

How Does the Russia–Ukraine War Affect the Stock Market?– –An Empirical Study

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Abstract: The Russia–Ukraine war is one of the most topical affairs of the first quarter of 2022. This study investigates the responses of stock market indexes and commodities markets to the ongoing war between Russia and the Ukraine. Using daily adjusted index prices from 1 April, 2021 to 19 April, 2022, and drawing data regarding Russian exports from the United Nations' Comtrade database, we observe a negative relationship between the level of reliance on Russian exports and the change in daily (compound) returns. Our results indicate that this relationship was stronger during the two-week period after 22 April, 2022, than when a longer impact window (22 February – 19 April, 2022) is used. These results are consistent with existing studies on other major geopolitical events.

Keywords: Russia-Ukraine Conflict, Stock Market, Regression, Economic Integration, Exports.

1. Introduction

The Russia–Ukraine war is one of the most critical geopolitical events in recent times, considering economic markets. Russia is a country rich in natural resources, and is, in particular, a significant exporter of energy. In terms of its GDP, it was ranked as the eleventh most prominent country globally in 2020.

Since March 2021, Russia had been establishing military bases close to the Russia–Ukraine border. Despite repeatedly denying plans of invading Ukraine, fighting escalated in the south-eastern part of Ukraine, around Donbas. On 22 February 2022, President Vladimir Putin of Russia declared that the Minsk agreements were no longer valid. On the same day, the Federation Council unanimously authorised the use of military force in the territories. The impact on financial markets was evident: crude oil reached its highest levels since 2014 among supply concerns, while investors sold off numerous stocks in a short period after Russian troops were mobilised in parts of Ukraine [1]. These events came to light publicly in many newspaper headlines globally. Considering these events, we have chosen this day—22 February, 2022—as the event day for the purposes of this study.

This study aims to examine the impact of the Russia–Ukraine war on stock markets, and to determine whether industries related to Russian exports—specifically Brent crude oil, gold, and nickel—are affected by the war. We also investigate the level of economic integration with Russia amongst the countries we selected.

2. Data and Methodology

Our research examines the relationship between two things: Degrees of economic integration with Russia, Impact of the conflict on stock market indexes.

2.1. Measuring degrees of economic integration with Russia

For our empirical investigation, we first choose countries on different continents with sizeable stock markets as our sample. We choose countries with prominent stock markets because these markets have representable indexes; for example, the FTSE for the United Kingdom and the Dow Jones for the United States. These stock markets are likely to be reasonably efficient, reflecting any available information in stock prices at a reasonable speed. We will use these indexes to determine the extent to which various stock markets are affected by the war.

For the first part of the equation, each country's level of economic integration with Russia is represented by its percentage of imports from Russia; in other words, its degree of reliance on Russia for produced goods, as shown in Figure 1. This trade data were obtained from the United Nations' Comtrade database [2-3], which provides the value of specific goods shipped between countries. We used the 2020 annual trade data for ten types of goods. We have chosen these goods based on analysis on the OEC website [4] which uses the same underlying data from the United Nations Comtrade database. The total value of these ten products is shown in Table 1.

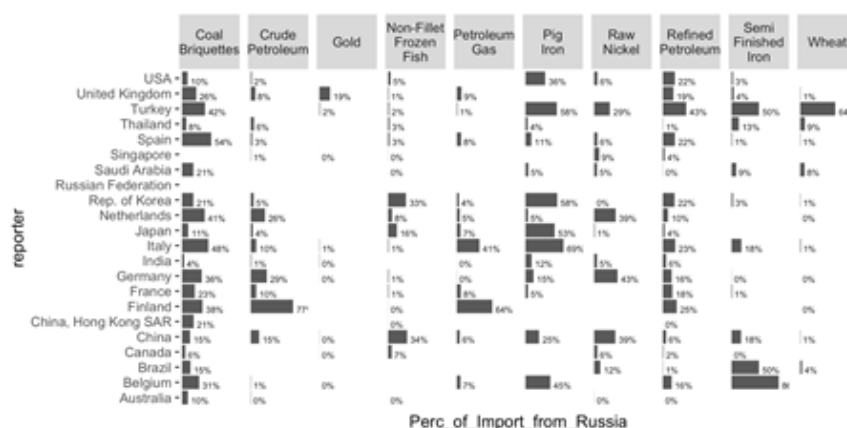


Figure1: Percentages of key imports from Russia by country and by type – 2020.

