THE RUSSIAN-UKRAINE INVASION AND STOCK MARKET BEHAVIOUR: An Empirical Assessment of the European Market

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ABSTRACT

The Russia-Ukraine conflict has exacerbated disruptions in the world rrder, and has caused massive shocks for the global stock market after the outbreak of COVID-19 and the Iraq-Afghanistan war. The present research analysed the response of stock markets of European countries to the Russia –Ukraine war, considering the 33 major stock exchanges of the European market, using the event study approach. Further panel regression was also utilized based on 6534 variable-wise observations to evaluate the impact of specific determinants, such as fatalities and injury cases, geo-political risk, and volatility index, on abnormal returns of stock markets in European countries. The main findings of the study revealed that Hungary, Austria, Croatia, Portugal, Denmark, Switzerland, Serbia and Sweden were among the highly-affected European countries, yielding abnormal losses ranging from 6% to 11.1% during the event windows after the commencement of the war. The results of panel regression show that fatalities and injury and geo-political risk had statistically significant effect on abnormal returns of European stock markets. This study has practical implications for investors and policy makers to comprehend the tendency of the financial markets during distress periods.

Keywords: Russia-Ukraine war, Stock Market, Event study, Abnormal Returns
JEL classification: F30, G12, G14, G15

1. Introduction

The United Nations Charter, under Article 2(4) outlaws the “threat or use of force against the territorial integrity or political independence of any State, or in any other manner inconsistent with the Purposes of the United Nations." The UN definition of war is based on actions, not words. It includes any use of armed force, regardless of whether it is between States or between a State and a non-State actor (United Nations Office of Legal Affairs, 1945). The Russia-Ukraine conflict is an ongoing war that started in February 2022, after Russia invaded Ukraine. Russia has been accused of crimes against civilization, and the International Criminal Court (ICC) has opened an investigation. The battle triggered a human disaster which caused the displacement of thousands of persons from their homes. The United Nations estimates that more than 10 million people have abandoned their residences since the start of the conflict, and more than 3 million have departed the country. This invasion poses a great threat to the world economy (Chowdhury et al., 2024). The prices of crude and gas have risen significantly, and there are concerns about a global food crisis. The conflict has also disrupted supply chains, raising fears concerning inflation. The war in Ukraine is a significant geopolitical event, and it is difficult to estimate its long-term consequences. However, it is obvious that not only has the conflict had a devastating impact on Ukraine, but it has also had a significant impact on the global economy (Basdekis et al., 2022).

The conflict between Russia and Ukraine exemplifies how geopolitical events can affect stock markets (Hamouda et al., 2024). The war in eastern Ukraine has been ongoing since 2014, and has claimed the lives of over 14,000 people. In February 2022, Russia launched a full-scale invasion of Ukraine, marking a significant escalation of the conflict (Antonenko et al., 2024). Some analysts believe that Putin was motivated by a desire to restore Russia's sphere of influence in Eastern Europe. Experts are afraid that this war is going to be the biggest armed conflict in Europe after World War II (Chowdhury et al., 2024). Millions of people have been displaced from their homes, and thousands have been killed. The war has led to rising energy prices and food shortages. The major source of tension between Russia and Ukraine is Russia’s opinion that NATO is a threat to its security. The Russo-Ukrainian war of 2022 is a hypothetical battle between Russia and Ukraine based on the ongoing conflict in Eastern Ukraine that began in April 2014. Ukraine represents a potentially

direct competitive threat to Russia's energy exports, which is one of the critical reasons for the dispute and Russian annexation of Crimea (Johannesson & Clowes, 2022). Severe economic sanctions have been imposed on Russia by several countries and corporations around the world (Glambosky & Peterburgsky, 2022). Figure 1 shows month-wise fatalities and injuries due to the Russia-Ukraine war from February 2022 to May 2023.

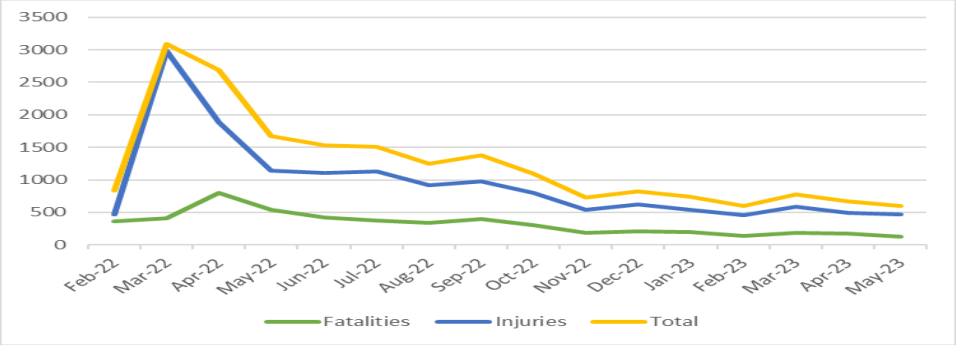


Figure 1: Month-wise Fatalities and Injuries due to Russia-Ukraine War

Source: Authors.

The Russia-Ukraine war has had a profound effect on European stock markets, largely due to its influence on geopolitical risk, energy prices, and investor sentiment. The outbreak of war in February 2022 triggered immediate market reactions, with European stock markets experiencing sharp declines. The uncertainty surrounding the conflict caused spikes in volatility, as measured by the VSTOXX index (which tracks European market volatility). Investors reacted to the unpredictability of the war's duration and outcomes, causing large oscillations in share prices, particularly in sectors sensitive to geopolitical risk. Studies (Ahmed et al., 2023; Basdekis et al., 2022) show that energy-dependent economies like Germany and Eastern European countries, which rely heavily on Russian natural gas, experienced higher market volatility due to fears of supply disruptions and rising energy prices. Ahmed et al. (2023) highlighted that geopolitical events, especially wars, lead to persistent shifts in market risk and return profiles. Their research on the Russia-Ukraine war confirmed that stock market volatility in European markets spiked

significantly, with varying impact across sectors. Basdekis et al. (2022) found that energy prices and geopolitical risks were major determinants of stock market returns during the conflict, particularly in the Eurozone. The study indicated that energy dependence heightened the exposure of specific European markets to the war.

