UK, US, and China's Stock Market Reactions to The Russia-Ukraine War: An Inspection across Industries

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Abstract. The Russia-Ukraine crisis is expected to have a considerable impact on the global economy. By applying the event study approach, we examine the effect of the war on the UK, the US, and China across ten major industries over different lengths of the event window around 22 February 2022. The observed significant cumulative abnormal returns (CAR) in specific industries, along with the differences between nations, are comprehensively analyzed with actual situations faced by each country. Through comparisons, the UK is concluded to be mainly more affected by the crisis than the US and China, especially in the material, information technology, and consumer staples industries. Notably, all three countries are observed to have positive and significant CARs across the event window, which provides strong evidence of the adverse impact of the Russia-Ukraine war on the global energy supply. In other industries, the harmful effects of the crisis vary from countries. This study could provide a new, broad inspection of the ongoing crisis at a macro level and a substantial information reference for policymakers.

Keywords: Event study; Russia-Ukraine crisis; Industry-level; Stock market.

1. Introduction

In the early morning of 24 February 2022, Russian President Vladimir Putin announced the implementation of a "special military operation" against Ukraine, followed by continuous gunfire throughout Ukraine. From that day on, the conflict officially became a full-scale war and rapidly developed into the fiercest war in Europe since the Second World War. The outbreak of the Russia-Ukraine war has shocked the whole world. The United States, the European Union, and other western countries have expressed their intention to impose the most severe sanctions on Russia. As the largest energy and food producers in Europe, Russia and Ukraine have put the European region into great jeopardy. The war also brought a severe energy and food crisis, which will undoubtedly further aggravate the global inflation issue. The CPI index of the United States, the Euro area, Canada, the United Kingdom, South Korea, and other countries and regions in the world has set new historical records. The United States is even experiencing its worst inflation in the last four decades. It is believed that the Russia-Ukraine crisis will change the situation of the whole world, becoming one of the significant turning points in human history. This major geopolitical event will inevitably have a fatal impact on all walks of life. Stock markets of more globalized economies worldwide are more vulnerable to being negatively affected by the crisis, but the effects are heterogeneous across different countries (Boubaker et al., 2022).

To explore whether the Russia-Ukraine war had a long-term and heterogeneous impact on the stock market, we conducted comprehensive research across countries and mainly focused on the industry level. For our empirical investigation, we use the stock index of 10 industries in Britain, America, and China from 1 November 2020 to 20 March 2022 to employ an event study methodology. In this study, national or regional circumstances are comprehensively linked to our collected empirical results.

2. Literature Review

The previous research on the relationship between the political risk crisis and the stock market is mainly divided into two aspects: one is investigating the difference between regions, while the other is researching specific industries, mainly focusing on essential industries such as consumption and energy. For the first aspect, research shows that war has little impact on stocks and does not change the long-term trend, and a short-term negative relationship between the Ukraine–Russia war and world stock market returns is documented (Boungou & Yatie, 2022). Many studies of recent major political risk events are carried out frequently, He et al. (2017) examined the economic cost of non-violent disputes between the mainland and Taiwan, and the results showed that political tension was associated with a significant decline in stock market returns. They also find that the expected level of future strain is associated with a decline in current stock returns, providing an inspiration for us to work on the connection between the current stock returns of different regions and the crisis. The impact of international conflicts like the Gulf War and the Iraq War on the financial markets is widely discussed (Schneider et al., 2006). For the second aspect, Berkman et al. (2011) provided empirical support for theoretical models that allow for time-varying rare disaster risk and concluded that industries that are more crisis risk sensitive yield higher returns. Moreover, sanctions imposed as a result of the crisis could impair financial intermediation and trade, raising fears of slower economic growth and faster inflation around the world. Thus, the impact of this crisis is much broader and more profound than that of previous political events, as proposed by Ahmed et al., 2022. Salisu et al. (2022) also demonstrated that geopolitical threats such as military build-ups have a greater negative impact on stock returns than the actual occurrence of geopolitical behavior, while more specific research on industries is expected to be conducted.

Some prior studies have investigated the impacts of war on the world economy and global stock markets and found the economic causes and consequences of armed conflicts (Leigh et al., 2003; Schneider et al., 2006; Hudson et al., 2015). Meanwhile, some documents have also investigated the significant impact of the Russia-Ukraine war on the geographically adjacent European region (Ahmed et al., 2022). The research shows that Russia-Ukraine crisis hurt European stock markets through economic and political channels. It is worth mentioning that most articles use the event study method to analyze the impact of war on the stock market (Boehmer et al., 1991). Based on the above research, we decided to expand the scope of Europe to investigate the impact of the Russia-Ukraine war on the stock market in other regions. In addition, we also selected industries such as energy, materials, and finance for horizontal comparison.

Our main predictions are: First, the war will not result in the sharp rise and fall of the stock market in the long term, but there will be more of a short-term impact on critical parts. At the country level, the more dependent on the countries at war, the more significant the impact will appear to be, making the UK more likely to be the biggest victim of the war. Second, at the industry level, sectors directly related to the output of the war, such as energy and materials, will be more affected than other unrelated industries.

3. Data

To diffusely observe the global effect of the Russia-Ukraine crisis, we investigate the stock markets of 3 countries respectively, and for each of them, ten industries are taken into consideration. For the ten industries, we use each nation's S&P Industry Index of the Global Industry Classification Standard (GICS) as a proxy. For the stock markets, we employ each country's stock market index in the most common use: the FTSE100 index for the UK, the S&P500 index for the US, and the SSEC index for CHN. See Table 1 for details.

We obtained the daily prices of each of the indexes mentioned above from the Wind database. The specific start and end dates will be discussed in the timeline along with the methodology.

Table 1. Data Details

Country	Market Index	Industry Index
US	S&P500	S&P500 Energy S&P500 Materials S&P500 Industrials S&P500 Consumer Discretionary S&P500 Consumer Staples S&P500 Health Care S&P500 Financials S&P500 Information Technology S&P500 Communication Services S&P500 Utilities
UK	FTSE100	S&P100 Energy S&P100 Materials S&P100 Industrials S&P100 Consumer Discretionary S&P100 Consumer Staples S&P100 Health Care S&P100 Financials S&P100 Information Technology S&P100 Communication Services S&P100 Utilities
CHN	SSEC	S&P300 Energy S&P300 Materials S&P300 Industrials S&P300 Consumer Discretionary S&P300 Consumer Staples S&P300 Health Care S&P300 Financials S&P300 Information Technology S&P300 Communication Services S&P300 Utilities

Note: The S&P GICS structure consists of eleven industry sectors in total. Except for the ten we selected in the list above, the Real Estate industry is the one left in the GICS. In our process of collecting the data, the S&P Real Estate Industry Index for the UK was found incomplete, so we dropped this industry as the requirement to conduct comparisons in the country-level cannot be fulfilled.

4. Methodology

This paper employs the event study approach brought forward by Fama et al. (1969) to comprehensively investigate the impact of the Russia-Ukraine crisis on ten different industries in the UK, the US, and China stock markets, respectively. We collected the data according to the timeline we set up. After preprocessing, Market Model is employed to calculate the normal and abnormal returns further. Two hypothesis tests are established based on the cumulative abnormal returns to respectively investigate the significance of the effect of the crisis on different industries of each country and whether the effects are the same between countries.

4.1 Timeline

The timeline we use in this paper is presented as below.

