winners from the Russian invasion of Ukraine. The chapter is organised as follows. Section 6.2 presents the main cumulative average abnormal return (CAAR) results for both groups. Section 6.3 provides a visual analysis of return dynamics around the event. Section 6.4 formally tests the difference between treated and control groups. Section 6.5 presents firm-level results for both groups. Section 6.6 discusses the economic interpretation and Section 6.7 summarises the findings.

Cumulative Average Abnormal Returns

Table 6.1 reports the cumulative average abnormal returns (CAAR) for the treated and control groups across three event windows. The pre-event window (−5, −1) captures potential anticipatory effects, the immediate window (−1, +1) captures the market's initial response, and the post-event window (0, +10) captures extended price adjustment.

Table 5- Cumulative Average Abnormal Returns by Group and Event Window

Event Window	Group	N	CAAR	Std. Dev.	Std. Error	t-statistic	p-value
(−5, −1)	Control	16	0.63%	2.59%	0.65%	0.97	0.349
(−5, −1)	Treated	14	3.14%	3.58%	0.96%	3.28	0.006**
(−1, +1)	Control	16	0.15%	1.10%	0.27%	0.56	0.587
(−1, +1)	Treated	14	4.09%	3.47%	0.93%	4.40	0.001***
(0, +10)	Control	16	−1.91%	5.67%	1.42%	−1.35	0.199
(0, +10)	Treated	14	14.66%	8.27%	2.21%	6.64	<0.001***

Notes: *** p<0.01, ** p<0.05, * p<0.10. CAAR calculated using the market model with estimation window (−250, −10). t-statistics based on cross-sectional distribution of firm-level CARs.

Pre-Event Window (−5, −1)

The pre-event window examines whether stock returns started changing before the war officially began. The control group shows a CAAR of 0.63%, which is not statistically significant (t = 0.97, p = 0.349). This confirms that defensive sector firms did not experience systematic abnormal performance in the days before the invasion.

The treated group, however, shows a CAAR of 3.14%, statistically significant at the 1% level (t = 3.28, p = 0.006). This indicates a positive return for treated group before the invasion. A likely explanation is that rising geopolitical tensions such as reports of Russian military build-ups and unsuccessful diplomatic efforts led investors to invest early in sectors expected to benefit from the conflict. The pre-event period also saw strong media coverage about the risk of invasion, which may have encouraged anticipatory trading.

Importantly, the absence of significant pre-event returns for the control group suggests these effects were sector-specific rather than reflecting broad market movements. Nevertheless, the pre-event returns indicate that the invasion was not entirely unexpected by investors.

Immediate Event Window (−1, +1)

The immediate event window captures the market's initial response to the invasion announcement. The control group shows a CAAR of 0.15%, which is economically negligible and statistically insignificant (t = 0.56, p = 0.587). This near-zero abnormal return confirms that defensive sector firms were neither significantly helped nor harmed by the immediate outbreak of conflict.

The treated group exhibits a CAAR of 4.09%, highly significant at the 1% level (t = 4.40, p = 0.001). This strong immediate reaction suggests that investors quickly adjusted their valuation of defense and energy firms after the invasion. The magnitude over 4% in three trading days reflects strong market expectations of increased defense spending and elevated energy prices benefiting these sectors.

Post-Event Window (0, +10)

The post-event window captures the extended market adjustment over eleven trading days following the invasion. The control group shows a CAAR of −1.91%, though this is not statistically significant (t = −1.35, p = 0.199). The negative point estimate may reflect sector rotation away from defensive stocks toward war beneficiaries, but since it is not significant, no strong conclusion can be drawn.

The treated group shows its strongest performance in this window, with a CAAR of 14.66%, highly significant (t = 6.64, p < 0.001). This result demonstrates that abnormal gains for defense and energy firms not only occurred at the invasion but accumulated substantially over the following two weeks as the implications of the conflict became clearer.

Visual Analysis of Return Dynamics

Figure 2 presents the evolution of cumulative average abnormal returns for both groups across the full event window from day −10 to day +10.

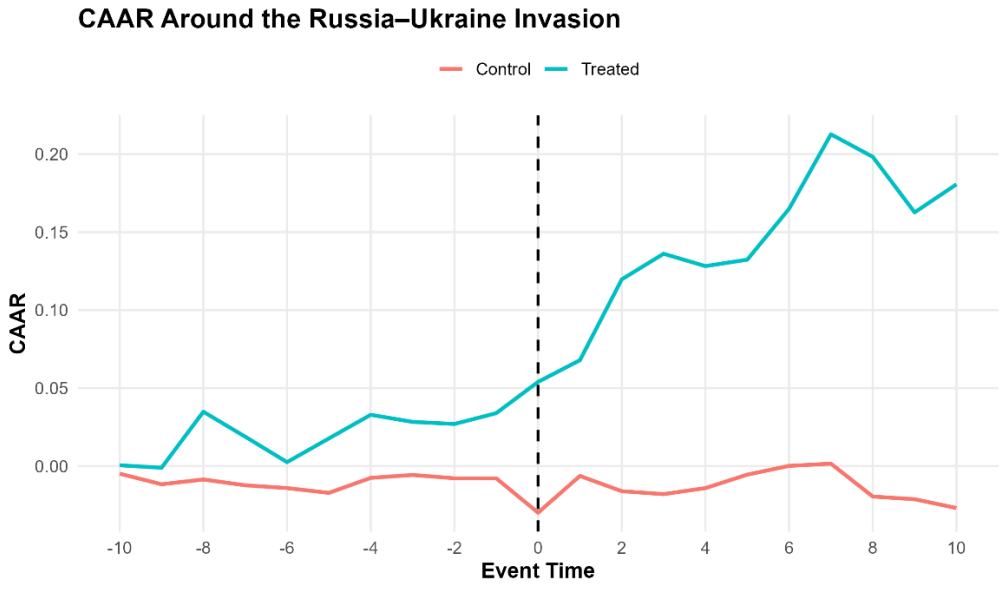


Figure 2- Cumulative average abnormal returns for treated (defense and energy) and control (defensive sectors) firms around the Russian invasion of Ukraine. Day 0 represents 24 February 2022. The vertical dashed line marks the event date.Several patterns emerge from Figure 2

- Pre-event divergence: The treated group begins diverging from the control group around day −8, with CAAR climbing from near zero to approximately 3-4% by day −1. The control group remains flat near zero throughout the pre-event period. This visual pattern supports the statistical finding of significant pre-event abnormal returns for treated firms.
- Sharp post-event increase: The treated group's CAAR increases sharply after day 0, rising from approximately 5% to over 20% by day +7. This steep trajectory reflects the rapid accumulation of positive abnormal returns as information about the war's implications such as sanctions, energy price spikes, and defense spending commitments emerged.
- Peak and partial reversal: The treated group's CAAR peaks around day +7 at approximately 21% before declining slightly to around 18% by day +10. This small decline may be due to profit-taking or adjustment of initial expectations. Despite this reversal, returns remain substantially positive.
- Control group stability: The control group's CAAR remains close to zero throughout the event window, fluctuating between approximately −3% and +1%. This stability confirms the control group's role as a neutral benchmark unaffected by the conflict.

  Figure 6.2 provides a closer examination of the post-event window (0, +10), showing the day-by-day evolution of CAAR.