1.1 Theoretical underpinning and contribution of the study

This study is related to two major theories of finance which are: portfolio selection theory by Markowitz (1952); and capital asset pricing theory (CAPT) propounded by Sharpe (1964). Portfolio selection theory is a foundational concept in modern finance that aims to optimize the balance between risk and returns when building an investment portfolio. This theory introduced a formal framework for making investment decisions by considering the diversification of assets, risk, and returns. The theory states that returns on a portfolio are uncertain but can be estimated. Investors should aim to maximize the expected returns for a defined level of risk. Risk is computed as the volatility (standard deviation) of the returns. Investors need to choose their level of risk tolerance and then identify portfolios that maximize returns for that level of risk. Markowitz's work earned him the Nobel Prize in Economics in 1990 and became the foundation for many modern investment strategies and risk management techniques. The theory is used by numerous financial scientists such as Mirza et al. (2021), Silva and Moreno (2021), Thompson and Edwards (2023), and Wong and Patel (2023).

The CAPT improves on the relation between risk and expected returns by adopting the optimal asset portfolio of the Markowitz's model (Olayungbo et al., 2024). It is a financial theory that explains the relationship between risk and expected returns on assets, particularly stocks. It is widely applied to calculate the expected returns on an asset, given its risk compared to the market, and to evaluate the required returns on an investment in order to decide if it is worth taking the risk. CAPT helps to forecast expected returns on an asset based on its risk in relation to the broader market. Sharpe, along with others who contributed to this theory, was awarded the Nobel Prize in Economics in 1990 for this work. The theoretical foundation of many research studies have been formulated based on the CAPT; the main studies include Patel and Singh (2021), Karolyi and Stulz (2021), Banerjee and Kumar (2021), Petkov and

Saito (2022), Ghosh and Sharma (2022), Efayena and Olele (2023), Verma et al. (2022), Olowookere and Tijani (2023), Elu (2022), Sharma et al. (2023).

The present study contributes to the rapidly-emerging literature that evaluates how political risks and geopolitical events (such as the Russia-Ukraine war) affect stock markets. This study contributes to the literature in various ways. It seeks to contribute to an inclusive understanding of the repercussions of war on the vital stock markets. It also attempts to help decision-makers in formulating effective plans/ strategies to mitigate risks and capitalize on emerging opportunities in the context of an evolving geopolitical landscape.

1.2 Statement of problem for the research

The outbreak of the Russia-Ukraine war in early 2022 introduced unprecedented geopolitical risks into global financial markets, disrupting stock market performance across multiple regions. The war has triggered sharp volatility, particularly in sectors like energy, defence, and commodities, while also leading to increased uncertainty among investors. Given the interconnected nature of global markets and the heavy reliance of many countries on Russian energy supplies and Ukrainian exports (such as agricultural products), the war has had cascading effects on inflation, supply chains, and investor sentiment. The challenge for investors and policymakers is to understand how this ongoing geopolitical crisis influences market risk, the correlation between assets, and the performance of different sectors. Furthermore, there is a critical need to assess whether traditional asset pricing models like the portfolio selection theory and CAPT can adequately explain stock market returns under such extreme conditions and to capture the risks associated with war.

In light of the above-mentioned motivation, our study, with a focus on European stock markets, attempts to achieve the following objectives: 1) inspect the reaction of the European stock market to the shock of the Russia-Ukraine war in the short and long terms; and 2) analyse the association between the determinants of the European stock markets' abnormal returns. The structure of the research paper is as follows. Section 2 examines the relevant

literature, while section 3 focuses on the methodology, followed by the analysis and interpretation in section 4 and the conclusion is presented in section 5.

2. Review of the Literature

The Russia-Ukraine war, which started on 24 February 2022, and the stock markets have been an exceedingly controversial subject among researchers in the field of finance and economics in the last two and a half years and researchers have gone to great lengths for impact assessment. Researches on how stock markets have responded to the Russia-Ukraine war have been conducted at the various country levels (Chowdhury et al., 2024; Hamouda et al., 2024; Izzeldin et al., 2023; Hasan et al., 2024; Ahmed et al., 2023; Höhler et al., 2024; Imeri et al., 2024; and Li et al., 2024), targeting the stock markets. These researches have demonstrated nearly similar results confirming the adverse impact of the war on the global financial market. A review of the main studies is presented in Table 1.

Table 1: Review of Main Studies on Russia-Ukraine War and Stock Markets

Author (Year)	Objective	Methodology	Main Findings
Hasan et al. (2024)	To determine whether traditional stock markets have been more volatile than fintech stock markets during the Russia-Ukraine war	✓ Event study ✓ 28 main countries	✓ They found that fintech stock markets were less volatile compared to traditional stock markets both during and prior to the Russia-Ukraine war. ✓ They also discovered that fintech market returns were higher than those of traditional markets both during and before the Russia-Ukraine war.
Höhler et al. (2024)	To investigate the impact of the invasion on stock prices, profitability and sentiments of agribusinesses along the food supply chain	✓ Event study ✓ Agribusiness firms, United States (30), Japan (19) and Europe (20)	✓ The findings show that firms in the food value chain were negatively impacted, with regional and sector-specific differences. ✓ Agribusiness firms in Europe and Japan were more negatively impacted by the war than those in the United States

Author (Year)	Objective	Methodology	Main Findings
Chowdhury et al. (2024)	To evaluate the effect of Russia–Ukraine war on global stock markets	✓ EGARCH Model and Event Study ✓ 12 stock exchanges from 6 continents	✓ The findings show the existence of substantial volatility and leverage outcome in all the markets. ✓ The results depict positive and substantial impact of the volatility index and adverse effect of oil on the ARs of the global stock markets.
Olayungbo et al. (2024)	To analyse the return correlation properties of oil prices on stock markets and their spillover effects in oil- European and exporting countries	✓ Static and dynamic Markov switching model	✓ The results indicate that stock price returns reacted significantly and positively to oil price returns only in the USA during the Russia-Ukraine war. In contrast, this relationship was significant and positive in Italy, Germany, and the USA during the COVID-19 pandemic. ✓ The study also reveals that in Nigeria, there is a significant spillover from the stock market to the oil market, whereas the opposite occurs in Saudi Arabia. Additionally, bi-directional volatility spillovers were observed in Germany, Italy, and the USA during the COVID-19 pandemic.
Yousaf et al. (2022)	To examine the effect of the Russia-Ukraine war on the G20 and other selected stock markets	✓ Event study ✓ G20 and relevant economies	✓ The country-wise analysis revealed negative returns in the stock markets of Hungary, Russia, Poland, and Slovakia during the pre-event days, while the post-invasion period saw adverse effects on the stock markets of Australia, France, Germany, India, Italy, Japan, Romania, South Africa, Spain, and Turkey. ✓ The regional analysis indicates that both the Asian and European regions experienced significant negative impacts.
Saini et al. (2023)	To analyse the influence of the Russia-Ukraine war	✓ Event study method	✓ The study revealed that India experienced negative average abnormal returns on the event day, which persisted until the fifth day after