We choose 22 February 2022, the first trading day after Russian President Vladimir Putin publicly recognize the independence of the Donetsk and Luhansk regions, as the event day. A special military operation against Ukraine was authorized by Putin on the following day, and many countries started

to impose economic sanctions against Russia shortly after the proclamation. Thus, 22 February is selected as the day when the crisis literally began and was sharpened the most.

We use the Market Model to estimate normal returns for individual industries over a 300-day (i.e.,$[-331, -30]$, Note that all the counts in this paper are based on trading days only.) estimation window, which is from 1 November 2020 to 10 January 2022. Following Ahmed et al. (2022), the abnormal returns are calculated over the event window with 8 different lengths, $[-X, +X], X = 1, 2, 3, 5, 10, 15, 20, 25$ (Note: Window $[-X, X]$ represents the range from the Xth trading day before the event date of 22 Feb 2022 to the Xth trading day following the event.), representing different lengths of horizons. The time between the two windows is spared as the quarantine, in case of information leaks before the event.
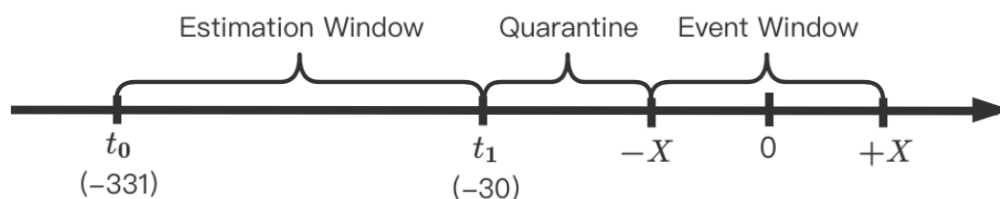

Figure 1. Timeline

4.2 Data Preprocessing

The variant data type is required to convert from daily prices to returns for the application of the model. With the daily prices of the index of each industry i $(i = 1, 2, \ldots, 10)$ in stock market j $(j = 1, 2, 3)$ represented by $P_{(i,j),t}$, we can obtain the logarithmic daily returns calculated by:

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

And the same for the return of the stock market j:

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

where $P_{Mj,t}$ is the stock market index prices of country j on day t.

4.3 Market Model

The Market Model is commonly used in capital market studies to estimate or predict the return rate of enterprises under normal conditions. In this paper we employ it on the return of the stock in different industries to obtain the normal returns, so as to calculate the abnormal returns with actual returns during the event window to measure the impact of the crisis.

For each stock in our sample, estimate:

$$R_{(i,j),t} = \hat{\alpha}_{(i,j)} + \hat{\beta}_{(i,j)} R_{Mj,t} + \varepsilon_{(i,j),t} \tag{1}$$

where $R_{(i,j),t}$ is the logarithmic daily return of industry i in stock market j on day t, and $R_{Mj,t}$ is the logarithmic market return of country j. We suppose $\varepsilon_{(i,j),t}$ is $i.i.d.$ with mean 0 and $Var(\varepsilon_{(i,j),t}) = \sigma^2_{(i,j)}$.

We use FTSE100 Index, S&P500 Index, SSEC Index respectively for the UK, the US and China as our proxy for the market index. Parameters $\hat{\alpha}_{(i,j)}$ and $\hat{\beta}_{(i,j)}$ are estimated through OLS regression over a 300-day estimation window that ends 30 days before the event day. See Table 2 for the regression results.

Table 2. Regression Results

UK		Estimate	Std_Error	t_value	P_value	r_squared
Energy	α	0.0001	0.0005	0.2395	0.8109	0.1946
	β	0.5057	0.0596	8.4845	0.0000	
Materials	α	-0.0001	0.0006	-0.2175	0.8279	0.1648
	β	0.5527	0.0721	7.6668	0.0000	
Industrials	α	-0.0001	0.0005	-0.2766	0.7823	0.6021
	β	1.1836	0.0557	21.2351	0.0000	
Consumer Discretionary	α	0.0004	0.0008	0.4317	0.6662	0.5250
	β	1.7237	0.0950	18.1468	0.0000	
Consumer Staples	α	0.0001	0.0007	0.1807	0.8568	0.5144
	β	1.4105	0.0794	17.7659	0.0000	
Health Care	α	0.0003	0.0004	0.7358	0.4624	0.5719
	β	0.8490	0.0426	19.9507	0.0000	
Financials	α	-0.0001	0.0005	-0.2147	0.8302	0.5706
	β	1.1743	0.0590	19.9005	0.0000	
Information Technology	α	-0.0001	0.0004	-0.3762	0.7071	0.3708
	β	0.5888	0.0444	13.2514	0.0000	
Telecommunication Services	α	0.3708	0.3708	0.3708	0.3708	0.6798
	β	0.3708	0.3708	0.3708	0.3708	
Utilities	α	0.0002	0.0007	0.3096	0.7571	0.1140
	β	0.4854	0.0784	6.1926	0.0000	

US		Estimate	Std_Error	t_value	P_value	r_squared
Energy	α	-0.0004	0.0004	-0.9985	0.3189	0.6727
	β	1.1188	0.0452	24.7502	0.0000	
Materials	α	0.0002	0.0003	0.4636	0.6433	0.3524
	β	0.5054	0.0397	12.7355	0.0000	
Industrials	α	0.0002	0.0003	0.6288	0.5300	0.4457
	β	0.6344	0.0410	15.4790	0.0000	
Consumer Discretionary	α	0.0000	0.0004	-0.0329	0.9738	0.5614
	β	0.9330	0.0478	19.5301	0.0000	
Consumer Staples	α	-0.0002	0.0003	-0.5792	0.5629	0.7669
	β	1.2986	0.0415	31.3111	0.0000	
Health Care	α	0.0000	0.0005	-0.0062	0.9951	0.4824
	β	0.9463	0.0568	16.6653	0.0000	
Financials	α	0.0004	0.0004	0.8243	0.4104	0.4046
	β	0.7425	0.0522	14.2306	0.0000	
Information Technology	α	-0.0003	0.0004	-0.8176	0.4143	0.6612
	β	1.0354	0.0429	24.1172	0.0000	
Telecommunication Services	α	-0.0002	0.0005	-0.4360	0.6632	0.1909
	β	0.5086	0.0607	8.3844	0.0000	
Utilities	α	0.0006	0.0006	1.1027	0.2710	0.4190
	β	0.9996	0.0682	14.6590	0.0000	

China		Estimate	Std_Error	t_value	P_value	r_squared
Energy	α	0.0006	0.0010	0.6201	0.5357	0.1610
	β	0.8184	0.1097	7.4593	0.0000	
Materials	α	0.0007	0.0008	0.8884	0.3751	0.5079
	β	1.5736	0.0909	17.3018	0.0000	
Industrials	α	0.0005	0.0006	0.9103	0.3634	0.6067
	β	1.4094	0.0666	21.1518	0.0000	
Consumer Discretionary	α	-0.0006	0.0007	-0.9124	0.3623	0.4763
	β	1.2237	0.0754	16.2390	0.0000	
Consumer Staples	α	-0.0003	0.0009	-0.3625	0.7172	0.3875
	β	1.3724	0.1013	13.5461	0.0000	
Health Care	α	-0.0010	0.0009	-1.0714	0.2849	0.3605
	β	1.3347	0.1044	12.7853	0.0000	
Financials	α	-0.0004	0.0005	-0.8065	0.4206	0.4707
	β	0.9908	0.0617	16.0597	0.0000	
Information Technology	α	-0.0001	0.0006	-0.2196	0.8264	0.4754
	β	1.1996	0.0740	16.2111	0.0000	
Telecommunication Services	α	-0.0013	0.0008	-1.5454	0.1233	0.3143
	β	1.0720	0.0930	11.5281	0.0000	
Utilities	α	0.0005	0.0007	0.7173	0.4738	0.0950
	β	0.4709	0.0854	5.5159	0.0000	

4.4 AR and CAR

With the estimated Market Model equation which reflects the normal returns, the daily abnormal returns over the event window can be calculated by:

$$AR_{(i,j),t} = R_{(i,j),t} - (\hat{\alpha}_{(i,j)} + \hat{\beta}_{(i,j)} R_{M,t}) \tag{2}$$

where $AR_{(i,j),t}$ is the daily abnormal return for industry i in stock market j at day t.