Table1: Values of total Russian exports in 2020 (per million USD).

Coal Briquet tes	Crude Petrole um	Gold	Non-Fillet Frozen Fish	Petrole um Gas	Pig Iron	Raw Nickel	Refine d Petrole um	Semi Finished Iron	Wheat	Total in 2020 (mil USD)
\$ 10, 897	\$ 56, 072	\$ 17, 664	\$ 2,3 34	\$ 12, 346	\$ 1,6 28	\$ 1,4 25	\$ 29, 225	\$ 3,27 1	\$ 1,6 98	\$ 136,560

Next, we investigated how much of each country's imports are from Russia, for each of these commodities. This is shown in the bar chart (Figure 1) as percentages. At the top of the list are all petroleum and fuel related commodities, such as crude petroleum, petroleum gas, and refined petroleum; this is followed by other commodities, including iron, gold, and raw nickel. For example, 29% of Germany's crude petroleum was imported from Russia in 2020, compared to 77% for Finland.

Finland was shown to be the most reliant on Russia's crude petroleum production, compared with the other countries on the list.

We then combined all these data into a single metric and named it the 'relationship indicator'. This metric is calculated by the following formula: Average % of each commodity imported from Russia = Sum of the % in the bar chart (Figure 1) / 10. This assumes that the ten commodities are of equal importance for each country.

Table 2 shows the relationship indicator ranges from the lowest, 0.01 (Australia and Singapore) to 0.29 (Turkey). The higher the value of the indicator, the higher the average percentage of the country's Russian imports across the ten key commodities.

Table2: Relationship indicator for each country concerned.

Country	Relationship indicator
United States	0.08
United Kingdom	0.09
Turkey	0.29
Thailand	0.04
Spain	0.11
Singapore	0.01
Saudi Arabia	0.05
Republic of Korea	0.13
Netherlands	0.15
Japan	0.1
Italy	0.21
India	0.03
Germany	0.02
France	0.14
Finland	0.07
Hong Kong SAR	0.2
China	0.16
Canada	0.02
Brazil	0.08
Belgium	0.19
Australia	0.01

2.2. Impact of the conflict on stock market indexes

Next, we examine the impact on stock markets. We chose to use the indexes listed in Table 3 to represent each country's stock market performance. These indexes generally include the largest publicly listed companies by market capitalisation.

Table3: Countries and stock market index symbols.

Country	Market symbol
Australia	^AXJO
Belgium	^BFX
Brazil	^BVSP
Canada	^GSPTSE
China	000001.SS
Finland	^OMXH25
France	^FCHI
Germany	^GDAXI
Hong Kong SAR	^HSI
India	^BSESN
Italy	FTSEMIB.MI
Japan	^N225
Republic of Korea	^KS11
Netherlands	^AEX
Russian Federation	IMOEX.ME
Saudi Arabia	TASI
Singapore	^STI
Spain	^IBEX
Thailand	^SET.BK
Turkey	XU100.IS
United Kingdom	^FTSE
United States	^DJI

Data related to these indexes were obtained from Yahoo Finance or Investing.com [5-6], with granularity of daily adjusted prices. Adjusted prices were chosen because it will ensure a more accurate valuation of the stock and reflect any corporate events, such as stock splits and dividend distributions. The data were collected from 1 April 2021 to 19 April 2022. The period before the event date is referred to as the reference window and comprises 10 months' worth of data before the conflict, equivalent to 300 data points. The two weeks after the conflict started are taken as the impact window and the whole period from the event day to the end of the dataset (22nd February 2022 - 19th April 2022) as the after window.

Figure 2 shows the stock market indexes when plotted in their own currency. The black vertical dash line indicates the event day.