Author (Year)	Objective	Methodology	Main Findings
	on the Indian economy		the event. In the automobile sector, negative abnormal returns continued until the tenth day of the event window.
Najaf et al. (2023)	To analyse the market reaction to the Russian invasion of Ukraine on the major European Union stock market indices	✓ Event study method ✓ Cross-sectional network analysis	✓ The study found that the event had a negative impact on stock market indices on the event day. However, Poland, Denmark, and Portugal showed positive cumulative abnormal returns following the event. In contrast, some developed nations showed no significant effect from the war event.
Martins et al. (2023)	To assess the short-term market impact of the onset of the military conflict between Russia and Ukraine on the largest European-listed banks	✓ Event study ✓ 100 top European listed banks	✓ The results indicate a stronger negative stock market reaction for Russian-listed banks and for foreign banks with significant exposure to Russia.
Mahran (2022)	To evaluate the impact of the Russia-Ukraine war on the volatility connectedness among sectors of the Egyptian stock market.	✓ DCC and GARCH method	✓ The research demonstrated that the level of connectedness among sectors in the Egyptian stock market fluctuates over time. On average, the dynamic connectedness among these sectors is 73.24%. However, during the Russia-Ukraine war, this average increased to 85.63%. ✓ The study also revealed that the transportation sector was the most significant net transmitter of volatility to other sectors during the Russia-Ukraine war.
Boubaker et al. (2022)	To analyse the effect of the 2022 Russian invasion of Ukraine on global equity markets	✓ Event study and cross sectional analysis	✓ The main findings of the study show that the Russia-Ukraine invasion led to negative cumulative abnormal returns for global stock market indices, though the effects varied across markets. ✓ Cross-sectional analysis indicates that economic globalization, measured by trade as a percentage of GDP, is negatively correlated with returns on

Author (Year)	Objective	Methodology	Main Findings
			the event day and in the post-event period.
Sun & Zhang (2023)	To study stock market reactions to the Russian invasion of Ukraine.	✓ Event study methods	✓ Country-level analysis confirms that firms in EU countries experienced a significant decline in cumulative abnormal returns, while firms in countries farther from the conflict zone were not notably affected. ✓ Sector-level analysis reveals that the manufacturing sector in EU countries has been significantly impacted by the war, with the finance and services sectors experiencing even greater negative effect than manufacturing.
Lo et al. (2022)	To observe the influence of the Russia-Ukraine war on financial markets, depending on a country's reliance on Russian commodities	✓ Event study analysis	✓ The study found that financial markets reacted strongly to the war-induced shock, with a greater impact on volatility than on asset prices. Markets viewed reliance on Russian commodities as a major risk factor, leading to declining stock returns and heightened instability. ✓ The impact of the war on returns was significant for countries with a dependency exceeding the 0–20% threshold, indicating that this level marks a threshold for negative effects on asset prices.

Source: Authors.

Previous researches have examined the consequences of the Russia-Ukraine war on the global stock market, and specific sectors like banks, agribusinesses, etc., yet a noticeable gap exists in the literature related to stock markets of European countries. Although a few studies have investigated volatility and herding behaviour in European stock markets during the Russia-Ukraine war, it is unclear how stock markets were impacted by this geopolitical event. The present research seeks to fill the gap in the existing literature while analysing the effect of the war on the stock markets of European nations. It also

evaluates the relationship between abnormal returns of the European stock markets and imperative factors such as fatalities and injuries due to war, geo-political risk, and volatility index, which is an uncovered area in the existing literature.

3. Methodology

3.1 Sample profile

This study considers all European countries as per the market classification given by Morgan Stanley Capital Investment (MSCI). The list of the selected stock exchanges from European nations and their foremost stock market indices are given in Table 2.

Table 2: List of Selected European Stock Exchange

S.No.	Country	Stock Exchange	Index
1.	Austria	Vienna Stock Exchange	ATX
2.	Belgium	Brussels Stock Exchange	BEL 20
3.	Bosnia and Herzegovina	Sarajevo Stock Exchange	SASX-10
4.	Bulgaria	Sofia Stock Exchange	SOFIX
5.	Croatia	Zagreb Stock Exchange	CROBEX
6.	Czech Republic	Prague Stock Exchange	PX
7.	Denmark	Nasdaq Copenhagen	OMXC20
8.	Estonia	Nasdaq Tallinn	OMXT All Share
9.	Finland	Nasdaq Helsinki	OMXH25
10.	France	Euronext Paris	.
11.	Germany	Deutsche Boerse AG	.DAX
12.	Greece	Athens Stock Exchange	Athens Composite Index (ASE)
13.	Hungary	Budapest Stock Exchange	BUX
14.	Iceland	Iceland Stock Exchange	OMX Iceland 15
15.	Italy	Borsa Italiana	FTSE MIB
16.	Latvia	Nasdaq Riga	OMX Baltic Benchmark Index

S.No.	Country	Stock Exchange	Index
17.	Lithuania	Nasdaq Vilnius	OMX Vilnius Index
18.	Malta	Malta Stock Exchange	MSE Share Index
19.	Montenegro	Montenegro Stock Exchange	MOEX Index
20.	Netherlands	Euronext Amsterdam	AEX Index
21.	Norway	Oslo Stock Exchange	OBX
22.	Poland	Warsaw Stock Exchange	WIG20 Index
23.	Portugal	Euronext Lisbon	PSI-20 Index
24.	Romania	Bucharest Stock Exchange	BET Index
25.	Russia	Moscow Exchange	MOEX
26.	Serbia	Belgrade Stock Exchange	BELEX
27.	Slovakia	Bratislava Stock Exchange	BSSE Index
28.	Slovenia	Ljubljana Stock Exchange	SBI TOP 20
29.	Spain	Bolsa De Madrid	IBEX 35
30.	Sweden	Nasdaq Stockholm	OMXS30
31.	Switzerland	Six Swiss Exchange	SMI
32.	UK	London Stock Exchange	FTSE 100
33.	Ukraine	Ukrainian Exchange (UX)	UX Index

Source: MSCI market classification.

3.2 Sources of data and study period

The study used secondary data collected from authorized sources like websites of respected stock exchanges and WHO, databases, news reports, etc. The event date is considered to be February 14, 2022 for event study methodology when the Russia-Ukraine war started, and a period of 198 days (February14, 2022 to December 31, 2022) after the commencement of the war is taken as the study period for the panel regression methodology.