From the estimated $AR_{(i,j),t}$, sum the daily ARs for industry i in country j over the period $[-\tau, +\tau]$ to obtain the cumulative abnormal returns:

$$CAR_{(i,j)}(\tau) = \sum_{t=-\tau}^{+\tau} AR_{(i,j),t} \tag{3}$$

where $\tau = 1, 2, 3, 5, 10, 15, 20, 25$, representing 8 lengths of the event window we selected. It can be used to investigate the effect of the event in different horizons.

4.5 Hypothesis Test I

The first hypothesis test is conducted to examine whether the effect of the event is significant on the inspected country's industry.

In Equation (1), we add further assumption of normal distribution to the residual:

$$\varepsilon_{(i,j),t} \sim N(0, \sigma_{(i,j)}^2)$$

as most applications of Market Model in the event study methodology generally do. Based on this, according to Equation (2),

$$AR_{(i,j),t} \sim N(0, \sigma_{(i,j)}^2)$$

should stand under the null hypothesis that the event has no significant effect on this industry. Thus, the calculation of CAR at a certain horizon τ in Equation (3) makes:

$$CAR_{(i,j)}(\tau) = \sum_{t=-\tau}^{+\tau} AR_{(i,j),t} \sim N\big(0, (2\tau + 1)\sigma_{(i,j)}^2\big)$$

Under the confidence level of α, the confidence interval for a two-sided significance test is:

$$\left[-z_{\alpha/2} \cdot \sigma_{(i,j)} \cdot \sqrt{2\tau + 1} , +z_{\alpha/2} \cdot \sigma_{(i,j)} \cdot \sqrt{2\tau + 1} \right]$$

where $z_{\alpha/2}$ is the $\alpha/2$ percentile of standard normal distribution. We use $\alpha = 0.95$ in this paper.

If the null hypothesis stands under the confidence level, the CAR value should lie within the symmetric bands. If not, it represents a surprise abnormal return indicating that the event has significant impact on the industry. In longer horizons, some surprises may be diluted. Our empirical work is to observe the surprises and attempt to relate them with events in the reality to locate the reasons.

4.6 Hypothesis Test II

Another hypothesis test is to verify the consistency of the event effects on the same industry of two different countries. The prior assumption is that the CARs of any two industries in any stock market is independent identically distributed. Under the null hypothesis of no significant difference between the same industry j of two different countries i, k, the difference between two CARs at a certain horizon τ can be calculated to follow the distribution below:

$$CAR_{(i,j)}(\tau) - CAR_{(k,j)}(\tau) \sim N\left(0, (2\tau + 1)\left(\sigma_{(i,j)}^2 + \sigma_{(k,j)}^2\right)\right)$$

To test the significance of the consistency between the two countries, the α-level confidence interval is set as:

$$\left[-z_{\alpha/2} \cdot \sqrt{(2\tau + 1)(\sigma_{(i,j)}^2 + \sigma_{(k,j)}^2)} , +z_{\alpha/2} \cdot \sqrt{(2\tau + 1)(\sigma_{(i,j)}^2 + \sigma_{(k,j)}^2)} \right]$$

If the null hypothesis stands, the calculated difference value should lie within the symmetric bands. If not, a significant different effect on the inspected industry between two different countries is proved to be true.

5. Empirical Findings I

With the data and model, we obtained, the methodology of Hypothesis Test I is employed to examine the significance of the event's effect on the ten industries we selected in the UK, the US, and China, respectively. The effect is demonstrated through each industry's cumulative abnormal returns (CAR). The following figures visualize the empirical results, in which the blue lines plot the CAR value, and the red curves portray the boundaries of the confidence interval in each situation.

5.1 Energy

According to the GICS, the S&P Energy Index covers companies engaged in the exploration, production, refining and marketing, storage and transportation of oil and gas, and coal and consumable fuels. It also includes companies that offer oil and gas equipment and services.
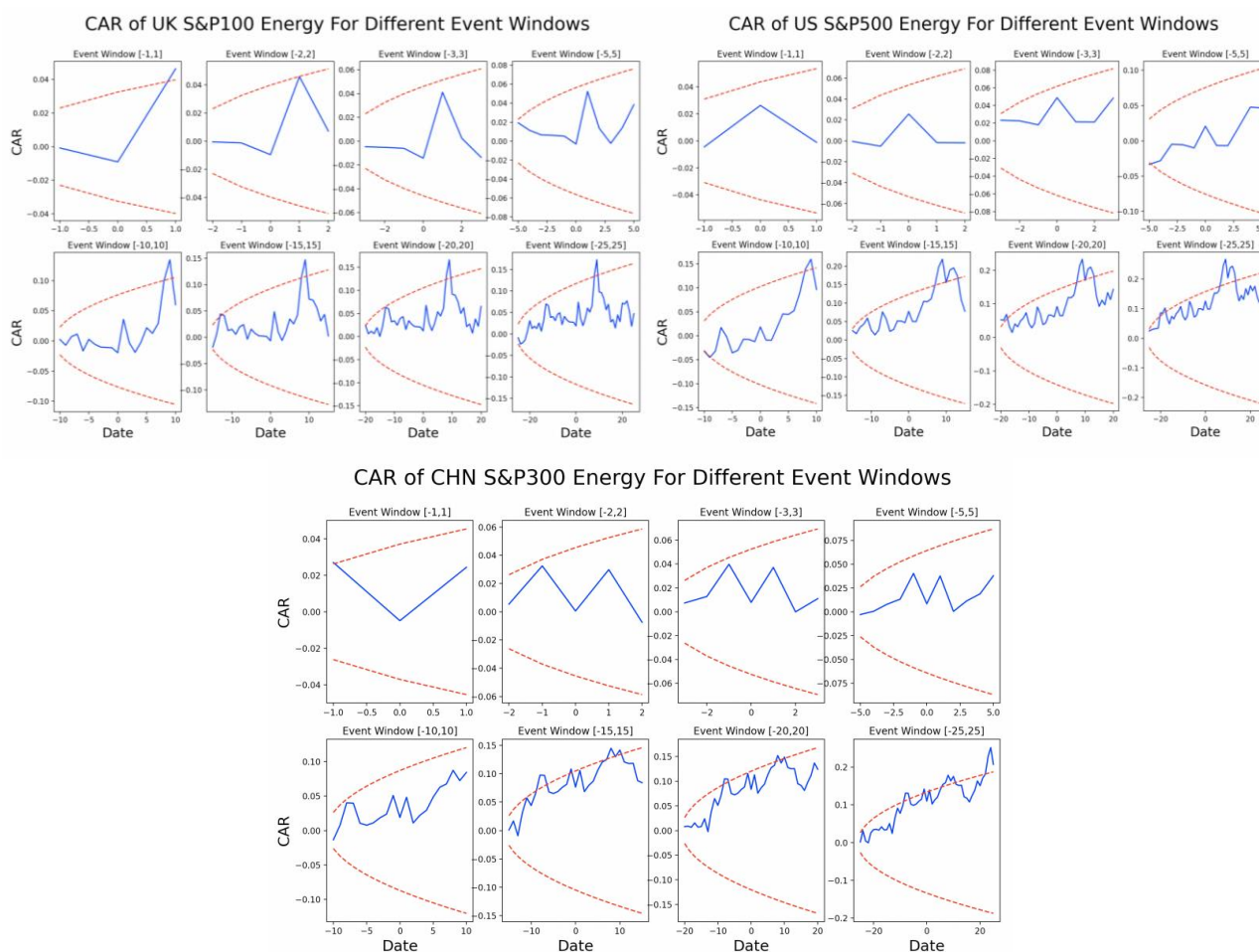
Figure 2. Cumulative Abnormal Returns (CAR) in Energy