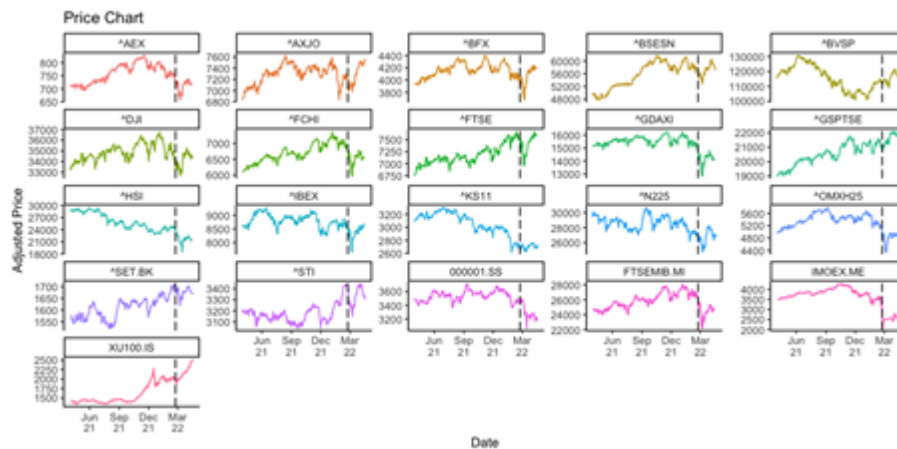


Figure2: Daily adjusted price for sample indexes.

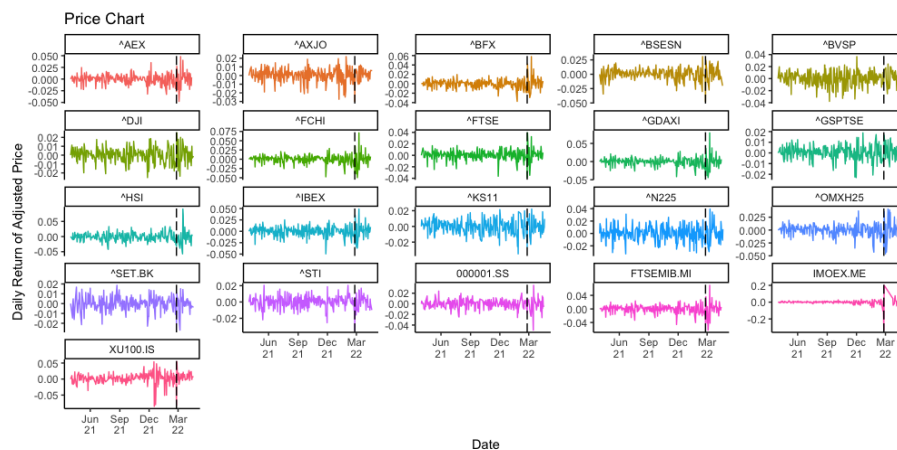


Figure3: Daily return of the selected indexes.

We see clearly that stock market indexes in countries such as Germany (GDAXI) and Finland (OMXH25) remained lower after the event; whereas countries such as Brazil (BVSP) and India (BSESN) rebounded.

We also define daily return as the percentage with which prices changed from the day before ($P_t - P_{t-1}/P_t$). Daily return of each stock market index is shown in Figure 3.

Some indexes show more remarkable variations in daily returns immediately after the event; however, this is not conclusive at this point, as some stock markets, such as South Korean index ^KS11, are more volatile in nature than others.

Calculating the means and standard deviations of the daily returns in the reference window and impact window did not yield a very clear picture. As shown in Table 4, the mean of the daily returns in the impact window lies within one standard deviation of the mean in the reference window for most countries; therefore, a Z-score and p-value would not show a statistically significant result. This also means that we cannot reject the null hypothesis: the mean of daily return during the impact window is different from the mean within reference window. The general observation, however, is that, in most cases, the standard deviations are higher in the after window. Moreover, greater price changes between days indicate a more volatile market environment.

Table4: Means and standard deviations (SD) of the daily return.