3.3 Event study

The study employed the event study approach to analyse the data. The daily closing prices were calculated using the following formula:

$$R_{ct} = 1n\ (P_{ct}/P_{ct\text{-}1})$$

where: R_{ct} represents the daily index return of the stock for country *c*, at time *t*, and P_{ct} and P_{ct-1} denote the stock market index prices for country *c* on a daily basis at times *t* and *t*−1, respectively.

Event study predominantly investigates the consequence of an event or a set of events on the worth of an asset like stock prices, bond prices, stock market indices, commodity prices, stock prices, exchange rates, etc. The method of event study is derived from the "efficient market hypothesis" propounded by Fama (1970), which states that: as the latest information is introduced to the market**,** investors analyse its present and future impact on the market and stocks. The response to the announcement of the conflict is calculated by forecasting a "normalized" return for all stock indices during the "event window" and then subtracting this normalized return from the actual return observed on the event day and the subsequent days.

Accordingly:

$$AR_{c,t} = R_{c,t} - E(R_{c,t})$$

where: $AR_{c,t}$ is the Abnormal Return or the Excess Return of stock market index of the country '*c*' at time *t*, $E(R_{c,t})$ is the Expected Return of stock market index of country '*c*' at time *t*.

The abnormal returns of the event day can be utilized to assess how quickly investors react to the occurrence of the terrorist attack. Cumulative returns in the following days or weeks may provide a clearer picture of the market's resilience and ability to recover from the attack. Therefore, it would be interesting to test whether the cumulative abnormal return (CAR) equals zero in each event window after constructing the abnormal return time series. This would help determine if the CAR is significantly different from zero on the event date and throughout the event window. The event method is considered to be the most suitable and dependable method for evaluating how geopolitical and pandemic events impact the financial markets and the same method is

applied in numerous studies (Pirgaip, 2021; Škrinjarić, 2021; Varma et al., 2021; Sayed & Eledum, 2021; Ji et al., 2022; Verma et al., 2022).

3.3 Panel regression method

The study used panel regression to evaluate the impact of the fatalities and injuries due to the Russia-Ukraine war, geo-political risk, the volatility index, on the ARs of various stock markets of European countries. The model has been constructed following the studies by Al-Awadhi et al. (2020), Liu et al. (2020), and Sharma et al. (2023), in which abnormal returns during the spread of COVID-19, was considered the dependent variable, and impact was measured of other specific determinants. These variables are employed in the model because of their connectedness to the uncertainty of the Russia-Ukraine war and their considerable relationship with the stock market. The fatalities and injuries show the severe intensity of war; the geo-political risk is a response variable for instability and conflict, and the volatility index measures the investors' attitude toward the event, the Russia-Ukraine war. The model used in the study and the description of the variables are as follows:

$$LN\_AR_{it} = \alpha + \beta_1 LN\_FAIJ_{it} + \beta_2 LN\_GEOR_{it} + \beta_3 LN\_VIX_{it} + \varepsilon_{it}$$

The description of the variables is given in Table 3. The abnormal returns of the country are computed through the event study methodology. The cases of fatalities and injuries data during the Russia-Ukraine war have been taken from the International Crisis Group database and Statista website. The data for geopolitical risk index (GPR) was collected from the index developed by Caldara and Iacoviello (2022), based on the share of newspaper articles mentioning geopolitical tensions, containing specific words in newspaper articles related to geopolitical risks. The Chicago Board Options Exchange Volatility Index (CBOE VIX) which computes the implied volatility based on the S&P 500 index has been taken as proxy for the volatility index.

Table 3: Variable Descriptions

Variable Acronym	Description	Source of Variables
Dependent Variable		

LN_AR	Log of Abnormal Returns	Verma et al., 2022; Mishra & Mishra, 2020; Sharma et al., 2023
Independent Variables		
LN_FAIJ	Log of Total Cases of Fatalities and Injuries	Singh et al., 2020; Mishra & Mishra, 2020
LN_GEOR	Log of Geopolitical Risk	Caldara & Iacoviello, 2022
LN_VIX	Log of Volatility Index	Chowdhury & Abedin, 2020; Hoffmann & Neuenkirch, 2017

Source: Authors.

The panel regression is applied to achieve the objective of the study, where 33 stock markets are considered as a cross section and 198 days after the commencement of war as time series. The number of observations for the panel is 6,534 and the Hausman test is employed to select the appropriate model between the fixed effects and random effects models.

4. Analysis and Interpretation

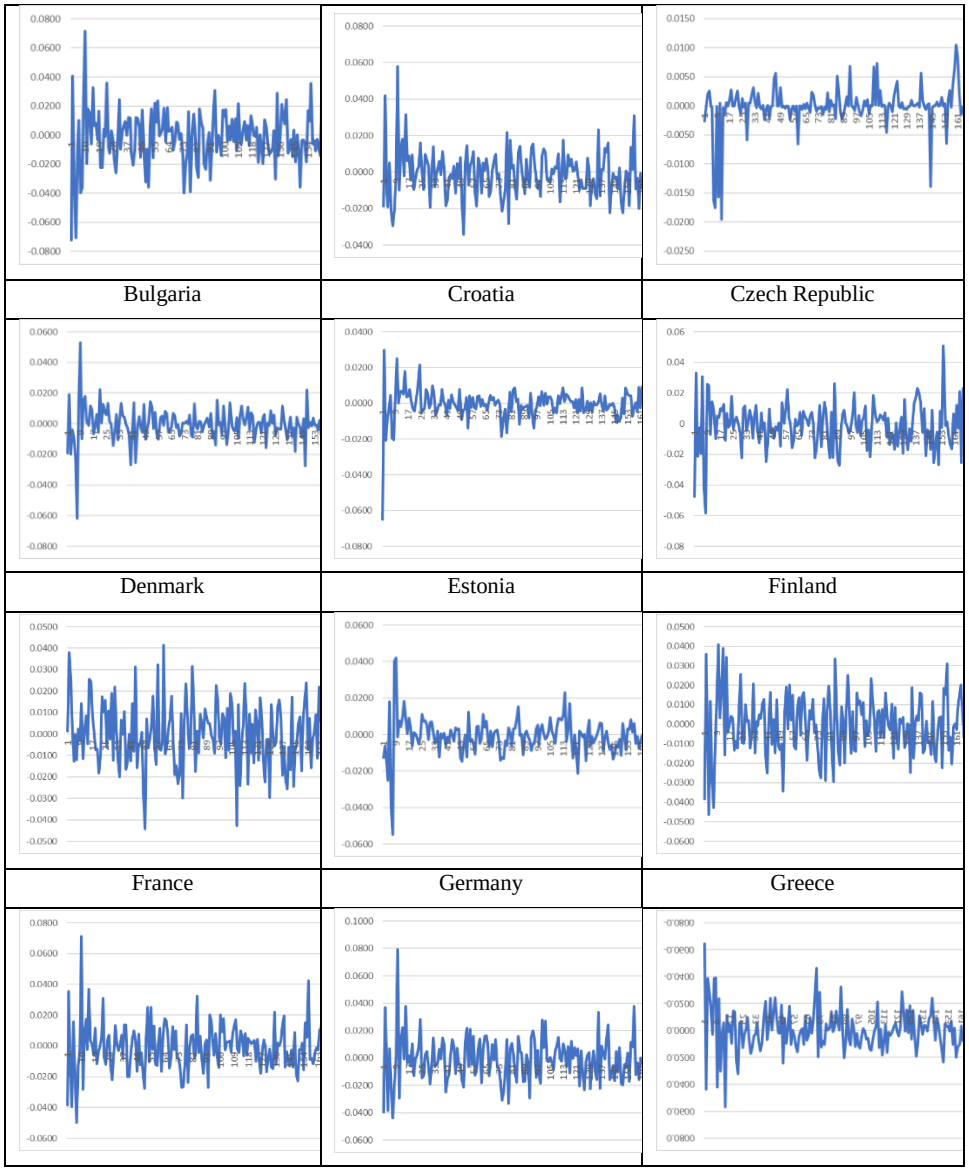
This section has been divided into two segments, i.e. results related to the event study methodology and results related to the panel regression.