Figure 2 presents the CAR in the UK, the US, and China's energy industry. The CARs of three countries all show significance after 8 to 10 days around the event, namely 8 March, when the US officially announced a ban on the import of Russian petroleum and natural gas, and the UK announced that it would gradually stop importing Russian oil and related products by the end of the year, representing that the war was a real shock to the energy market in these three countries. This result is consistent with our prior expectation since Russia is the world's second-largest oil exporter and all three countries rely heavily on the import of petroleum oils, according to 2021 International Trade Statistics Yearbook, UN Comtrade.

For Britain, the good news is that it imports barely any gas from Russia. Britain meets about half of its gas requirements from the North Sea, while another third is sourced from Norway. However,

the bad news is that its gas sources could become highly expensive if European markets soar (see Figure 5.1.2).

For China, the CAR shows significance eight days before the event day, which may be related to the pandemic panic and increasing heating in winter around the Spring Festival. Thus, the expansion of demand for fossil fuels like coal and gas was reflected in the increase in stock prices.
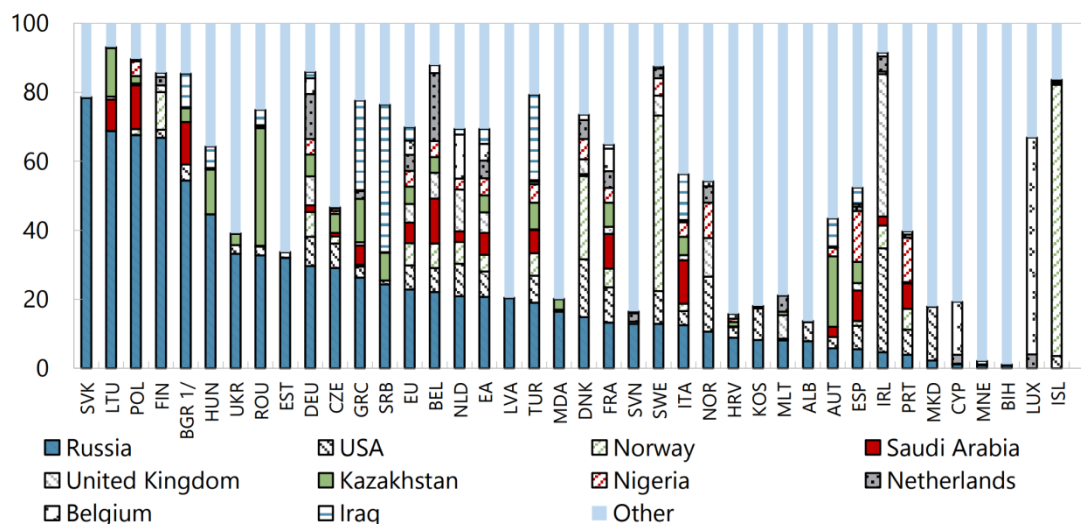
Figure .3 Imports of oil and petroleum products, 2020.
Data is sourced from Eurostat. 1/ Data for Bulgaria is for 2019.

5.2 Materials

The GICS S&P Material Index includes companies that manufacture chemicals, construction materials, glass, paper, forest products and related packaging products, and metals, minerals and mining companies, including producers of steel.
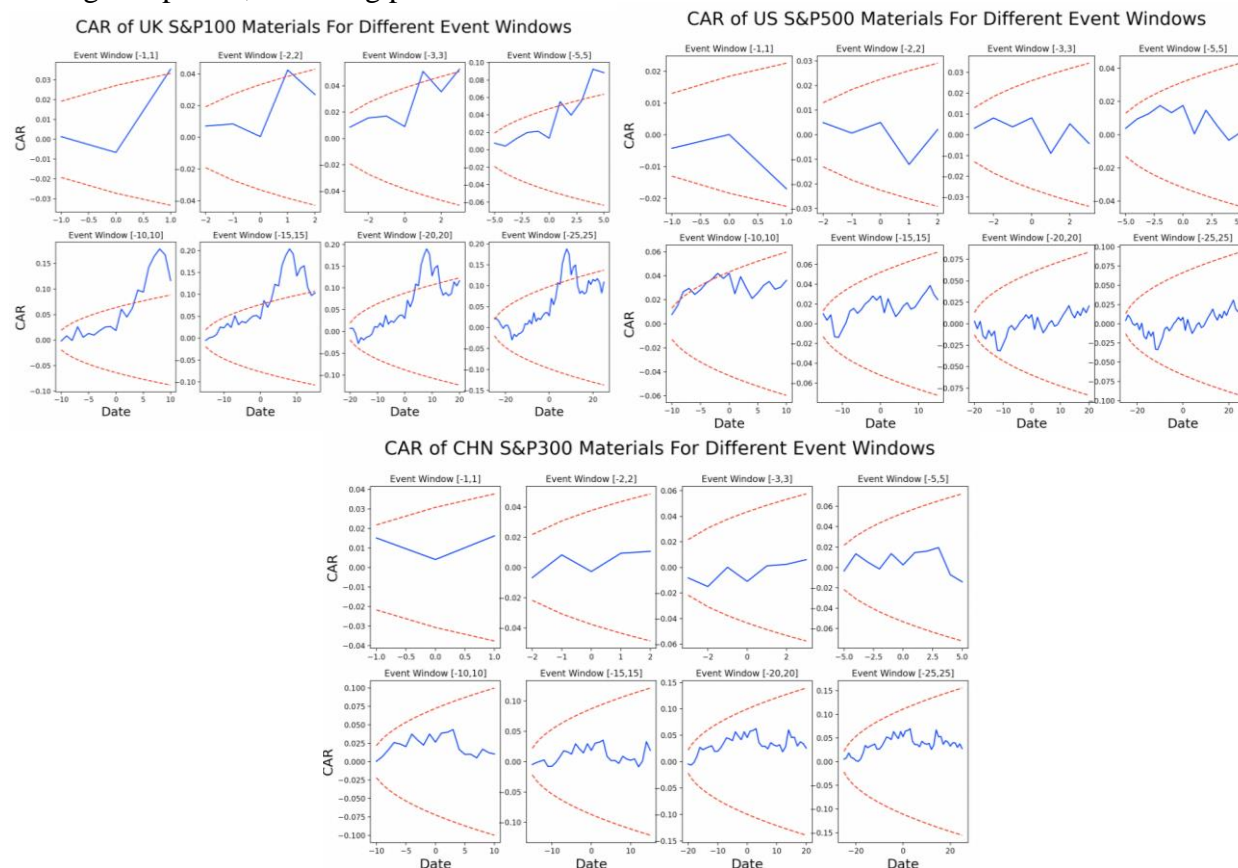
Figure 4. Cumulative Abnormal Returns (CAR) in Materials