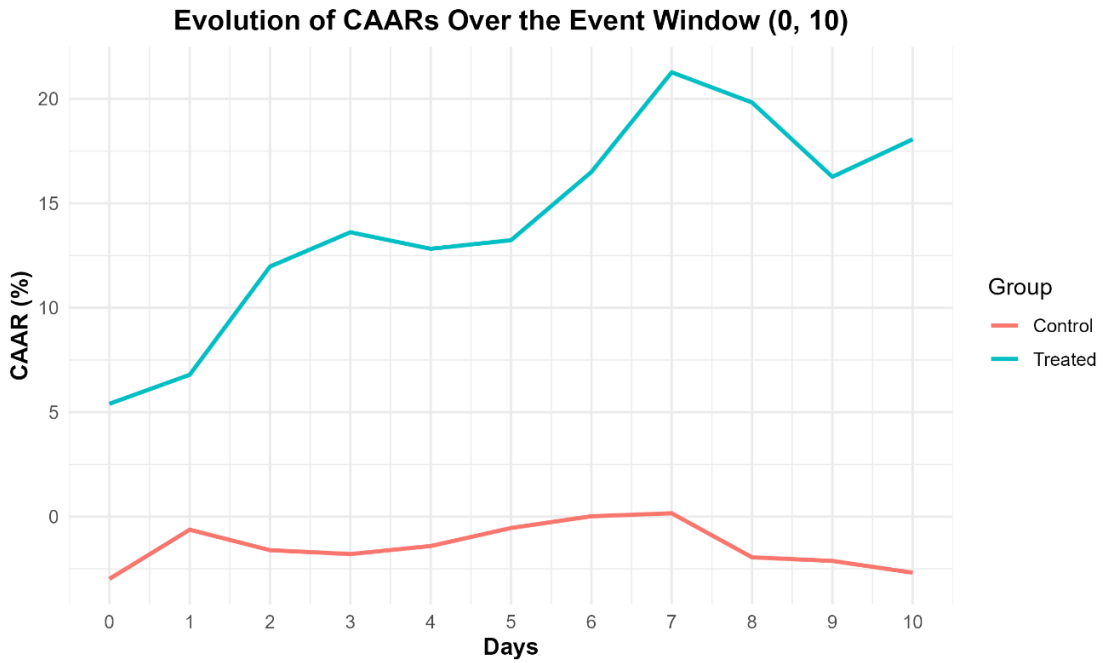


Figure 3- Daily evolution of cumulative average abnormal returns during the post-event window. Day 0 is the invasion date (24 February 2022)

Figure 3 reveals the dynamics of the post-event adjustment:

- Day 0: The treated group begins at approximately 5.5% CAAR while the control group is at approximately −2.5%
- Days 1-2: Rapid accumulation for treated firms, rising to approximately 12%
- Days 3-4: Continued gains, reaching approximately 13%
- Days 5-7: Acceleration to the peak of approximately 21%
- Days 8-10: Partial reversal, settling at approximately 18%

The gap between treated and control groups widens continuously from approximately 8 percentage points on day 0 to approximately 20 percentage points by day 10. This persistent and widening differential strongly supports the conclusion that defense and energy firms were systematic winners from the invasion.

Comparison of Treated and Control Groups

Table 6 formally tests the difference in mean cumulative abnormal returns between treated and control groups for each event window.

Table 6- Difference in Cumulative Abnormal Returns Between Groups

Event Window	Treated Mean	Control Mean	Difference	t-statistic	p-value
(−5, −1)	3.14%	0.63%	2.51%	2.17	0.040**
(−1, +1)	4.09%	0.15%	3.94%	4.07	0.001***
(0, +10)	14.66%	−1.91%	16.57%	6.31	<0.001***

*Notes: Difference calculated as treated minus control. t-statistics from Welch's two-sample t-test (unequal variances assumed). *** p<0.01, ** p<0.05.*

The difference between groups is statistically significant in all three windows:

- Pre-event (−5, −1): Treated firms outperformed by 2.51 percentage points (p = 0.040)
- Immediate (−1, +1): Treated firms outperformed by 3.94 percentage points (p = 0.001)
- Post-event (0, +10): Treated firms outperformed by 16.57 percentage points (p < 0.001)

The widening differential across windows from 2.51% pre-event to 16.57% post-event—indicates that the relative advantage of defense and energy firms over the control group grew as the conflict unfolded.

Firm-Level Results

While aggregate CAAR statistics capture the central tendency, examining firm-level results reveals the distribution of returns within each group. Tables 5 and 6 report cumulative abnormal returns for each firm in the treated and control groups, respectively.

Table 7- Firm-Level Cumulative Abnormal Returns — Treated Group

Firm	Ticker	Sector	CAR (−5, −1)	CAR (−1, +1)	CAR (0, +10)
AeroVironment	AVAV	Defense	−0.82%	6.09%	33.71%
Kratos Defense	KTOS	Defense	−4.80%	12.29%	28.91%
Chevron	CVX	Energy	4.23%	4.34%	21.52%
L3Harris	LHX	Defense	1.93%	5.45%	15.57%
Halliburton	HAL	Energy	3.43%	1.01%	16.64%
Northrop Grumman	NOC	Defense	1.66%	4.27%	13.24%
Lockheed Martin	LMT	Defense	3.24%	5.08%	13.08%
Leidos	LDOS	Defense	10.66%	6.03%	12.38%
Huntington Ingalls	HII	Defense	7.62%	6.22%	12.00%
ConocoPhillips	COP	Energy	2.61%	1.63%	9.53%
Exxon Mobil	XOM	Energy	2.27%	−0.04%	8.61%
Schlumberger	SLB	Energy	4.47%	−2.33%	7.20%
General Dynamics	GD	Defense	4.99%	3.57%	7.16%
Raytheon	RTX	Defense	2.46%	3.61%	5.76%

Notes: Firms sorted by CAR in (0, +10) window, descending.

Table 8 Firm-Level Cumulative Abnormal Returns — Control Group-

Firm	Ticker	Sector	CAR (−5, −1)	CAR (−1, +1)	CAR (0, +10)
Walmart	WMT	Consumer Staples	2.95%	−0.85%	5.10%
Costco	COST	Consumer Staples	0.42%	1.05%	5.16%
Johnson & Johnson	JNJ	Healthcare	−1.57%	2.39%	4.65%
Pfizer	PFE	Healthcare	−7.01%	−0.19%	2.70%
Amgen	AMGN	Healthcare	2.16%	1.40%	2.22%
Merck	MRK	Healthcare	−1.64%	−0.02%	2.02%
Bristol-Myers	BMY	Healthcare	1.78%	1.38%	0.24%
AbbVie	ABBV	Healthcare	3.24%	1.59%	0.10%
Verizon	VZ	Telecom	1.23%	0.10%	−0.34%
AT&T	T	Telecom	−1.30%	0.18%	−1.13%
Coca-Cola	KO	Consumer Staples	3.16%	−0.13%	−7.44%
Procter & Gamble	PG	Consumer Staples	0.38%	−0.57%	−8.63%
Kimberly-Clark	KMB	Consumer Staples	0.39%	−0.93%	−9.09%
PepsiCo	PEP	Consumer Staples	2.35%	−1.07%	−8.38%
Colgate-Palmolive	CL	Consumer Staples	1.26%	−1.40%	−6.74%
Mondelez	MDLZ	Consumer Staples	2.22%	−0.48%	−10.93%

Notes: Firms sorted by CAR in (0, +10) window, descending.

Heterogeneity Between-Groups

Comparing Tables 6.3 and 6.4 shows clear differences between the treated and control groups.

Post-event returns (0, +10):

- Treated group: All 14 firms show positive CAR, ranging from 5.76% (Raytheon) to 33.71% (AeroVironment).
- Control group: Only 6 of 16 firms show positive CAR; the remaining 10 firms show negative CAR, ranging from −0.34% (Verizon) to −10.93% (Mondelez)

This pattern shows that the positive CAAR for the treated group comes from consistent gains across most defense and energy firms, and not the performance of a few outliers. On the other hand, control group's near-zero aggregate CAAR masks substantial heterogeneity, with healthcare firms generally stable and consumer staples and telecom firms experiencing negative returns.

Immediate window (−1, +1):

- Treated group: 12 of 14 firms show positive CAR
- Control group: 9 of 16 firms show positive CAR, but magnitudes are smaller

Pre-event window (−5, −1):

- Treated group: 11 of 14 firms show positive CAR
- Control group: 11 of 16 firms show positive CAR

Although both groups have a similar number of positive firms, the treated group has stronger and significant returns, while the control group’s returns are small and not significant.

Economic Interpretation

The event study results provide strong evidence that U.S. defense and energy firms were winners from the Russian invasion of Ukraine. The key findings can be summarised as follows: Defense and energy firms earned substantial abnormal returns: The treated group's CAAR of 14.66% over the post-event window represents significant wealth creation for shareholders. For

instance, for a firm with a market capitalization of approximately $100 billion such as Lockheed Martin this corresponds to an increase of nearly $14.7 billion in market value.