		Daily Return = (P _t - P _{t-1})/P _{t-1}			
		Mean		SD	
Country	Symbol	Before	After	Before	After
Turkey	XU100.IS	0.17%	0.54%	0.016	0.018
Italy	FTSEMIB.MI	0.03%	-0.10%	0.011	0.023
Finland	^OMXH25	0.01%	-0.06%	0.010	0.021
Belgium	^BFX	0.00%	0.17%	0.008	0.017
China	000001.SS	0.01%	-0.22%	0.008	0.015
Republic of Korea	^KS11	-0.05%	-0.02%	0.009	0.011
Germany	^GDAXI	-0.01%	-0.08%	0.010	0.023
Netherlands	^AEX	0.02%	-0.02%	0.010	0.018
Spain	^IBEX	0.00%	0.08%	0.010	0.018
Japan	^N225	-0.05%	0.02%	0.012	0.016
United Kingdom	^FTSE	0.04%	0.06%	0.008	0.015
United States	^DJI	0.02%	0.03%	0.008	0.011
Brazil	^BVSP	-0.02%	0.10%	0.012	0.012
France	^FCHI	0.05%	-0.05%	0.010	0.022
Thailand	^SET.BK	0.03%	-0.04%	0.007	0.008
India	^BSESN	0.07%	-0.01%	0.009	0.015
Canada	^GSPTSE	0.05%	0.11%	0.006	0.007
Hong Kong SAR	^HSI	-0.07%	-0.28%	0.012	0.028
Saudi Arabia	TASI	0.11%	0.21%	0.007	0.008
Singapore	^STI	0.03%	-0.10%	0.007	0.010
Australia	^AXJO	0.03%	0.12%	0.008	0.008

To perform a more meaningful comparison, we calculated the return over the reference window and impact window (two-week period after the event date) respectively, before normalising the total return to an equivalent daily (compound) return, using the following formula:

For the return over the reference window: $([P_{-1} / P_{R1}] ^ {1/T}) - 1$

where P₀ is the event date, P_{R1} is the earliest date in the reference window, P₋₁ is the day before the event date, and T is the number of days within the reference window minus 1.

The impact on the indexes is then the percentage difference of the calculated daily return between the reference window and the impact window.

Table5: Equivalent daily return.

Country	Symbol	Equivalent Daily Return		
		Reference Window	Impact Window	Impact
Turkey	XU100.IS	0.1%	0.0%	-0.129%
Italy	FTSEMIB.MI	0.0%	-1.0%	-1.035%
Finland	^OMXH25	0.0%	-0.9%	-0.860%
Belgium	^BFX	0.0%	-0.5%	-0.502%
China	000001.SS	0.0%	-0.3%	-0.325%
Republic of Korea	^KS11	0.0%	-0.2%	-0.175%
Germany	^GDAXI	0.0%	-0.9%	-0.891%
Netherlands	^AEX	0.0%	-0.7%	-0.729%
Spain	^IBEX	0.0%	-0.6%	-0.577%
Japan	^N225	0.0%	-0.4%	-0.404%
United Kingdom	^FTSE	0.0%	-0.5%	-0.520%
United States	^DJI	0.0%	-0.2%	-0.202%
Brazil	^BVSP	0.0%	-0.1%	-0.091%
France	^FCHI	0.0%	-0.9%	-0.892%
Thailand	^SET.BK	0.0%	-0.3%	-0.308%
India	^BSESN	0.0%	-0.5%	-0.509%
Canada	^GSPTSE	0.0%	0.1%	0.072%
Hong Kong SAR	^HSI	-0.1%	-0.8%	-0.772%
Saudi Arabia	TASI	0.1%	0.2%	0.097%
Singapore	^STI	0.0%	-0.5%	-0.535%
Australia	^AXJO	0.0%	-0.2%	-0.188%
Russian Federation	IMOEX.ME	0.0%	-1.5%	-1.424%

If we turn our focus to daily trading volume (Table 6), the average volume after the conflict is overall higher for most of the sample countries. This indicates more buying or selling of the indexes and higher activity in changing positions.

Table6: Daily trading volume of selected indexes.