4.1 Results related to event study methodology

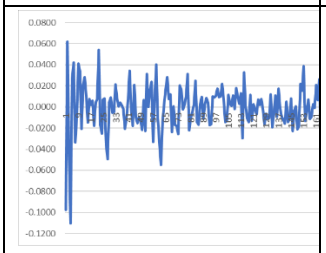
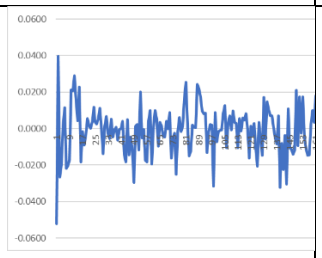
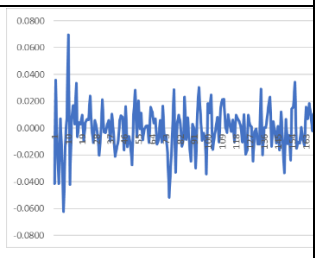
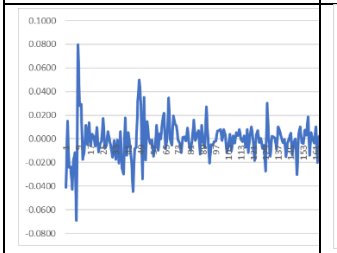
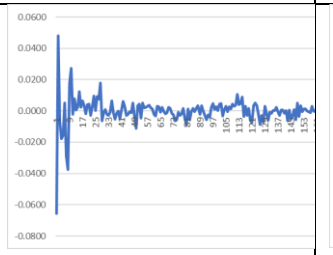
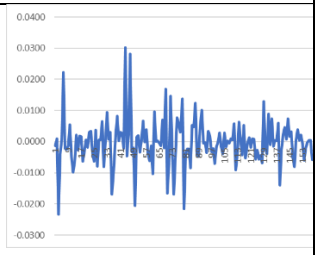
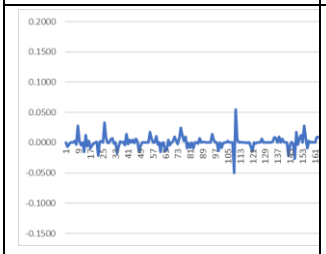
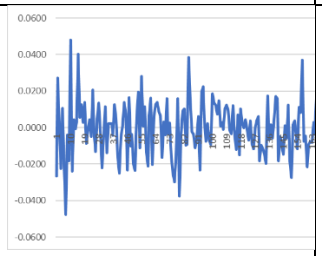
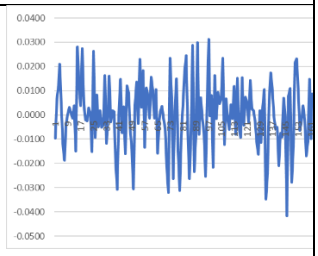
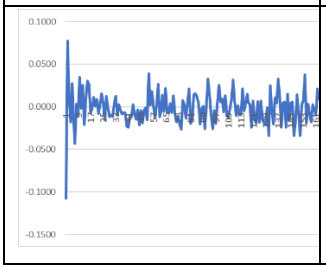
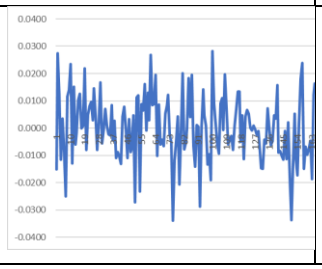
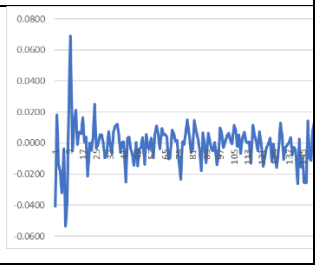
The event study is applied to evaluate the effect of the event of the Russia-Ukraine war on the European stock markets in the short term as well as the long term periods. Figure 2 provides the daily returns charts of various European stock markets during the Russia-Ukraine war. It can be observed that the majority of the European stock markets were declined due to the announcement effect of the Russia-Ukraine war.