The control group provides a valid benchmark: The control group's statistically insignificant CAAR across all windows, combined with their near-zero average returns, confirms their appropriateness as a neutral benchmark. This supports its role as a neutral comparison group and allows the positive returns of the treated group to be attributed to the invasion rather than general market movements.

Market response was rapid but continued over time: The significant immediate window CAAR (4.09%) indicates rapid investor response, consistent with market efficiency. However, the growth of returns through the post-event window reached 14.66% suggests that the full implications took time to incorporate likely as specific sanctions, energy price movements, and defense spending commitments were announced.

Some anticipation occurred: The treated group shows significant pre-event returns (3.14%), suggesting that investors expected the conflict before it officially began.

In contrast, the control group does not show significant pre-event returns, indicating that this anticipation was specific to the treated sectors rather than the overall market.

Summary

The event study analysis demonstrates that U.S. defense and energy firms were clear winners from the Russian invasion of Ukraine:

1. Treated firms earned statistically significant positive abnormal returns in all three event windows examined
2. Control firms showed no significant abnormal returns, validating the benchmark.
3. The difference between groups was significant and widened over time, reaching 16.57 percentage points in the post-event window

4. Visual analysis confirms the divergence between groups, with treated firms accumulating gains while control firms remained flat
5. Firm-level analysis reveals that gains were broad-based among treated firms, while control firms showed mixed results

These findings support the hypothesis that Defense and energy sectors benefited from the invasion through anticipated increases in military spending and elevated commodity prices. The following section examines whether these short-term gains persisted over a longer horizon using the difference-in-differences methodology.

5.2 Difference-in-Differences Results

This chapter presents the empirical findings from the difference-in-differences (DiD) analysis examining whether U.S. defense and energy firms generated sustained returns relative to the control group following the Russian invasion of Ukraine. The chapter is organised as follows. Section 7.2 validates the parallel trends assumption using a linear pre-trend test. Section 7.3 presents the main DiD estimate. Section 7.4 provides a visual analysis of the cumulative return dynamics across the full sample period. Section 7.5 discusses the economic interpretation of the results. Section 7.6 summarises the key findings. Robustness checks, including an event-study parallel trends test and a placebo analysis, are presented in the Appendix.

IDENTIFICATION ISSUE: PARALLEL TREND

The validity of the DiD estimator relies on the parallel trends' assumption, which means that, without the event, both the treated and control groups would have followed similar trends before the invasion. While this assumption cannot be directly verified but it can be tested empirically whether there were any differences in trends between the two groups before the event.

To address this a linear parallel trends test is run using data from the pre-invasion period. This model checks whether the trend in returns differs between the treated and control groups over time, while controlling for firm and time effects.

If the interaction term is not statistically significant, it suggests that there was no systematic difference in trends before the event, supporting the parallel trends assumption.

Table 9- Linear Parallel Trends Test

Variable	Estimate	Std. Error	t-statistic	p-value
Time Index × Treated	−0.00026	0.0005	−0.51	0.611
Firm Fixed Effects	Yes			
Date Fixed Effects	Yes			
Observations	3,630			
Number of Firms	30			

Notes: * p<0.10, ** p<0.05, *** p<0.01. The dependent variable is the cumulative log return. The interaction term Time Index × Treated captures any differential pre-treatment trend between the treatment and control groups. Standard errors are clustered at the firm level

The estimated coefficient on the interaction term (Time Index × Treated) is −0.00026 and is not statistically significant (t = −0.51, p = 0.611). This means there is no meaningful difference in trends between the treated and control groups before the invasion.

This result suggests that both groups were following similar paths in the pre-invasion period, supporting the parallel trends assumption required for the DiD analysis.

An additional event-study parallel trends test has been done which examines pre-treatment weekly lead coefficients, is presented in Appendix 6B. The pattern of results across both tests is consistent and supports the validity of the parallel trends assumption.

Difference-in-Differences Results

The table reports the main DiD results from the preferred model with firm and time fixed effects. The key coefficient is the interaction term (Treated × Post), which measures the change

in cumulative log returns for defense and energy firms compared to the control group after the invasion.

Table 10 - DID Results

Variable	Estimate	Std. Error	t-statistic	p-value
Treated* × *Post	0.1271	0.0599	2.12	0.043**
Firm Fixed Effects	Yes			
Date Fixed Effects	Yes			
Observations	10,080			
Number of Firms	30			

Notes: ** p<0.05. The dependent variable is the cumulative log return for firm i at time t. The coefficient reported is for the interaction term Treated × Post. Standard errors are clustered at the firm level. Firm and date fixed effects are included in all specifications.

The estimated DiD coefficient is 0.1271 and is statistically significant at the 5% level (t = 2.12, p = 0.043). This means that, after the invasion, defense and energy firms earned about 12.7 percentage points higher cumulative log returns than the control group, after accounting for firm and time effects. In simple return terms, this is roughly equal to a 13.6 percentage point higher return, showing a strong positive impact of the invasion on these firms. The positive and significant DiD coefficient shows that defense and energy firms performed better than the control group after the invasion, beyond general market effects affecting all firms.

The inclusion of firm fixed effects removes all constant differences between firms, such as sector, business model, and past performance. Time (date) fixed effects control for factors that affect all firms at the same time, like market movements, economic news, and policy changes. Furthermore. since all firms in the sample are U.S.-listed and headquartered domestically,

geographic state fixed effects are not applicable in this context. The firm fixed effects included in the preferred specification are strictly more granular than state-level controls, as each firm receives its own time-invariant intercept that absorbs all permanent cross-firm differences including any geographic variation. Given these controls, the estimated effect captures the true impact of the invasion on the treated group compared to others

It is also worth noting that the magnitude of the DiD estimate is economically meaningful. A 12.7 log-point differential in cumulative returns over the post-invasion period represents a substantial and persistent outperformance by defense and energy (treated group) firms relative to defensive firms (control group).

Visual Analysis of Return Dynamics

Figure 4 plots the average cumulative log returns for the treated and control groups across the full sample window, from September 2021 till December 2022. The dashed vertical line marks the invasion date of 24 February 2022.

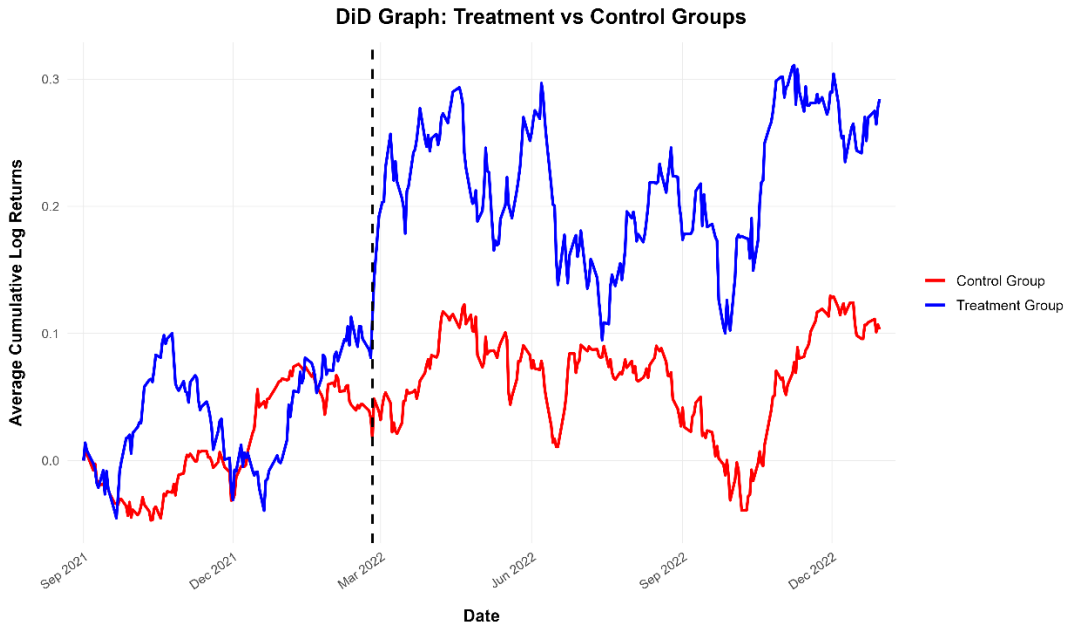


Figure 4- Average cumulative log returns for treated (defense and energy) and control (defensive sectors) firms across the full sample period. The vertical dashed line marks the invasion date of 24 February 2022

Figure 2 complements the regression results by plotting the average cumulative log returns of treated and control firms over time. Before the invasion, the trajectories of the two groups move closely together, which visually supports the previously tested parallel trends assumption. There is no clear or systematic divergence between the groups during the pre-treatment period.