Figure 4 shows the CAR in the material industry that the UK was distinctly affected by the Russia-Ukraine war, while the material industry in the US and China appear unaffected. In general, supply chains around the world are dependent on exports of metals from Russia and Ukraine, for they lead the global production of metals such as nickel, copper, and iron, as well as are primarily involved in the export and manufacture of other essential raw materials like neon, palladium, and platinum, according to USGS Mineral Commodity Statistics and UN Comtrade. Fears of sanctions on Russia have increased the price of these metals. According to the U.S. Department of the Interior U.S. Geological Survey Mineral Commodity Summaries 2022, Russia has the most reserves to supply materials. Also, America and China can self-support, so that may be why the material industry in these two countries did not significantly increase during the war (see also Figure 5). In addition, Britain relies heavily on importing industrial finished products, illustrating the idea that the UK lacks the crucial metals to produce these apparatuses from the side. As a result, when the Ukrainian military advisers announced the closure of Black Sea ports on Feb 24th, a piece of negative news for transporting bulk commodities, the material industry in the UK showed a colossal shock.
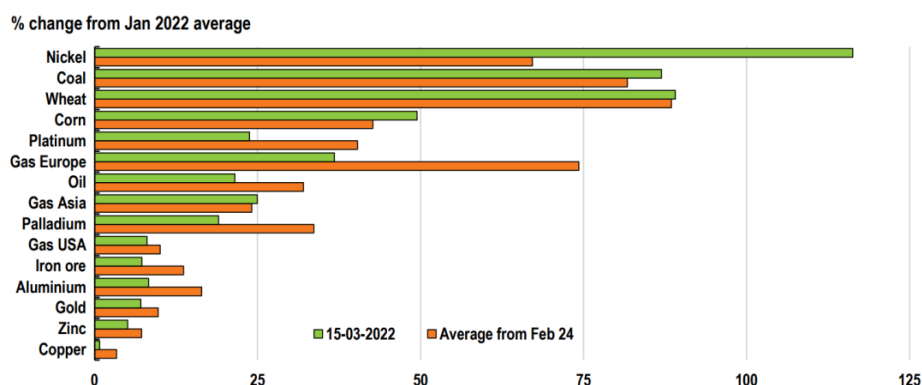

Figure 5. The prices of the principal export commodities of Russia and Ukraine have risen sharply. Data is sourced from OECD ECONOMIC OUTLOOK, INTERIM REPORT MARCH 2022

5.3 Industrials

The Industrials includes manufacturers and distributors of capital goods such as building products, electrical equipment and machinery, and aerospace and defense products. Providers of commercial services such as construction and engineering, printing, environmental services, human resource services, research and consulting services, and transportation services are also included.

Figure 6 shows the CAR in the industrial industry. Different from the material industry, the CARs of the UK and China in the industrial industry both show a downward trend, which can be attributed to the potential shortages of raw materials, which lead to increased prices for many products and services downstream. Many subsectors in the industrial industry need precious metals imported from Russia. For instance, the aerospace industries depend on supplies of titanium from Russia, cars' exhaust systems need palladium to build, and batteries in electric cars are built from nickel. Since UK's material industry was affected by the war most, it is clear why its industrial industry shows significance around the event day.

As for China, the significance of CAR gradually diminishes as the event window stretches longer, suggesting that the war's overall impact on China's industrial industry is limited. On 12 March, Shanghai began to take city-wide preventive measures due to the recurrence of COVID-19, which may impose another hit on the A-stock market. As a result, our explanation for China remains controversial.
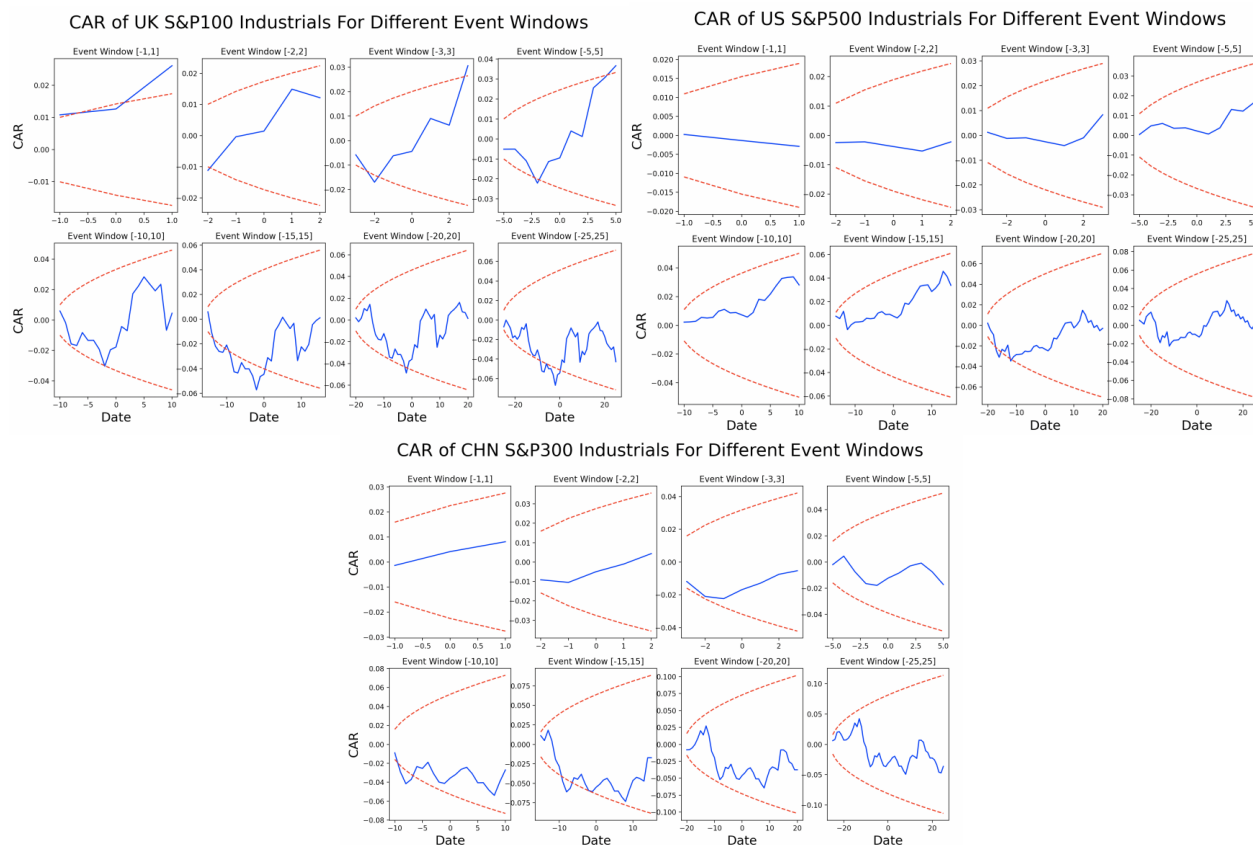
Figure 6. Cumulative Abnormal Returns (CAR) in Industrials