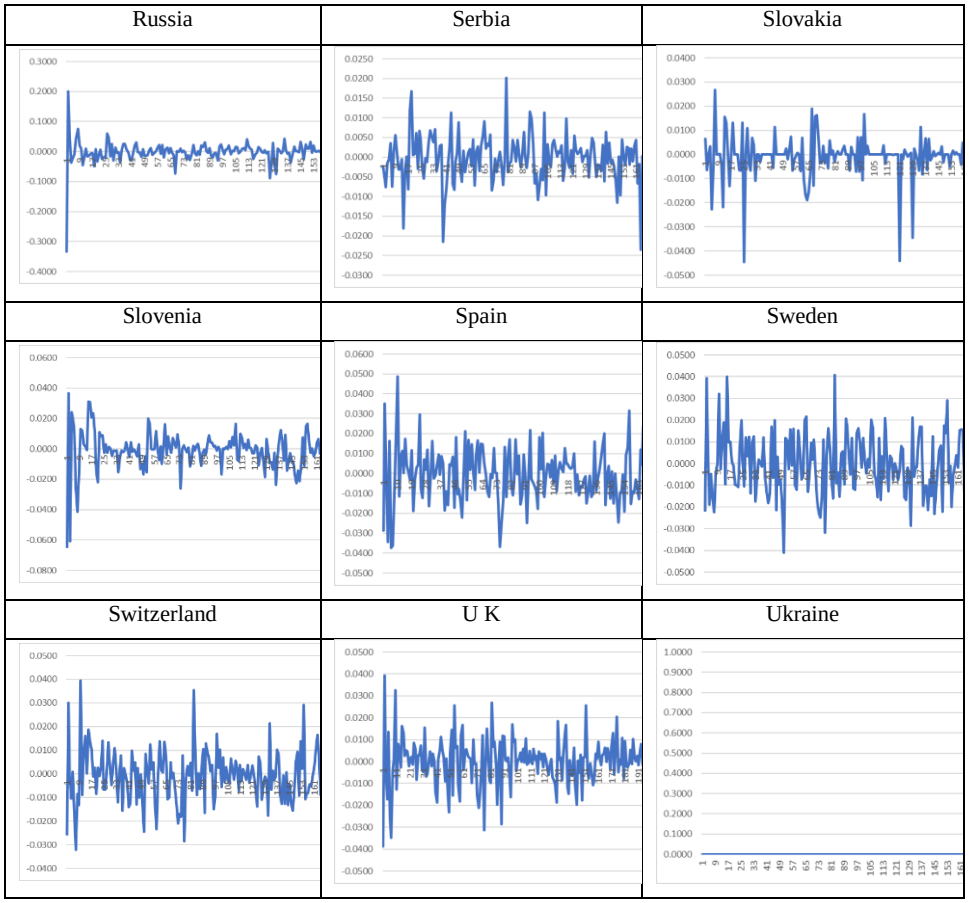
Figure 2: Daily Returns of Major European Stock Markets

Austria	Belgium	Bosnia and Herzegovina



Bulgaria	Croatia	Czech Republic
Denmark	Estonia	Finland
France	Germany	Greece

Hungary	Iceland	Italy
		
Latvia	**Lithuania**	**Malta**
		
Montenegro	**Netherland**	**Norway**
		
Poland	**Portugal**	**Romania**
		



Source: Authors

Table 4 shows the abnormal returns of the European stock markets before and after 5 days of the event, i.e. the Russia-Ukraine war. It was quite definite that Russia would attack Ukraine in early February 2022. Due to the anticipation of war and increasing risk, major stock markets across the globe, including the European stock markets, were continuously falling.

Table 4: Abnormal Returns during Event Window of -5 to +5

Country	Abnormal Returns										
	-5	-4	-3	-2	-1	0	1	2	3	4	5
Austria	-0.008	-0.025	-0.012	-0.014	-0.025	-0.010	0.012	-0.027	-0.011	0.019	-0.008
Belgium	-0.004	-0.022	-0.004	-0.011	-0.025	0.002	-0.003	-0.020	0.002	0.019	-0.003
Bosnia and Herzegovina	-0.006	-0.023	-0.010	-0.012	-0.024	-0.003	0.008	-0.023	-0.004	0.020	-0.009
Bulgaria	-0.006	-0.023	-0.009	-0.010	-0.022	0.001	0.005	-0.020	-0.003	0.022	-0.005
Croatia	-0.008	-0.026	-0.009	-0.015	-0.022	-0.019	0.015	-0.029	-0.006	0.019	-0.008
Czech Republic	-0.006	-0.024	-0.010	-0.012	-0.024	-0.003	0.008	-0.024	-0.004	0.020	-0.009
Denmark	-0.005	-0.020	-0.007	-0.012	-0.023	-0.003	0.001	-0.028	-0.004	0.023	-0.009
Estonia	-0.005	-0.023	-0.008	-0.011	-0.025	-0.002	0.009	-0.022	-0.002	0.019	-0.006
Finland	0.000	-0.021	-0.005	-0.007	-0.022	0.012	-0.006	-0.019	0.014	0.016	0.003
France	-0.006	-0.023	-0.008	-0.012	-0.024	0.001	0.005	-0.022	0.000	0.019	-0.007
Germany	-0.006	-0.023	-0.009	-0.012	-0.024	-0.001	0.007	-0.023	-0.002	0.020	-0.008
Greece	-0.006	-0.023	-0.010	-0.012	-0.024	-0.003	0.009	-0.024	-0.004	0.020	-0.009
Hungary	-0.007	-0.026	-0.014	-0.013	-0.025	-0.015	0.016	-0.029	-0.018	0.024	-0.004
Iceland	-0.006	-0.023	-0.009	-0.012	-0.024	-0.002	0.008	-0.023	-0.004	0.020	-0.009
Italy	-0.006	-0.024	-0.010	-0.012	-0.024	-0.003	0.008	-0.024	-0.004	0.020	-0.009
Latvia	-0.006	-0.024	-0.009	-0.012	-0.024	0.001	0.007	-0.022	-0.002	0.024	-0.007
Lithuania	-0.005	-0.023	-0.006	-0.013	-0.024	0.010	-0.001	-0.022	0.000	0.023	-0.010
Malta	-0.006	-0.024	-0.010	-0.012	-0.024	-0.003	0.008	-0.024	-0.004	0.020	-0.009

Country	Abnormal Returns										
	-5	-4	-3	-2	-1	0	1	2	3	4	5
Montenegro	-0.006	-0.023	-0.010	-0.012	-0.024	-0.003	0.008	-0.024	-0.004	0.020	-0.009
Netherland	-0.005	-0.022	-0.006	-0.012	-0.023	0.001	0.004	-0.024	0.000	0.019	-0.006
Norway	-0.006	-0.023	-0.009	-0.012	-0.024	-0.003	0.008	-0.024	-0.005	0.020	-0.008
Poland	-0.003	-0.021	-0.003	-0.014	-0.019	0.018	-0.007	-0.026	0.000	0.015	-0.007
Portugal	-0.006	-0.024	-0.012	-0.013	-0.025	-0.005	0.011	-0.022	-0.005	0.021	-0.010
Romania	-0.005	-0.022	-0.008	-0.011	-0.023	-0.001	0.009	-0.022	-0.002	0.022	-0.008
Russia	-0.007	-0.021	-0.007	-0.004	-0.025	0.021	-0.006	-0.027	-0.001	0.022	-0.008
Serbia	-0.006	-0.023	-0.010	-0.013	-0.025	-0.003	0.008	-0.024	-0.004	0.020	-0.009
Slovakia	-0.006	-0.023	-0.010	-0.012	-0.024	-0.003	0.008	-0.024	-0.004	0.021	-0.009
Slovenia	-0.006	-0.021	-0.005	-0.003	-0.017	0.019	-0.004	-0.003	-0.012	0.015	-0.012
Spain	-0.006	-0.024	-0.010	-0.012	-0.024	-0.003	0.009	-0.024	-0.004	0.020	-0.009
Sweden	-0.001	-0.017	-0.003	-0.013	-0.020	0.005	-0.006	-0.026	0.003	0.022	-0.003
Switzerland	-0.007	-0.024	-0.010	-0.012	-0.024	-0.005	0.011	-0.024	-0.005	0.020	-0.010
U K	-0.005	-0.023	-0.009	-0.012	-0.024	0.004	0.001	-0.023	0.000	0.018	-0.004
Ukraine	-0.006	-0.023	-0.010	-0.012	-0.024	-0.003	0.008	-0.024	-0.004	0.020	-0.009

Source: Authors.