At the time of invasion, the two groups begin to diverge clearly. The treatment group which is depicted in blue rises steeply after the event, reflecting investors' expectations of benefits for defense and energy firms. The control group which is depicted in red remains mostly flat with no upward shift.

The gap that appears after the invasion continues throughout the rest of the window. While both groups show some fluctuations the difference between them still remains with the treated group consistently having higher returns. By the end of the sample period in December 2022, the treated group's returns are clearly higher than the control group, matching the results from the DiD analysis.

The consistency between the graphical evidence and the regression estimates strengthens the overall conclusion. Both approaches indicate that U.S. energy and defense firms experienced a significant and persistent relative advantage following the outbreak of the Russia–Ukraine war.

Economic Interpretation

The DiD results reinforce and extend the findings from the event study, offering several important insights regarding the medium-term stock market effects of the invasion on U.S. defense and energy firms

First, the gains documented in the event study were not temporary. The event study established that defense and energy firms earned strong abnormal returns in the days immediately surrounding the invasion, with a CAAR of 14.66% over the post-event window of ten trading days. The DiD analysis shows these gains were not subsequently reversed. Instead, the

treatment group maintained a significantly higher level of cumulative returns relative to the control group throughout the full post-invasion period of approximately ten months. This persistence is economically important: it implies that investor optimism in the immediate aftermath of the invasion was validated by subsequent developments, and that the war's effects on defense procurement and energy revenues represented genuine, sustained improvements in firm fundamentals rather than a short-lived speculative reaction.

Second, the two main transmission channels fiscal and market worked as anticipated. Energy firms benefitted from the higher oil and gas prices which increased their revenues and profits during 2022. For example, ExxonMobil reported approximately $55.7 billion in profit in 2022, while Chevron reported around $35.5 billion, both representing record highs. Defense firms benefited from increased military spending, especially by NATO countries, leading to more contracts and stronger future expectations. The fact that DiD coefficient remains significant even after controlling for firm and time effects shows that these gains were specific to the treated firms and not due to overall market trends.

Third, the results highlight that financial market reactions to geopolitical shocks differ across sectors. While the existing literature documents that wars tend to generate negative aggregate market reactions, the evidence from both the event study and the DiD analysis shows that certain sectors can generate substantial positive returns precisely because the economic consequences of conflict are unevenly distributed.

Summary

The DiD analysis provides medium-term evidence that U.S. defense and energy firms were genuine winners from the Russian invasion of Ukraine:

- The linear parallel trends test shows that the pre-treatment interaction term is not statistically significant ($\beta = -0.00026$, $p = 0.611$). This indicates that the treated and control groups followed similar return trends before the invasion, supporting the validity of the DiD assumption.

- The main DiD estimate is positive and statistically significant at the 5% level ($\beta = 0.1271$, $t = 2.12$, $p = 0.043$), indicating that defense and energy firms accumulated approximately 12.7 log-point higher cumulative returns than the control group over the post-invasion period.
- Visual analysis of the full sample period shows similar trends between the groups before the invasion, followed by a clear and sustained divergence afterward. This pattern is consistent with the DiD framework and supports the estimated treatment effect.
- Taken together with the event study findings, the results indicate that the initial gains accruing to defense and energy firms in the days surrounding the invasion were not temporary. They persisted over the following months, reflecting sustained improvements in these sectors due to higher energy prices and increased defense spending

  Robustness checks have been done and reported in the Appendix, including an event-study parallel trends test using pre-treatment weekly lead coefficients and a placebo analysis using a fictitious invasion date of 1 December 2021, which further supports the validity and reliability of the main finding.

Chapter 6: Discussion and limitations

6.1 Economic Interpretation of the Results

The central finding is that U.S. defense and energy firms were genuine and lasting stock market winners from the Russian invasion of Ukraine. The event study documents a CAAR of 14.66% for treated firms over the ten days following the invasion against −1.91% for the control group, and the Difference in Differences (DID) analysis confirms this gap did not close and treated firms maintained approximately 13.6% higher cumulative returns over the following ten months. Taken together, the two methods establish not only that markets reacted

strongly but that the reaction was correct. On the energy side, this is validated by actual firm outcomes, firms like ExxonMobil and Chevron both reported record annual profits in 2022. On the defense side, NATO member military spending rose 13% in real terms in 2022 and a further 16% in 2023. According to SIPRI, directly expanding the procurement budgets from which U.S. defense contractors derive their revenues. The market reaction therefore reflected investors correctly anticipating higher future earnings, not short-term speculation.

The magnitude of these gains is economically meaningful beyond the statistical results. Lockheed Martin, with a market capitalisation of approximately $100 billion at the time of the invasion, recorded a post-event CAR of 13.08% which corresponding to roughly $13 billion in additional shareholder value created within two weeks. Importantly, this was not an isolated case driven by one or two outliers. All 14 treated firms recorded positive post-event CARs, ranging from 5.76% for Raytheon to 33.71% for AeroVironment, confirming that the economic gains from the invasion were distributed broadly and consistently across the entire treated group.

6.2 Revenue Concentration and Firm-Level Heterogeneity

The aggregate results confirm the hypothesis, but the firm-level data in Table 7 reveals a pattern that deserves direct attention. Post-event CARs across the treated group range from 5.76% for Raytheon to 33.71% for AeroVironment which is a very wide spread for firms supposedly exposed to the same shock. Understanding this variation connects directly to the existing literature.

(Martins et al., 2025) find that the degree of a firm's reliance on defense revenues plays a key role in explaining market reactions after the invasion. Firms that generate more than 66% of their revenue from defense activities experienced the strongest positive abnormal returns, while those with less than 33% exposure actually saw negative abnormal returns. The

intuition behind this is fairly straightforward. Financial markets respond to changes in expected future earnings, and for firms heavily dependent on government defense contracts, an anticipated increase in military spending translates directly into higher expected revenues. In contrast, for more diversified firms, where defense represents only a portion of total operations, the same increase in spending has a more diluted effect on overall profitability. The firm-level evidence in this analysis aligns well with that argument. AeroVironment and Kratos, which are among the most defense-focused companies in the sample, recorded the highest cumulative abnormal returns following the event. On the other hand, firms such as General Dynamics and Raytheon, despite having significant defense operations, exhibited comparatively smaller gains. These companies operate across a broader mix of defense and commercial segments, which likely dampens the relative impact of increased defense spending on their expected earnings.

Taken together, these results suggest that the market response is less about firm size and more about the concentration of revenue streams. Investors rewarded firms whose earnings are most directly tied to defense expenditure, reinforcing the idea that exposure, rather than scale, is the more relevant factor in explaining post-event performance.

For energy firms, the results are in line with Nerlinger and Utz (2022), who also find positive abnormal returns for energy producers following the invasion. However, the pattern is not uniform across firms. There is clear heterogeneity depending on the operational structure and the degree of exposure to upstream activities.

Within the sample, Chevron recorded the highest post-event CAR among energy firms at 21.52%, whereas ExxonMobil recorded a much lower CAR of 8.61%. One likely explanation lies in differences in operational structure. Chevron has relatively greater exposure to upstream operations, meaning it benefits more directly from increases in oil prices. In

contrast, ExxonMobil operates as a large integrated major with significant upstream as well as downstream and refining activities.