5.4 Information Technology

The GICS Information Technology sector mainly covers companies that offer software and information technology consulting and data processing, excluding internet services and home entertainment. Manufacturers and distributors of technology hardware and equipment such as communications equipment, cell phones, computers, electronic equipment, and semiconductors are widely involved as well.
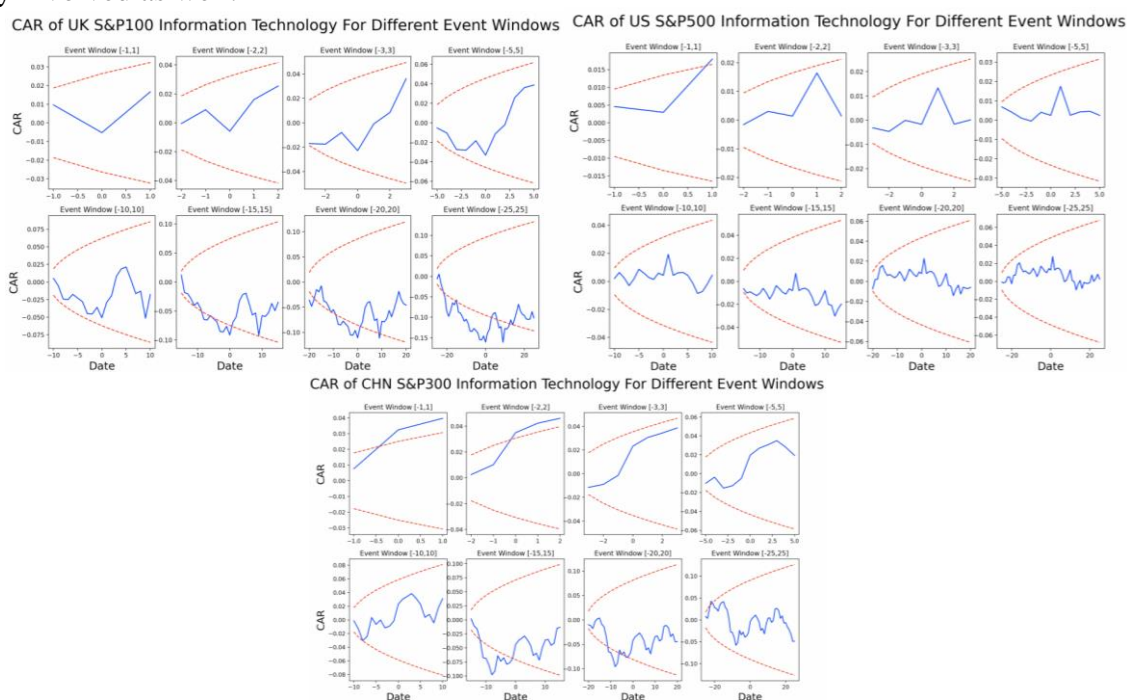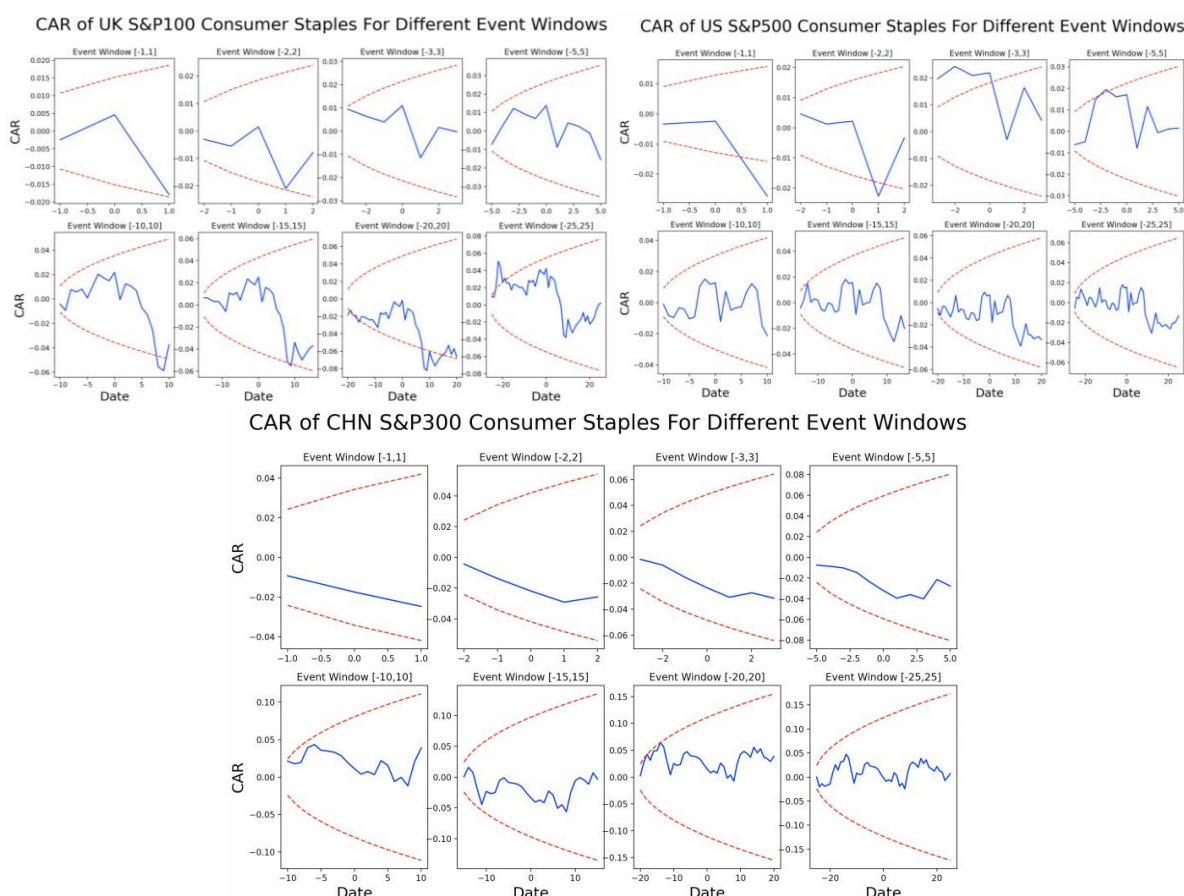

Figure 7. Cumulative Abnormal Returns (CAR) in Information Technology

Figure 7 presents the CAR in the information technology industry, suggesting that the trend of CAR in this industry is similar to the industrial industry as these two sectors belong to the downstream part of the supply chain. The CARs of Britain and China show significance, for the crisis posed a risk to the supply of raw materials around the world, thus potentially exacerbating semiconductor supply issues as well as chip shortages that lasted for the past two years (Vinay Ramani et al., 2022). However, America's CAR is within the confidence interval. Our explanation for this is that America has advanced information technology, taking the lead in semiconductors and electronic apparatus fields. Thus, the war posed little threat to its IT market.

5.5 Consumer Staples

Businesses that are less sensitive to economic cycles, including manufacturers and distributors of food, beverages and tobacco, and producers of non-durable household goods and personal products are covered in the Consumer Staples Index.

Figure 8. Cumulative Abnormal Returns (CAR) in Consumer Staples

Figure 8 presents the CAR in the consumer staples industry. The CAR of the UK shows significance after 8 to 12 days around the event day. However, this significance gradually disappears as the event window extends for the US, while China's CAR keeps its silence in all horizons.