It can be observed from the table that average abnormal loss of 33 European stock markets was 2.28 on Day -3, 1.15% on Day -2 and 2.35% on Day -1 to the event. All the European stock markets showed abnormal losses during the 3 days prior to the event, continued to show the same on the event day and during the 2 days after the event. Country-wise analysis showed that the highest abnormal losses observed were: -2.9% for Croatia on Day 2 after the event, followed by -2.6% also for Croatia on Day 4 before; -2.5% for Austria on Day 1 before; -1.9% for Croatia on event day; -1.8% for Hungary on Day 3 after; -1.5% for Croatia on Day 2 before; -1.4% for Hungary on Day 3 before and -1.2% for Slovenia on Day 5 after the event.

Table 5 shows the severely-affected European stock markets due to the Russia-Ukraine war in terms of cumulative abnormal returns during the short term window of -2 to +2; -3 to +3, -4 to +4 and -5 to +5. Although various stock markets of Europe were in the red due to the Russia-Ukraine war, the event was terrible for countries like Hungary, Austria, Croatia, Portugal, Denmark, Switzerland, Serbia and Sweden. During the evemt window of -2 to +2, the highest cumulative abnormal loss (-7%) was observed for Croatia. The same was highest for Hungry in all the other windows, i.e. -3 to +3 (-9.8%), -4 to +4 (-10%) and -5 to +5 (-11.1%). Austria and Croatia also featured on the list of severely-affected European nations during all the event windows with the highest cumulative abnormal losses.

Table 5: Severely-affected European Stock Markets during Various Short-term Windows

	-2 to +2 Days		-3 to +3 Days		-4 to +4 days		-5 to +5 Days
Croatia	-0.070	Hungary	-0.098	Hungary	-0.100	Hungary	-0.111
Hungary	-0.066	Austria	-0.087	Austria	-0.093	Austria	-0.109
Denmark	-0.065	Croatia	-0.085	Croatia	-0.092	Croatia	-0.108
Austria	-0.064	Denmark	-0.076	Portugal	-0.074	Switzerland	-0.090
Sweden	-0.060	Portugal	-0.071	Serbia	-0.074	Portugal	-0.090

Source: Authors

Table 6 shows the cumulative abnormal returns of the European stock markets during various event windows before and after the commencement of the Russia-Ukraine war. While observing the event window of -50 to 0 days prior to the war, it was observed that the most severely-affected stock markets were Hungry (-28.2%), Austria (-27.3%), Croatia (-27%), Switzerland (-26.6%) and Portugal (-26.3%) due to the expectation of transformation of the conflict into war between Russia and Ukraine. During the immediate event window of commencement of the war (1-50 days), the highest abnormal losses were observed for the markets of Austria (-28.9%), Hungary (-28.8%), Croatia (-27.7%), Bosnia and Herzegovina (-27.6%) and Serbia (-27.3%). These mentioned abnormal losses were found to be significant also. Most of the European stock markets recovered from the abnormal losses during the event window of 51 to 100 days as 78.78% of the showed abnormal gain. All the European markets reflected abnormal gains ranging from 4% to 17.1% during the event window of 101 to 200 days, which shows full recovery of the abnormal loss due to the Russia-Ukraine war. The results of the event study methodology show adverse market responses to the geopolitical event, the Russia-Ukraine War, in line with the study of Verma et al. (2022), Mishra & Mishra (2022), and Sharma et al. (2023).

Table 6: CARs of European Stock Markets during Various Long-term Windows

	CAR (P value)			
	-50 to 0 days	1-50 days	51- to 100 days	101 to 200 days
Austria	-0.273 (.009)	-0.289 (.006)	-0.009 (.929)	0.058 (.683)
Belgium	-0.239 (.015)	-0.258 (.009)	0.024 (.804)	0.066 (.625)
Bosnia and Herzegovina	-0.261 (.006)	-0.276 (.004)	-0.003 (.968)	0.056 (.668)
Bulgaria	-0.242 (.013)	-0.257 (.008)	0.008 (.937)	0.076 (.563)
Croatia	-0.270 (.004)	-0.277 (.003)	-0.027 (.765)	0.040 (.750)
Czech Republic	-0.259 (.007)	-0.267 (.006)	0.001 (.992)	0.060 (.647)

	CAR (P value)			
	-50 to 0 days	1-50 days	51- to 100 days	101 to 200 days
Denmark	-0.225 (.040)	-0.267 (.016)	-0.008 (.944)	0.066 (.661)
Estonia	-0.246 (.021)	-0.259 (.015)	0.012 (.913)	0.071 (.625)
Finland	-0.200 (.049)	-0.227 (.026)	0.012 (.905)	0.053 (.705)
France	-0.248 (.015)	-0.252 (.013)	0.008 (.937)	0.059 (.668)
Germany	-0.253 (.014)	-0.262 (.010)	0.004 (.992)	0.058 (.661)
Greece	-0.258 (.012)	-0.267 (.010)	0.001 (.992)	0.061 (.661)
Hungary	-0.282 (.007)	-0.288 (.006)	0.002 (.984)	0.063 (.661)
Iceland	-0.257 (.009)	-0.265 (.007)	0.002 (.984)	0.063 (.634)
Italy	-0.258 (.013)	-0.267 (.010)	0.001 (.992)	0.062 (.661)
Latvia	-0.252 (.010)	-0.251 (.010)	-0.007 (.944)	0.063 (.639)
Lithuania	-0.232 (.014)	-0.260 (.006)	0.007 (.937)	0.055 (.668)
Malta	-0.257 (.008)	-0.266 (.007)	0.002 (.984)	0.061 (.647)
Montenegro	-0.258 (.009)	-0.266 (.007)	0.002 (.984)	0.061 (.654)
Netherland	-0.240 (.019)	-0.249 (.013)	0.006 (.952)	0.057 (.683)
Norway	-0.256 (.012)	-0.265 (.010)	0.002 (.984)	0.064 (.647)
Poland	-0.214 (.036)	-0.233 (.023)	0.009 (.929)	0.062 (.661)
Portugal	-0.263 (.010)	-0.266 (.009)	0.001 (.992)	0.053 (.705)