Country	Symbol	Daily Trading Volume			
		Mean		SD	
		Before	After	Before	After
Turkey	XU100.IS	2,572,418,322	3,389,757,505	1,141,831,871	1,054,648,925
Italy	FTSEMIB.MI	407,476,753	683,064,768	198,318,695	248,635,800
Finland	^OMXH25	2,875,082	18,227,821	10,408,125	27,930,229
Belgium	^BFX	892,503	6,227,995	2,095,056	10,904,804
China	000001.SS	359,280	382,892	78,800	43,651
Republic of Korea	^KS11	865,492	793,928	403,546	255,972
Germany	^GDAXI	64,982,157	114,333,003	21,073,739	42,619,378
Netherlands	^AEX	12,132,534	31,740,289	28,657,333	49,340,347
Spain	^IBEX	169,227,170	259,856,153	63,183,992	99,044,565
Japan	^N225	66,229,108	76,751,282	16,013,261	19,678,961
United Kingdom	^FTSE	726,664,409	1,156,917,003	229,832,762	398,727,387
United States	^DJI	333,329,111	384,002,308	84,220,956	78,173,388
Brazil	^BVSP	10,013,159	12,159,768	2,894,018	3,131,501
France	^FCHI	69,611,687	118,514,245	30,572,823	46,423,963
Thailand	^SET.BK	10,557,387	8,070,147	3,239,345	2,122,527
India	^BSESN	10,517	10,708	5,838	7,668
Canada	^GSPTSE	22,417,734,395	29,970,023,590	6,563,332,518	8,199,748,086
Hong Kong SAR	^HSI	1,997,252,309	2,732,030,170	532,854,393	1,064,647,424
Saudi Arabia	TASI	230,742,377	222,652,195	87,701,275	53,877,966
Singapore	^STI	251,152,551	283,514,672	85,145,760	93,129,337
Australia	^AXJO	632,188	762,644	192,269	237,417
Russian Federation	IMOEX.ME	2,572,418,322	3,389,757,505	1,141,831,871	1,054,648,925

SD: Standard Deviation

There is one anomaly that stands out: Turkey. Its stock market index has risen to a historical high, while it was experiencing inflation of more than 60% during March of 2022. Considering this anomaly, it is not hard to relate to recent news about powerful and wealthy Russians moving their capital to sanction-free Turkey [7]. Because of this potential manipulation of the Turkish stock market, we will be excluding this data point in our next steps.

2.3. Analysis

Pulling the two research questions together, we explore whether there is a direct relationship between a country's reliance on Russian exports and the impact of the war on the country's stock market. First, we rank the countries according to their relationship indicator, as displayed on the x-axis in Figure 4. On the y-axis, we see the impact, obtained from the equivalent daily returns (Table 5). We then plotted the scatter plot and added a trendline. The trend shows a slight negative relationship between these two variables. Notice that, in Figure 4, we have flipped the x-axis, to have the higher rank on the right. Russia ranks first at far right, while Australia ranks the lowest on the left. The R squared value is 0.27, showing that this regression model explained some of the impact on stock market, but not all factors that could affect individual stock markets.

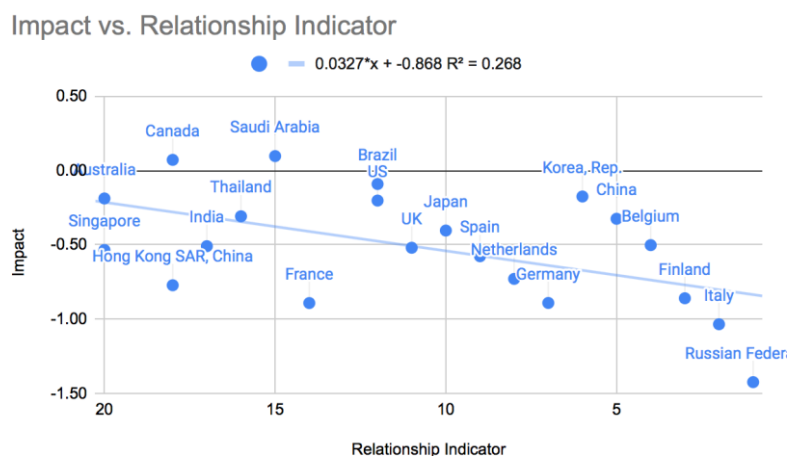


Figure4: Scatter plot showing ranking of relationship indicator versus % impact (changes in daily returns).

The indexes of some countries are shown to have a much greater reaction than others; for example, Italy—which had the highest impact after Russia—is directly involved in the conflict. France also experienced a relatively larger impact, compared with its neighbouring countries, as the impact window features additional uncertainty around the French presidential election [8], on top of the economic impact from the Russia–Ukraine conflict.