The significant adverse reaction of the UK in this industry points to the fact that investors do predict this sector to be negatively affected by a decrease in consumer spending due to higher inflation and lower disposable income, lower consuming desires, and more importantly, increasing agricultural product prices. Russia and Ukraine are leading global producers and exporters of agricultural commodities, particularly wheat, sunflowers and barley (see Figure 9). Russia is the biggest food exporter to Europe, presented by UN Comtrade. On March 9, the Ukrainian government announced a ban on the export of wheat, corn, and other major agricultural products. On March 12, the Ukrainian government further decided to ban all types of chemical fertilizers' export temporarily. These restrictions may be a painful blow to the European agricultural market. In the US, fertilizers' price

has been rising continuously since 2022, with necessities' prices fluctuating continuously. In addition, both US and China have abundant grain reserves, contributing to the result of little significance of CAR in this sector.

HS code	4-digit heading of Harmonized System 2012	Value (million US$)			Unit value				SITC code
		2019	2020	2021	2019	2020	2021	Unit	
	All Commodities..	50 054.4	49 230.8	65 870.3					044
1005	Maize (corn)..	5 218.3	4 885.1	5 854.6	0.2	0.2	0.2	US$/kg	044
1512	Sunflower-seed, safflower or cotton-seed oil..........	4 273.5	5 319.9	6 310.6	0.7	0.8	1.2	US$/kg	421
2601	Iron ores and concentrates, including roasted iron pyrites..........	3 397.8	4 239.3	6 810.6	0.1		0.2	US$/kg	281
1001	Wheat and meslin..	3 658.4	3 594.2	4 722.7	0.2	0.2	0.2	US$/kg	041
7207	Semi-finished products of iron or non-alloy steel.......	2 860.0	2 746.4	3 888.5	0.4	0.4	0.6	US$/kg	672
7208	Flat-rolled products of iron or non-alloy steel..........	1 943.8	1 599.2	3 436.7	0.5	0.4	0.7	US$/kg	673
8544	Insulated (including enamelled or anodised) wire, cable....	1 465.1	1 351.0	1 625.4	19.6	20.1	20.9	US$/kg	773
1205	Rape or colza seeds, whether or not broken.............	1 282.4	1 007.1	1 359.0	0.4	0.4	0.6	US$/kg	222
2306	Oil-cake and other solid residues.........................	1 012.4	1 177.8	1 275.7	0.2	0.2	0.3	US$/kg	081
7201	Pig iron and spiegeleisen in pigs, blocks or other primary forms.......	801.8	922.2	1 576.7	0.3	0.3	0.5	US$/kg	671

(1)

HS code	4-digit heading of Harmonized System 2017	Value (million US$)			Unit value				SITC code
		2018	2019	2020	2018	2019	2020	Unit	
	All Commodities..	451 494.8	426 720.3	337 104.0					333
2709	Petroleum oils and oils obtained from bituminous minerals; crude....	129 201.1	122 228.6	72 564.3	0.5	0.5	0.3	US$/kg	333
2710	Petroleum oils, other than crude.........................	78 209.9	66 946.5	45 360.1	0.5	0.5	0.3	US$/kg	334
9999	Commodities not specified according to kind............	63 727.3	55 642.7	39 315.7					931
2701	Coal; briquettes, ovoids and similar solid fuels manufactured from coal....	17 034.9	15 986.7	12 388.2	0.1	0.1	0.1	US$/kg	321
7108	Gold (including gold plated with platinum)...............	697.1	5 763.4	18 536.0	41.2	46.4	58.1	thsd US$/kg	971
2711	Petroleum gases and other gaseous hydrocarbons.......	7 497.6	9 501.4	7 841.8	0.4	0.3	0.2	US$/kg	343
1001	Wheat and meslin..	8 432.5	6 403.0	7 918.3	0.2	0.2	0.2	US$/kg	041
7207	Semi-finished products of iron or non-alloy steel.......	7 957.1	6 100.3	4 854.8	0.5	0.4	0.4	US$/kg	672
7110	Platinum, unwrought or in semi-manufactured forms, or in powder form....	3 644.9	5 128.6	7 842.1					681
7601	Unwrought aluminium......................................	5 126.7	4 642.8	4 218.9	1.7	1.7	1.6	US$/kg	684

(2)

Figure 9. (1) Ukraine Top 10 export commodities from 2019 to 2021. Data is sourced from UN Comtrade 2021 International Trade Statistics Yearbook, Vol. I. (2) Russia Top 10 export commodities from 2018 to 2020. Data is sourced from UN Comtrade 2021 International Trade Statistics Yearbook, Vol. I.

5.6 Consumer Discretionary

The sector of Consumer Discretionary contains businesses that are more sensitive to economic cycles, including makers of automobiles, household durable goods, textiles and apparel. Services such as hotels, restaurants, and retailing, are covered as well.
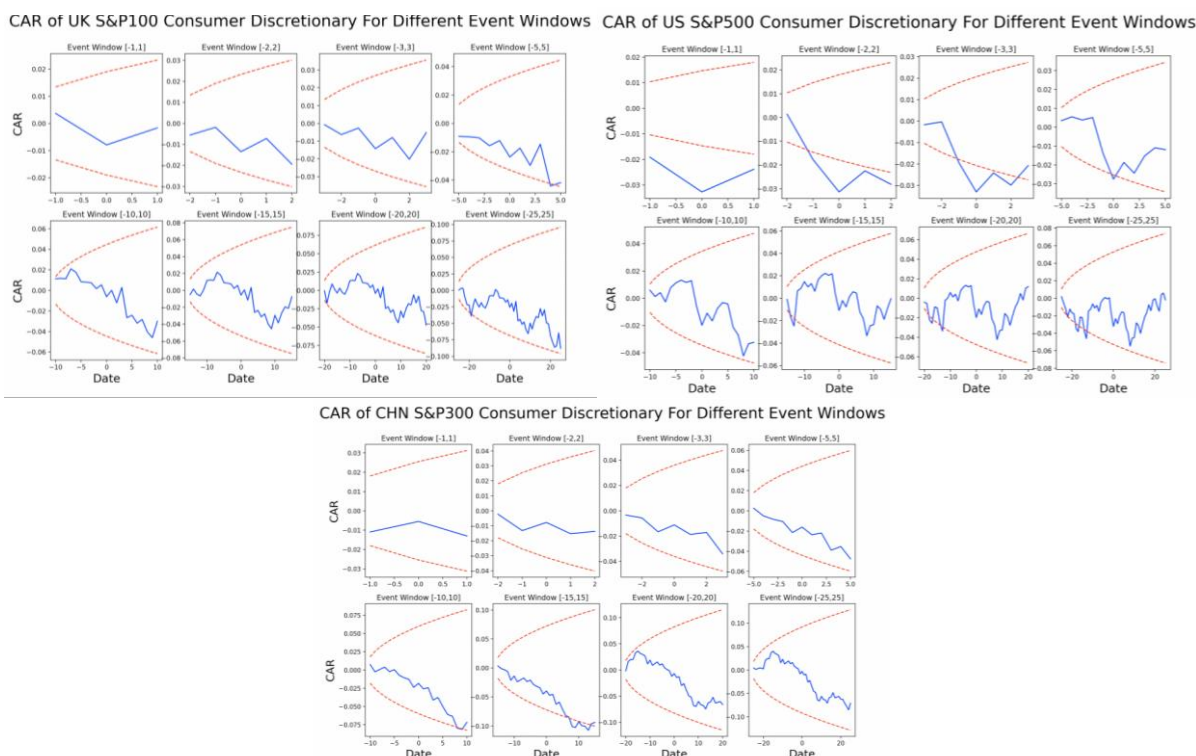