This integrated structure complicates the transmission of oil price shocks. While higher crude prices boost upstream revenues, they simultaneously increase input costs for downstream segments such as refining and petrochemicals. As a result, even though oil prices surged past $130 per barrel in the immediate aftermath of the invasion, the overall market reaction to ExxonMobil remained more muted.

Taken together, this suggests that, similar to the defense sector, the market response is driven not just by sector classification but by the underlying composition of firm activities. Firms with more direct exposure to price increases tend to experience stronger abnormal returns, while more diversified or integrated firms show comparatively weaker responses.

6.3 How Markets Processed the Shock

The pattern of returns across the event study and DiD results raises three questions that the analysis can directly address.

The first is why treated firms were already earning positive returns before the invasion officially began. The treated group earned a statistically significant CAAR of 3.14% in the five days before the invasion, while the control group showed nothing comparable. This is not surprising once the context is considered. For weeks before 24 February, Russian military buildups had been publicly documented, diplomatic talks had visibly collapsed, and Western governments were openly warning of an imminent attack. Investors were simply acting on publicly available information, which is what efficient markets predict. The pre-event gains are concentrated entirely within the treated sectors, rather than being spread across the market. This suggests that investors were not simply becoming more optimistic or pessimistic in general but were actively repositioning toward firms expected to benefit from the anticipated shock. In other words, this

was not a broad market movement but a targeted response driven by expectations about which sectors would gain from rising defense spending and energy prices.

The second question is why returns kept accumulating for ten days after the invasion rather than adjusting fully on day one. The invasion was not a single piece of news it triggered a sequence of subsequent developments including SWIFT sanctions, European energy embargoes, Germany's €100 billion defense fund, and U.S. military aid appropriations, each of which carried direct earnings implications for treated firms. As (Hong & Stein, n.d.) argue, when relevant information arrives gradually in complex events, continuous price adjustment is consistent with rational market behaviour rather than speculation.

The DiD results help answer a third, and arguably the most important, question: where these returns justified, or were they simply a short-term market overreaction? If the post-invasion gains had been driven purely by speculation or temporary sentiment, we would expect the DiD coefficient to weaken over time as prices corrected. Instead, the coefficient remains positive and statistically significant over a ten-month horizon.

This persistence suggests that the market response was not just a brief spike in optimism, but a sustained reassessment of firms' future earnings potential. In other words, investors were not merely reacting emotionally to the shock; they were updating expectations in a way that continued to be reflected in prices well beyond the immediate event window.

6.4 Broader Implications

The existing literature, including (Boungou & Yatié, 2022; Caldara & Iacoviello, 2022) treats geopolitical shocks primarily as negative events that raise uncertainty and reduce stock market valuations broadly. This is well established and this thesis does not contradict it, the average market return was negative around the invasion, which is visible in the descriptive statistics of the event study.

However, this aggregate view misses an important part of the picture. While the overall market falls during a geopolitical shock, not all firms fall equally. The consequences of a conflict are not distributed evenly across the economy some sectors face higher costs and disruption, while others face higher demand and better revenues. This thesis shows that for defense and energy firms; the invasion created a genuine and lasting improvement in earnings prospects that was reflected in stock prices both immediately and over the following months. This means geopolitical shocks do two things simultaneously. They destroy aggregate market value, but they also redistribute expected earnings from some sectors to others. These two things are not in conflict they are simply two different levels at which the same shock operates. The existing literature has studied the first extensively. The second has received far less attention.

This has a straightforward implication for future research. Studying which sectors benefit from geopolitical shocks, by how much, and for how long is at least as informative as studying the aggregate market impact. The tools are available as this thesis demonstrates using event study and difference-in-differences methods and extending this type of analysis to other conflicts and other potentially benefiting sectors would considerably improve our understanding of how financial markets respond to geopolitical risk.

6.5 Limitations

Sample Size

The sample of 30 firms is smaller than many event studies in the literature. This was a deliberate choice, only firms with primary revenue exposure to defense or energy were included in the treated group, and only firms with genuinely war-insensitive revenues were included in the control group. A larger but less precisely classified sample would have introduced contamination bias. The results are statistically significant despite the small sample, which

suggests the findings are not a product of sample size. However, the small treated group of 14 firms prevents any formal comparison between defense and energy subgroups, which would have allowed a more precise test of whether the two sectors performed differently from one another.

Homogeneity of the Control Group

The control group was selected on the basis that healthcare, consumer staples, and telecommunications firms have stable, war-insensitive revenues. This holds on the revenue side. However, several consumer staples firms including Mondelez, PepsiCo, and Procter and Gamble recorded substantial negative post-event returns, reflecting their exposure to agricultural commodity prices and energy input costs that rose sharply following the invasion. This means the control group is not perfectly homogeneous as it contains firms that were indirect losers from the invasion alongside firms that were genuinely neutral. The practical implication is that DiD estimate of 0.127 log points may modestly understate the true treatment effect.

Parallel Trends Assumption

The linear pre-trend test supports the parallel trends assumption, returning an insignificant interaction coefficient of −0.00026 ($p = 0.611$). However, the event-study parallel trends test in Appendix F1 shows that several lead coefficients in weeks four to ten before the invasion are negative and statistically significant, indicating the treated group was underperforming the control group slightly before recovering as the invasion approached. The most natural interpretation is anticipatory investor repositioning as geopolitical tensions escalated, meaning these pre-treatment differences are part of the treatment effect rather than a violation of the identifying assumption. The placebo test returning an insignificant coefficient ($p = 0.303$) supports this interpretation. Nevertheless, readers should treat the DiD causal estimate with appropriate caution given these pre-treatment dynamics.

Macroeconomic Confounds and External Validity

The post-invasion period coincided with aggressive Federal Reserve monetary tightening, with interest rates rising from near zero to over 4% during 2022. While time fixed effects in the DiD specification control for aggregate shocks common to all firms, they cannot fully absorb differential interest rate sensitivity across sectors. Growth-oriented and rate-sensitive firms may respond differently to rising rates than defensive or commodity-exposed firms, potentially conflating the treatment effect with an interest rate effect. The direction of any resulting bias is unclear, and this remains an inherent challenge of studying a geopolitical shock that occurred during a period of significant macroeconomic turbulence.

More broadly, the Russia-Ukraine conflict has specific structural features that made it an unusually powerful shock for both treated sectors: its scale, its direct implications for NATO security commitments, and Russia's dominant role in global energy supply. The magnitude of the gains documented here may not replicate in conflicts with weaker implications for Western defense budgets or global energy markets. The findings should therefore be understood as evidence from a particularly strong natural experiment rather than as a general estimate of how defense and energy stocks respond to geopolitical shocks on average

Additional technical limitations relating to the data source and market proxy discussed in Appendix B.

Chapter 7: Conclusion

This thesis investigated whether U.S. defense and energy firms were stock market winners from the Russian invasion of Ukraine, and whether any gains they experienced were sustained over subsequent months. Using two complementary empirical methods an event study to capture short-run abnormal returns and a difference-in-differences framework to assess

medium-run persistence, the analysis provides consistent and robust evidence in support of both hypotheses.

The event study shows that treated firms earned a CAAR of 4.09% in the three-day window around the invasion and 14.66% over the following ten trading days, compared to statistically insignificant returns for the control group across all windows. At the firm level, all 14 treated firms recorded positive post-event CARs while the control group showed no comparable pattern. The difference between the two groups widened continuously from 2.51 percentage points in the pre-event window to 16.57 percentage points in the post-event window. The DiD analysis then confirms that these gains were not reversed and treated firms maintained approximately 13.6% higher cumulative returns than the control group over the ten months following the invasion, with the coefficient remaining positive and significant at the 5% level after controlling for firm and time fixed effects. The parallel trends assumption is supported by both the linear pre-trend test and the placebo analysis. Taken together, the findings show that the Russian invasion of Ukraine created clear sector-specific winners in the U.S. stock market. Therefore, the initial stock market reaction was not only short-term speculation but also reflected a real reassessment of expected future cash flows.