It is not hard to see that countries that are less reliant on Russia's oil and gas are experiencing a lesser impact on their stock markets. Saudi Arabia, one of the largest global oil exporters, is in direct competition with Russia in terms of oil production. Its stock market is performing much better than other countries of similar rank, despite the significant volume of coal imported from Russia. It appears to have benefited more from the global oil price hike.

In hindsight, this analysis compares a static variable—the relationship indicator based on an annual percentage of Russian imports—and a time-series, stock market indexes. The calculated impact could therefore vary, depending on how we define the impact window. If we had included the after window, which extends to 19 April 2022, we would have obtained a much flatter trendline on the scatter plot, as most of the stock indexes had recovered back to their price level before the event day. One future

extension of this research would be to add another time-series variable, so that a regression model could be constructed, based on a time variable and a fixed variable (such as the relationship indicator we have developed). This time-series variable can, for example, be an index relating to the number of web searches related to the Russia–Ukraine conflict, using data from Google Trend.

2.4. Key commodities

On a quick note, we also analysed the three key commodities: Brent crude oil, gold and nickel. We use Brent crude oil here because it is produced in the North Sea and accounts for approximately two thirds of the global oil trade. Figure 5 presents the graphs and summary statistics of the commodity prices. We see that the mean price levels after the event day are also higher, confirmed by the high Z-scores. This reflects the tighter supply and the general nervousness within the market, as these commodities are used in a lot of manufacturing productions.

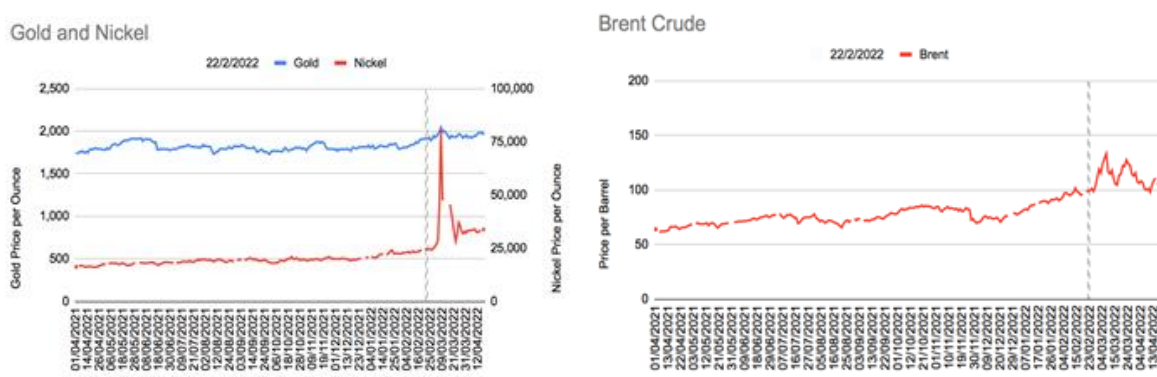


Figure5: Price level for the three key commodities.

Table7: Z-score for the three key commodities.

	Price Level				Z-score		
	Mean		SD		Mean Price Level		
	Before	After	Before	After	Z-score	p-value	Sig Level
Brent	77	111	8	20	4.13	0.000	***
Gold	1,813	1,949	42	104	3.20	0.001	***
Nickel	19,352	34,407	1,798	4,549	8.37	0.000	***

3. Conclusion

To summarise, this study found some degree of correlation between a country’s reliance on Russian exports and the impact of the geopolitical Russia–Ukraine conflict on stock markets. We also found that the war had an impact on the key commodities that Russia exports. Historically speaking, research has shown that stocks tend to recover quickly after being greatly affected by major international events [9]. From Figure 6, it can be seen that most of the impacts are short lived. Looking ahead, it would be interesting to see when investors will look past the war or whether the war-induced inflation will be sustained and have a longer impact on the stock market.