	CAR (P value)			
	-50 to 0 days	1-50 days	51- to 100 days	101 to 200 days
Romania	-0.200 (.038)	-0.206 (.032)	0.085 (.367)	0.171 (.187)
Russia	-0.222 (.043)	-0.251 (.023)	0.005 (.960)	0.062 (.683)
Serbia	-0.259 (.007)	-0.273 (.004)	0.000 (.999)	0.052 (.690)
Slovakia	-0.257 (.008)	-0.265 (.007)	0.003 (.976)	0.065 (.618)
Slovenia	-0.205 (.031)	-0.222 (.019)	0.023 (.804)	0.116 (.776)
Spain	-0.258 (.013)	-0.267 (.010)	0.001 (.992)	0.061 (.661)
Sweden	-0.186 (.075)	-0.237 (.024)	0.007 (.932)	0.076 (.597)
Switzerland	-0.266 (.007)	-0.272 (.006)	-0.005 (.952)	0.056 (.675)
U K	-0.250 (.011)	-0.255 (.010)	0.005 (.952)	0.068 (.611)
Ukraine	-0.258 (.005)	-0.266 (.003)	0.002 (.934)	0.061 (.618)

Source: Authors.

4.2 Results related to the panel regression

Panel regression was conducted to assess the impact of selected variables, including total fatalities and injury cases, geopolitical risk, and volatility index, on the abnormal returns of European stock markets. Table 7 shows the descriptive statistics of the study. Variable-wise, 6534 observations were taken into consideration to analyse the data. Transformation was done to streamline the data while taking log for all the variables. The mean was highest for fatalities and injury cases due to the war and lowest for geopolitical risk among the independent variables. The standard deviation which is a measurement of variability was highest for abnormal returns among all variables and for geopolitical risk among independent variables. The maximum figure was

negative only for abnormal returns and minimum was found to be negative for abnormal returns as well as geo-political risk.

Table 7: Descriptive Statistics

	LN_AR_	LN_FAIJ_	LN_GEOR_	LN_VIX_
Mean	-4.3533	7.2962	0.6826	3.1667
Median	-4.1341	7.3198	0.6931	3.1311
Maximum	-2.3399	8.0359	2.2343	4.4129
Minimum	-13.5903	6.5903	-1.6094	2.5771
Std. Dev.	1.1712	0.4306	0.7742	0.2839
Skewness	-1.7397	0.2292	0.1101	0.7979
Kurtosis	8.5942	2.2752	2.3834	4.6945
Observations	6534	6534	6364	6534

Source: Authors

Table 8 shows the results for the panel regression where ARs of the European stock markets were the dependent variables and fatalities and injury, geopolitical risk and volatility index were considered as independent variables. The p-value of the Hausman test statistics was 0.0000, which showed that the fixed effect model is an appropriate model. The constant coefficient was negative and significant, showing that abnormal returns would be harmful in the absence of variables. The finding reveals that fatalities and injury cases due to the Russia-Ukraine War and geo-political risk had statistically significant and positive coefficients while volatility index had a statistically insignificant and negative coefficient.

The findings of the panel regression results reveal that VIX had a negative coefficient (-0.0317), which indicates that investors of European stock markets had pessimistic expectations about the market after commencement of the Russia-Ukraine war even after various sanctions imposed by several countries. It had been hoped that the sanctions would bring about the termination of the war. The findings are in line with the results of Mishra and Mishra (2020). Geopolitical risk generally has significant and adverse impact on financial markets (Caldara & Iacoviello, 2022; Ahmed et al., 2023). In our results, the geopolitical risk's coefficient was positive (0.2681) and significant also to

abnormal returns, contradictory to Abbassi et al. (2022) and Choi (2022). The possible reason might be that geopolitical events invite corrections in the stock market and give opportunities to investors to buy at lower prices and generate returns in the future.

Table 8: Results of Panel Regression

Dependent Variable: AR	Fixed Effect		Random Effect	
	Coefficient	p-value	Coefficient	p-value
Constant	-5.8901	0.0000	-5.8334	0.0000
Ln_FAIJ	0.2000	0.0000	0.1905	0.0000
Ln_GEOR	0.2681	0.0000	0.0104	0.5885
Ln_VIX	-0.0317	0.7448	0.0279	0.5946
R^2	0.6533		0.5132	
Durbin-Watson	2.2376		2.2256	
F-Stat.	1.9188		11.0592	
(p-value)	(0.0000)		(0.0000	
Hausman Test Statistics				
Chi-Sq.	30.0594			
(p-value)	(0.0000)			

Source: Authors.

The study, based on the findings, provides valuable recommendations to policy makers as well as investors. Policy makers may give considerable attention to volatility and geopolitical risk while formulating policies, especially in problematic times such as the Russia-Ukraine war and the outbreak of COVID-19. Further, investors may decide to shift from market investment to safe havens during troubled times. Crises also provide opportunities to invest and generate returns for the future and investors would undertake in-depth analysis of country and sector-wise market reactions towards historical catastrophe events such as a global financial crisis, COVID-19 and the Russia-Ukraine war to select the best investment avenues.

5. Conclusion

This study investigated the impact of the Russia-Ukraine conflict on European stock markets and examined the relationship between abnormal returns in these markets and various determinants, including fatalities and injuries, geopolitical risk, and the volatility index. To achieve the study's objectives, the event study and panel regression approaches were utilized. The sample comprised 33 major stock exchanges across European markets, with daily returns from these indices analysed to gauge the response of the stock markets to the Russia-Ukraine war.

The findings indicate that major indices in European stock markets were affected by the Russia-Ukraine conflict, with Hungary, Austria, Croatia, Portugal, Denmark, Switzerland, Serbia, and Sweden being the most significantly impacted countries, which continued to experience abnormal losses for an extended period. Furthermore, the results from the panel regression analysis revealed that fatalities and injuries, as well as geopolitical risk, had a statistically significant impact on the abnormal returns of European stock markets. In contrast, the volatility index was found to have a negative association but did not significantly impact the returns.

The study's findings have practical implications for investors, portfolio managers, and policymakers, offering insights into stock market behaviour during turbulent periods and aiding in the formulation of portfolio and risk-hedging strategies. Additionally, future researchers are encouraged to explore the effects of this violent interstate conflict on stock markets in other global regions.

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