The main takeaway from this thesis is that geopolitical shocks do not affect all firms in the same direction. Although wars usually increase uncertainty and create negative pressure on aggregate markets, their economic effects are unevenly distributed across sectors. Firms directly linked to the positive consequences of conflict may benefit even when the broader market faces higher risk and uncertainty. These results matter because they show how financial markets identify and price the winners of geopolitical shocks. The thesis contributes to the existing literature by providing firm-level evidence using a formal counterfactual comparison and by combining short-term event study results with medium-term difference-in-

differences evidence. This makes it possible to assess both the immediate reaction and the persistence of gains within the same framework.

While the findings provide strong evidence in the context of the Russia-Ukraine war, future research could extend the analysis in several ways. First, defense and energy firms could be separated into two treatment groups to examine whether the fiscal channel and the market channel produced different effects over time. Second, the sample period could be extended beyond December 2022 to assess whether the gains remained persistent in the longer run. Finally, future studies could compare U.S. firms with firms in European and other international markets to examine whether the same pattern holds across different regions and financial systems.

Bibliography

Aït-Sahalia, Y., Parker, J. A., & Yogo, M. (2004). Luxury Goods and the Equity Premium. *The Journal of Finance*, *59*(6), 2959–3004. https://doi.org/10.1111/j.1540-6261.2004.00721.x

Ang, A., Hodrick, R. J., Xing, Y., & Zhang, X. (2006). The Cross-Section of Volatility and Expected Returns. *The Journal of Finance*, *61*(1), 259–299. https://doi.org/10.1111/j.1540-6261.2006.00836.x

Angrist, J. D., & Pischke, J.-S. (2009). *Mostly harmless econometrics: An empiricist's companion*. Princeton university press. https://books.google.com/books?hl=en&lr=&id=YSAzEAAAQBAJ&oi=fnd&pg=PR11&dq=Joshua+D.+Angrist+%26+J%C3%B6rn-Steffen+Pischke+(2008)+Mostly+Harmless+Econometrics:+An+Empiricist%E2%80%99s+Companion+(Princeton+University+Press&ots=qgFnzr8A_8&sig=pObPKiSDb5h7xZN3wVMXpCnKYKY

Baker, S. R., Bloom, N., & Davis, S. J. (2016). Measuring Economic Policy Uncertainty*. *The Quarterly Journal of Economics*, *131*(4), 1593–1636. https://doi.org/10.1093/qje/qjw024

Baumeister. (2013). *THE ROLE OF TIME-VARYING PRICE ELASTICITIES IN ACCOUNTING FOR VOLATILITY CHANGES IN THE CRUDE OIL MARKET - Baumeister—2013—Journal of Applied Econometrics—Wiley Online Library*. https://onlinelibrary.wiley.com/doi/full/10.1002/jae.2283

Baumeister, C., & Kilian, L. (2016). Forty Years of Oil Price Fluctuations: Why the Price of Oil May Still Surprise Us. *Journal of Economic Perspectives*, *30*(1), 139–160. https://doi.org/10.1257/jep.30.1.139

Baur, D. G., & Lucey, B. M. (2010). Is Gold a Hedge or a Safe Haven? An Analysis of Stocks, Bonds and Gold. *Financial Review*, *45*(2), 217–229. https://doi.org/10.1111/j.1540-6288.2010.00244.x

Baur, D. G., & McDermott, T. K. (2010). Is gold a safe haven? International evidence. *Journal of Banking & Finance, New Contributions to Retail Payments: Conference at Norges Bank (Central Bank of Norway) 14–15 November 2008*, *34*(8), 1886–1898. https://doi.org/10.1016/j.jbankfin.2009.12.008

Berger, D., Easterly, W., Nunn, N., & Satyanath, S. (2013). Commercial Imperialism? Political Influence and Trade during the Cold War. *American Economic Review*, *103*(2), 863–896. https://doi.org/10.1257/aer.103.2.863

Berkman, H., Jacobsen, B., & Lee, J. B. (2011). Time-varying rare disaster risk and stock returns. *Journal of Financial Economics*, *101*(2), 313–332.

Boungou, W., & Yatié, A. (2022). The impact of the Ukraine–Russia war on world stock market returns. *Economics Letters*, *215*, 110516. https://doi.org/10.1016/j.econlet.2022.110516

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

Caldara, D., & Iacoviello, M. (2022). Measuring Geopolitical Risk. *American Economic Review*, *112*(4), 1194–1225. https://doi.org/10.1257/aer.20191823

Capelle-Blancard, G., & Couderc, N. (2008). What drives the market value of firms in the defense industry. *Review of Financial Economics*, *17*(1), 14–32.

Charles M. Jones & Gautam Kaul. (1996). *Oil and the Stock Markets—JONES - 1996—The Journal of Finance—Wiley Online Library*. https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1540-6261.1996.tb02691.x

Chesney, M., Reshetar, G., & Karaman, M. (2011). The impact of terrorism on financial markets: An empirical study. *Journal of Banking & Finance*, *35*(2), 253–267. https://doi.org/10.1016/j.jbankfin.2010.07.026

Cochrane, J. H. (2009). *Asset Pricing: Revised Edition*. Princeton University Press.

Cunningham, S. (2021). *Causal Inference: The Mixtape*. Yale University Press.

Driesprong, G., Jacobsen, B., & Maat, B. (2008). Striking oil: Another puzzle? *Journal of Financial Economics*, *89*(2), 307–327. https://doi.org/10.1016/j.jfineco.2007.07.008

Dunne, J. P., Smith, R. P., & Willenbockel, D. (2005). Models of Military Expenditure and Growth: A Critical Review. *Defense and Peace Economics*, *16*(6), 449–461. https://doi.org/10.1080/10242690500167791

Dunne, J. P., & Tian, N. (2013). Military expenditure and economic growth: A survey. *The Economics of Peace and Security Journal*, *8*(1). https://doi.org/10.15355/epsj.8.1.5

Eitan Goldman, Jörg Rochol, & Jongil So. (2013). *Politically Connected Boards of Directors and The Allocation of Procurement Contracts | Review of Finance | Oxford Academic*. https://academic.oup.com/rof/article/17/5/1617/1582382?guestAccessKey=

European Commission. (2022). *Sanctions adopted following Russia's military aggression against Ukraine—Finance*. https://finance.ec.europa.eu/eu-and-world/sanctions-restrictive-measures/sanctions-adopted-following-russias-military-aggression-against-ukraine_en

European Council. (2022). *EU sanctions against Russia: Questions and answers*. Consilium. https://www.consilium.europa.eu/en/policies/sanctions-against-russia-explained/?utm_source=chatgpt.com

Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, *25*(2), 383–417. https://doi.org/10.2307/2325486

Fama, E. F., Fisher, L., Jensen, M. C., & Roll, R. (1969). The Adjustment of Stock Prices to New Information. *International Economic Review*, *10*(1), 1–21. https://doi.org/10.2307/2525569

Fama, E. F., & French, K. R. (1997). Industry costs of equity. *Journal of Financial Economics*, *43*(2), 153–193. https://doi.org/10.1016/S0304-405X(96)00896-3

Federle, J., Meier, A., Müller, G. J., & Sehn, V. (2022). Proximity to War: The Stock Market Response to the Russian Invasion of Ukraine. *Journal of Money, Credit and Banking*, *n/a*(n/a). https://doi.org/10.1111/jmcb.13226

Getzen, T. E. (2000). Health care is an individual necessity and a national luxury: Applying multilevel decision models to the analysis of health care expenditures. *Journal of Health Economics*, *19*(2), 259–270. https://doi.org/10.1016/S0167-6296(99)00032-6

Goldman, E., Rocholl, J., & So, J. (2013a). Politically Connected Boards of Directors and The Allocation of Procurement Contracts. *Review of Finance*, *17*(5), 1617–1648. https://doi.org/10.1093/rof/rfs039

Goldman, Rocholl, & So. (2013b). *Politically Connected Boards of Directors and The Allocation of Procurement Contracts | Review of Finance | Oxford Academic*. https://academic.oup.com/rof/article/17/5/1617/1582382?guestAccessKey=

Gruber, H., & Verboven, F. (2001). The evolution of markets under entry and standards regulation—The case of global mobile telecommunications. *International Journal of Industrial Organization, Evolution of Markets*, *19*(7), 1189–1212. https://doi.org/10.1016/S0167-7187(01)00069-8

Hamilton, J. D. (2009). *Causes and Consequences of the Oil Shock of 2007-08* (Working Paper No. 15002). National Bureau of Economic Research. https://doi.org/10.3386/w15002

Hartley, K., & Sandler, T. (1995). *Handbook of Defense Economics: Defense in a Globalized World*. Elsevier.