How Do Stocks Do After Major Events?					
S&P 500 Index Performance After Geopolitical And Major Historical Events					
Market Shock Events	Event Date	S&P 500 Index Returns			
		1 Month	3 Months	6 Months	12 Months
Germany Invades France	5/10/1940	(19.9%)	(12.7%)	(4.5%)	(18.7%)
Pearl Harbor Attack	12/7/1941	(1.0%)	(11.0%)	(6.5%)	4.3%
N. Korean Invades S. Korea	6/25/1950	(10.0%)	1.6%	4.1%	11.7%
Hungarian Uprising	10/23/1956	(2.1%)	(2.8%)	(1.3%)	(11.7%)
Suez Crisis	10/29/1956	(4.4%)	(3.6%)	(0.0%)	(11.6%)
Cuban Missile Crisis	10/16/1962	5.1%	14.1%	20.7%	27.8%
Kennedy Assassination	11/22/1963	8.8%	11.9%	15.5%	23.2%
Gulf of Tonkin Incident	8/2/1964	(1.6%)	1.9%	5.3%	2.7%
Six-Day War	6/5/1967	3.3%	5.9%	7.5%	13.5%
Tet Offensive	1/30/1968	(3.8%)	5.1%	5.2%	10.2%
Penn Central Bankruptcy	6/21/1970	(0.1%)	7.2%	16.8%	28.6%
Munich Olympics	9/5/1972	(1.0%)	5.7%	2.3%	(5.6%)
Yom Kippur War	10/6/1973	(3.9%)	(10.7%)	(15.3%)	(43.2%)
Oil Embargo	10/16/1973	(7.0%)	(13.2%)	(14.4%)	(35.2%)
Nixon Resigns	8/9/1974	(14.4%)	(7.0%)	(2.8%)	8.4%
Reagan Shooting	3/30/1981	(0.9%)	(1.8%)	(14.0%)	(16.4%)
Continental Illinois Bailout	5/9/1984	(3.1%)	1.0%	6.4%	12.8%
1987 Stock Market Crash	10/19/1987	8.1%	10.9%	14.7%	22.9%
Iraq's Invasion of Kuwait	8/2/1990	(8.2%)	(13.5%)	(2.1%)	10.1%
Soros Breaks Bank of England	9/16/1992	(2.5%)	3.0%	6.8%	9.9%
First World Trade Center Bombin	2/26/1993	1.7%	2.0%	4.0%	4.7%
Asian Financial Crisis	10/8/1997	(3.7%)	(1.8%)	14.1%	(1.5%)
U.S.S. Cole Yemen Bombing	10/12/2000	2.7%	(0.9%)	(11.3%)	(19.6%)
U.S. Terrorist Attacks	9/11/2001	(0.2%)	2.5%	6.7%	(18.4%)
Iraq war started	3/20/2003	1.9%	13.6%	18.7%	26.7%
Madrid Bombing	3/11/2004	3.5%	2.7%	1.5%	8.4%
London Subway Bombing	7/5/2005	3.3%	1.8%	5.3%	5.5%
Bear Stearns Collapses	3/14/2008	3.6%	5.6%	(2.8%)	(41.5%)
Lehman Brothers Collapses	9/15/2008	(16.3%)	(26.2%)	(34.8%)	(11.7%)
Boston Marathon Bombing	4/15/2013	6.3%	8.4%	9.7%	17.9%
Russia annexed Crimea	2/20/2014	1.5%	2.6%	8.0%	14.7%
BREXIT	6/24/2016	6.5%	6.2%	11.0%	19.7%
Bombing of Syria	4/7/2017	1.8%	3.1%	7.6%	12.8%
North Korea Missile Crisis	7/28/2017	(1.1%)	3.6%	14.8%	13.4%
Saudi Aramco Drone Strike	9/14/2019	(1.4%)	5.4%	(8.8%)	12.5%
Iranian General Killed in Airstrike	1/3/2020	1.9%	(23.1%)	(4.2%)	14.4%
U.S. Pulls Out of Afghanistan	8/30/2021	(3.7%)	2.8%	?	?

Source: LPL Research, S&P Dow Jones Indices, OFRA, Strategies 10/22/2022
All indices are unmanaged and cannot be invested into directly. Past performance is no guarantee of future results.
The modern design of the S&P 500 Index was first launched in 1957. Performance before then incorporates the performance of its predecessor index, the S&P 90.

Figure6: S&P500 performance after geopolitical events.

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