Hong. (1999). *A Unified Theory of Underreaction, Momentum Trading, and Overreaction in Asset Markets—Hong—1999—The Journal of Finance—Wiley Online Library*. https://onlinelibrary.wiley.com/doi/full/10.1111/0022-1082.00184

Hong, H., & Stein, J. C. (n.d.). *A Unified Theory of Underreaction, Momentum Trading, and Overreaction in Asset Markets*.

Hong & Stein. (1999). *A Unified Theory of Underreaction, Momentum Trading, and Overreaction in Asset Markets—Hong—1999—The Journal of Finance—Wiley Online Library*. https://onlinelibrary.wiley.com/doi/full/10.1111/0022-1082.00184

IEA. (2022, March 3). *A 10-Point Plan to Reduce the European Union's Reliance on Russian Natural Gas – Analysis*. IEA. https://www.iea.org/reports/a-10-point-plan-to-reduce-the-european-unions-reliance-on-russian-natural-gas

Kilian, L. (2009). Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market. *American Economic Review*, *99*(3), 1053–1069. https://doi.org/10.1257/aer.99.3.1053

Mackinlay, A. C. (1997). *Event Studies in Economics and Finance*.

Malkiel, B. G. (2003). The Efficient Market Hypothesis and Its Critics. *Journal of Economic Perspectives*, *17*(1), 59–82. https://doi.org/10.1257/089533003321164958

Martins, A. M. (2024). Stock market effects of military conflicts on defense industry. *International Journal of Islamic and Middle Eastern Finance and Management*, *17*(5), 1014–1026. https://doi.org/10.1108/IMEFM-01-2024-0019

Martins, A. M., Correia, P., & Gouveia, R. (2025). War! Good news for defense firms? Analysis of the impact of Russia–Ukraine conflict. *Journal of Economic Studies*, *52*(2), 303–321. https://doi.org/10.1108/JES-11-2023-0667

Mearsheimer, J. J. (2014). Why the Ukraine Crisis Is the West's Fault: The Liberal Delusions That Provoked Putin Essays. *Foreign Affairs*, *93*(5), [i]-89.

Mohamed, A. (2012). Stock returns and oil price changes in europe: A sector analysis. *Manchester School*, *80*, 237–261. https://doi.org/10.1111/j.1467-9957.2010.02223.x

Moiseienko, A. (2023). Legal: The Freezing of the Russian Central Bank's Assets. *European Journal of International Law*, *34*(4), 1007–1020. https://doi.org/10.1093/ejil/chad050

NATO. (2022). *NATO's support for Ukraine*. Site Name Seo. https://www.nato.int/en/what-we-do/partnerships-and-cooperation/natos-support-for-ukraine

Nerlinger, M., & Utz, S. (2022). The impact of the Russia-Ukraine conflict on energy firms: A capital market perspective. *Finance Research Letters*, *50*, 103243. https://doi.org/10.1016/j.frl.2022.103243

Pástor, L., & Veronesi, P. (2012). Uncertainty about Government Policy and Stock Prices. *The Journal of Finance*, *67*(4), 1219–1264. https://doi.org/10.1111/j.1540-6261.2012.01746.x

Rigobon, R., & Sack, B. (2005a). The effects of war risk on US financial markets. *Journal of Banking & Finance*, *29*(7), 1769–1789.

Rigobon, R., & Sack, B. (2005b). The effects of war risk on US financial markets. *Journal of Banking & Finance*, *29*(7), 1769–1789. https://doi.org/10.1016/j.jbankfin.2004.06.040

Rigobon, R., & Sack, B. (2005c). The effects of war risk on US financial markets. *Journal of Banking & Finance*, *29*(7), 1769–1789. https://doi.org/10.1016/j.jbankfin.2004.06.040

Schneider, G., & Troeger, V. E. (2006). War and the World Economy: Stock Market Reactions to International Conflicts. *Journal of Conflict Resolution*, *50*(5), 623–645. https://doi.org/10.1177/0022002706290430

SIPRI 2022. (2023). SIPRI. https://www.sipri.org/publications/2023/sipri-fact-sheets/trends-world-military-expenditure-2022

Snow, J. (1856). On the Mode of Communication of Cholera. *Edinburgh Medical Journal*, *1*(7), 668–670.

S.P. Kothari & Jerold Warner. (2007). Econometrics of Event Studies. In *Handbook of Empirical Corporate Finance* (pp. 3–36). Elsevier. https://doi.org/10.1016/B978-0-444-53265-7.50015-9

Trebesch, C. (2023). *Military and financial support to Ukraine hits a record high*. https://www.economist.com/graphic-detail/2023/02/21/military-and-financial-support-to-ukraine-hits-a-record-high

Waverman, L., Meschi, M., & Fuss, M. (2005). *The Impact of Telecoms on Economic Growth in Developing Countries*.

Appendix

Appendix A: Sample Composition

Table A 1, Panel A: Treated Group (Defense and Energy Firms)

Firm	Ticker	Sector	Exchange	Market Cap (Feb 2022, approx.)
AeroVironment	AVAV	Defense	NASDAQ	~$2.1B
Kratos Defense	KTOS	Defense	NASDAQ	~$2.4B
Chevron	CVX	Energy	NYSE	~$220B
L3Harris Technologies	LHX	Defense	NYSE	~$45B
Halliburton	HAL	Energy	NYSE	~$28B
Northrop Grumman	NOC	Defense	NYSE	~$72B
Lockheed Martin	LMT	Defense	NYSE	~$100B
Leidos	LDOS	Defense	NYSE	~$14B
Huntington Ingalls	HII	Defense	NYSE	~$9B
ConocoPhillips	COP	Energy	NYSE	~$120B
ExxonMobil	XOM	Energy	NYSE	~$340B
Schlumberger	SLB	Energy	NYSE	~$38B
General Dynamics	GD	Defense	NYSE	~$60B
Raytheon Technologies	RTX	Defense	NYSE	~$135B

Note: Market capitalization values are approximate and based on publicly available data around February 2022. Source: Author's compilation using Yahoo Finance.

Table A 2, Panel B: Control Group (Defensive Sector Firms)

Firm	Ticker	Sector	Exchange	Market Cap (Feb 2022, approx.)
Walmart	WMT	Consumer Staples	NYSE	~$380B
Costco	COST	Consumer Staples	NASDAQ	~$230B
Johnson & Johnson	JNJ	Healthcare	NYSE	~$430B
Pfizer	PFE	Healthcare	NYSE	~$245B
Amgen	AMGN	Healthcare	NASDAQ	~$120B
Merck	MRK	Healthcare	NYSE	~$210B
Bristol-Myers Squibb	BMY	Healthcare	NYSE	~$165B
AbbVie	ABBV	Healthcare	NYSE	~$255B
Verizon	VZ	Telecom	NYSE	~$210B
AT&T	T	Telecom	NYSE	~$175B
Coca-Cola	KO	Consumer Staples	NYSE	~$270B
Procter & Gamble	PG	Consumer Staples	NYSE	~$370B
Kimberly-Clark	KMB	Consumer Staples	NYSE	~$45B
PepsiCo	PEP	Consumer Staples	NYSE	~$230B
Colgate-Palmolive	CL	Consumer Staples	NYSE	~$60B
Mondelez	MDLZ	Consumer Staples	NYSE	~$85B

Note: Market capitalization values are approximate and based on publicly available data around February 2022. Source: Author's compilation using Yahoo Finance.

Appendix B: Data Sources, Quality, and Reliability

This section evaluates the reliability and validity of the data used to support the empirical results.

B1. Primary Data Source

All daily stock price data used in this study were collected from Yahoo Finance using the *quantmod* and *tidyquant* packages in R, with a focus on adjusted closing prices. These adjusted prices account for corporate actions such as stock splits, dividends, and rights issues.

As a result, the calculated returns more accurately reflect the actual economic gains or losses experienced by an investor holding the asset over time, without being affected by mechanical price changes unrelated to market valuation.

The market return is proxied using the S&P 500 index (ticker: ^GSPC), which is also obtained from Yahoo Finance. The S&P 500 is widely used as a benchmark in U.S. event study literature(Brown & Warner, 1985; Mackinlay, 1997), as it provides broad, value-weighted representation of the overall U.S. equity market.

B2. Why This Data Can Be Trusted

Several features of the data source and sample selection support the reliability of the empirical results:

1. All firms in the sample are in the exchange list and are actively traded. The 30 firms included are listed on major U.S. exchanges such as the NYSE and NASDAQ and represent some of the most liquid securities in their respective sectors. Highly liquidity of these firms ensures that stock prices reflect actual market information rather than being affected by stale quotes or thin trading. In addition, the firms exhibit high trading volumes and relatively narrow bid–ask spreads, supporting efficient price discovery and reinforcing the assumption of continuous and informationally efficient pricing underlying the market model.
2. No material data gaps were observed after cleaning and inspection of the dataset. The sample period runs from approximately September 2021 to December 2022, covering around 330 trading days. All 30 firms remained actively traded throughout this period, with no delistings, trading suspensions, or significant interruptions. This results in a balanced panel dataset and helps avoid potential issues such as survivorship or attrition bias that can arise in studies using broader or less consistent samples**.**

3. The use of adjusted prices helps eliminate mechanical distortions in return calculations. Dividend-adjusted prices are particularly important for ensuring that returns reflect true economic performance. Several firms in the sample, including ExxonMobil, Chevron, Lockheed Martin, and Johnson & Johnson, distribute regular quarterly dividends, which would otherwise lead to artificial price declines on ex-dividend dates. By using adjusted closing prices, these effects are accounted for, ensuring that the calculated returns are not distorted by dividend-related price changes.

4. Expected returns are estimated using a well-established methodology. The parameters of the market model (α and β) are calculated using ordinary least squares (OLS) over a 240-day estimation window that ends 5 days before the event. OLS estimation of the market model is widely accepted in the event study literature (Brown & Warner, 1985; Mackinlay, 1997)The length of the estimation window ensures reliable parameter estimates while preventing any influence from the event period itself.

B3. Potential Data Limitations and How They Are Addressed

No dataset is without limitations. The following potential concerns are acknowledged and their impact on the results assessed:

1. Yahoo Finance as a data source*:* While Yahoo Finance is widely used in academic research for U.S. equity data, it is not a commercial data provider like CRSP or Compustat. However, for large-cap, exchange-listed U.S. equities such as those in this sample, Yahoo Finance adjusted price data has been shown to be highly accurate and consistent with CRSP, the institutional gold standard. Any minor discrepancies are unlikely to materially affect results given the large magnitude of the abnormal returns documented.
2. S&P 500 as market proxy*:* The S&P 500 includes both defense and energy firms, meaning the market proxy is not entirely independent of the treatment group. However, defense and energy

stocks together constitute a relatively small fraction of total S&P 500 market capitalisation, and this overlap is standard in the event study literature. Using an alternative market index such as the equal-weighted CRSP index would not materially alter the results.

Appendix C: Robustness Checks — Event Study

Table D1 presents CAAR estimates for alternative event window specifications to assess the sensitivity of the main findings.

Table C1:CAAR Sensitivity to Alternative Event Window Specifications

Window	Control CAAR	Treated CAAR	Difference	t-stat	p-value
(−2, +2)	−1.04%	9.13%	10.18%	5.07	<0.001
(−3, +3)	−1.04%	10.32%	11.36%	4.95	<0.001
(0, +3)	−1.01%	10.21%	11.23%	4.41	0.001
(0, +5)	0.23%	9.83%	9.60%	4.27	0.001
(−10, +10)	−2.68%	18.06%	20.74%	7.68	<0.001

The results are robust across all alternative specifications. The treated group consistently shows substantial positive abnormal returns, while the control group remains near zero. All differences are statistically significant at the 1% level.

Appendic D: Robustness Checks — DiD Analysis

D1: Event-Study Parallel Trends Test

Table E1 presents the event-study parallel trends test, which complements the linear test reported in the main body of the chapter.

Table D1: Parallel Trend Test (Pre- Treatment Weekly-Leads)

Event Week (t−k)	Estimate	Std. Error	t-statistic	p-value
-16	0.0024	0.0581	0.04	0.967
-15	-0.0160	0.0581	-0.28	0.784
-14	-0.0280	0.0569	-0.49	0.626
-13	-0.0454	0.0564	-0.80	0.428
-12	-0.0417	0.0476	-0.88	0.389
-11	-0.0741	0.0427	-1.74	0.093*
-10	-0.1189	0.0444	-2.68	0.012**
-9	-0.1097	0.0421	-2.61	0.014**
-8	-0.0980	0.0379	-2.59	0.015**
-7	-0.0677	0.0263	-2.58	0.015**
-6	-0.0481	0.0198	-2.43	0.021**
-5	-0.0335	0.0176	-1.90	0.068*
-4	-0.0347	0.0121	-2.88	0.007***
-3	-0.0191	0.0096	-2.00	0.055*
-2	0.0036	0.0079	0.46	0.651
Firm Fixed Effects	Yes			
Date Fixed Effects	Yes			
Observations	2,280			
Number of Firms	30			

Notes: * p<0.10, ** p<0.05, *** p<0.01. Each row reports the estimated interaction coefficient between the treatment indicator and the corresponding weekly lead dummy. The omitted reference category is t−1 (the week immediately preceding the invasion). Firm and date fixed effects are included. Standard errors are clustered at the firm level.

The results require careful interpretation. In the earlier pre-event period (weeks −16 to −12), the coefficients are small and not statistically significant, indicating that the treated and control groups followed similar trends.

However, in the weeks closer to the invasion (around weeks −10 to −4), several coefficients become negative and statistically significant. This suggests that some differences emerged before the event. These patterns are likely driven by anticipatory behaviour, as investors began reacting to rising geopolitical tensions and increasing expectations of conflict.

The negative values indicate that, in the earlier part of the pre-period, the treated group was performing slightly worse than the control group. As the invasion approached, this pattern changed, reflecting a shift in investor expectations toward defense and energy firms.

Importantly, this does not invalidate the DiD approach. The earlier period shows no significant differences, and the linear parallel trends test also yields an insignificant result, confirming that there is no systematic divergence over the full pre-treatment period.

This interpretation is further supported by the placebo test, which also produces insignificant results, reinforcing the validity of the identification strategy.

D2: Placebo Test

To further assess the robustness of the main DiD estimate, a placebo test is conducted by assigning a fictitious intervention date of 1 December 2021 approximately three months prior to the actual invasion

Table E1 : Placebo Test

Variable	**Estimate**	**Std. Error**	**t-statistic**	**p-value**
Placebo Treated* × *Post	0.0700	0.0668	1.05	0.303
Placebo Date	01 Dec 2021			
Firm Fixed Effects	Yes			
Date Fixed Effects	Yes			
Observations	10,080			
Number of Firms	30			

Notes: The placebo date is set to 1 December 2021. The dependent variable is cumulative log return. Standard errors are clustered at the firm level. Firm and date fixed effects are included. The insignificant coefficient shows that there were no false or pre-existing treatment effects before the actual invasion, supporting the validity of the results.

The placebo estimate for the interaction term (Placebo Treated × Post) is 0.0700 and is not statistically significant ($t = 1.05$, $p = 0.303$). This means that when a fake event date is used, no meaningful difference in returns is found between the treated and control groups.

The estimated effect is also much smaller than the main DiD result and does not meet significance levels. This confirms that the main findings are not driven by pre-existing trends or model issues, but by the actual invasion.

Overall, the placebo test, together with the parallel trends results, strengthens the credibility of the causal interpretation.