Figure 10. Cumulative Abnormal Returns (CAR) in Consumer Discretionary

Figure 10 displays the CAR of the UK, the US, and China in the consumer discretionary industry. It is worth noting that there is a downward trend of CAR in the UK without significance as the horizon extends, which may be ascribed to multiple factors such as inflation and post-epidemic economic recovery superimposed on the Russian-Ukrainian war. On March 30th, the British Retail Alliance released a report pointing out that with the continuous soaring of food, clothing, fuel, and energy prices and the lagging of wages, the British people are facing a severe cost of living crisis, and the spare money that families can spend on consumer discretionary is significantly reduced. S&P Global Market Intelligence reported on February 15th that investors' hold short positions in consumer discretionary as consumer goods stocks rose to a one-year high, for they expected consumer spending to be curbed with the US inflation rate soaring to the highest since 1982. According to the US Department of Labor, America's CPI cycle witnessed a surge at the beginning of 2022. Thus, American people are reducing unnecessary consumption, which may explain the reason why the CAR of the US shows significance 10 to 15 days before the event.

The situation in China is different from UK and US. The inflation rate in China is within a reasonable range (see also Figure 11), so the continuous downward trend of CAR around the event days may be due to COVID-19 recurring in different areas in China, which curbed the need for consumption nationwide.
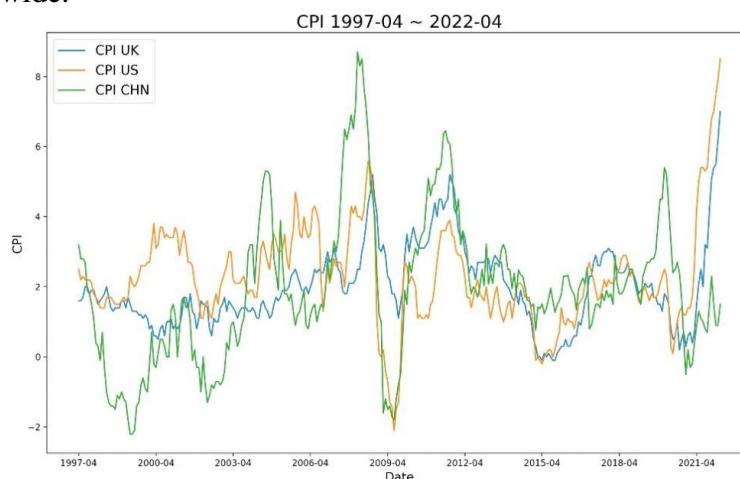

Figure 11. The UK, the US and China's CPIs from April, 1997 to April, 2022

5.7 Health Care

As stipulated by the GISC, the S&P Health Care Index includes health care providers and services, companies that manufacture and distribute health care equipment and supplies, and health care technology companies, as well as pharmaceutical and biotechnology companies.

Figure 5.7 shows the CARs of the 3 selected countries in the health care industry. It can be observed that the medical industries in all 3 countries hardly experience significant impact. However, it is worth mentioning that the conflict between Russia and Ukraine may cause more than 200 biomedical-related clinical trials in Ukraine to be affected and some trials to be postponed or suspended, according to the report of Fierce Biotech. But the business of the 3 chosen countries in Ukraine has not been significantly affected. According to Investment bank Jefferies' report, which investigated 45 biopharmaceutical companies, of which 9 have clinical trial sites in Ukraine. The report believes that the conflict between Russia and Ukraine will not have a significant impact on the clinical trials mentioned in the report.
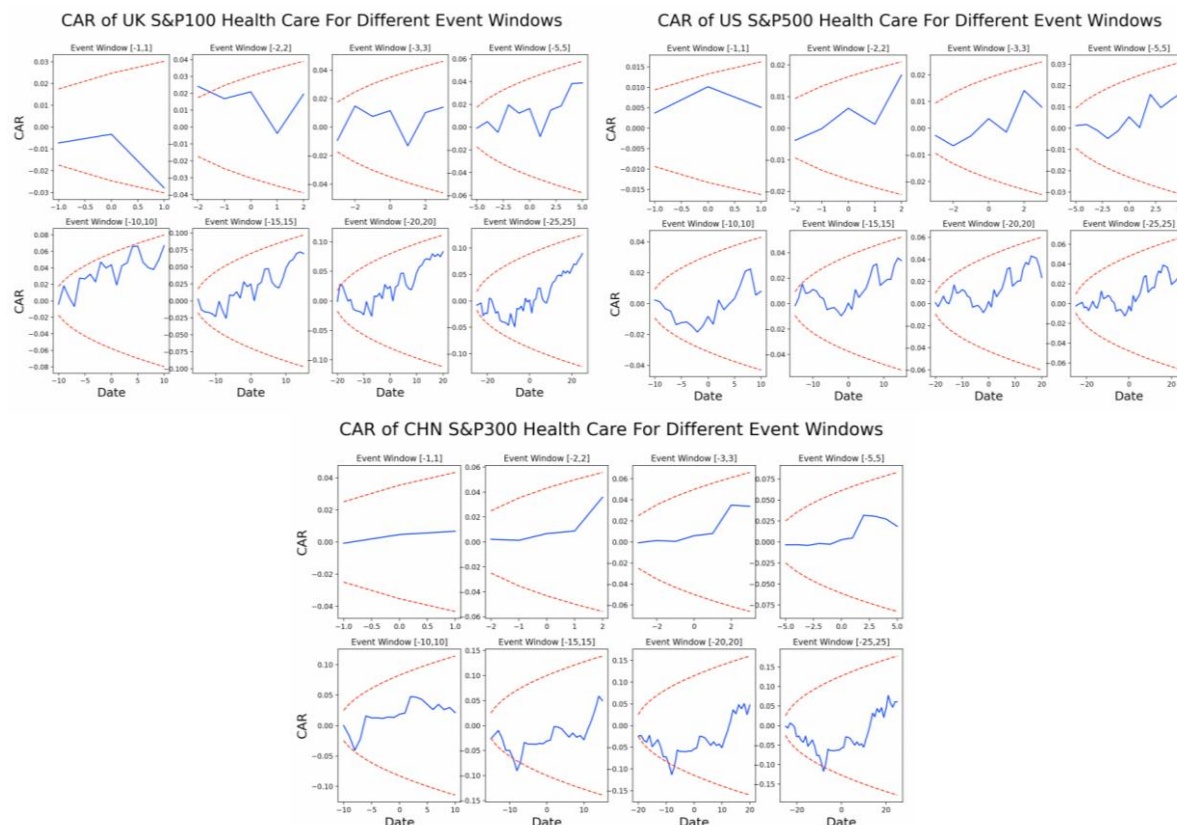
Figure 12. Cumulative Abnormal Returns (CAR) in Health Care

5.8 Financials

The Index of Financials includes banks and thrifts, as well as providers of diversified financial services, specialized finance, consumer finance, asset management and custody of securities, investment banking and brokerage services, capital markets services, financial exchanges, data and analytics, insurance underwriters and brokers, and mortgage REITs.
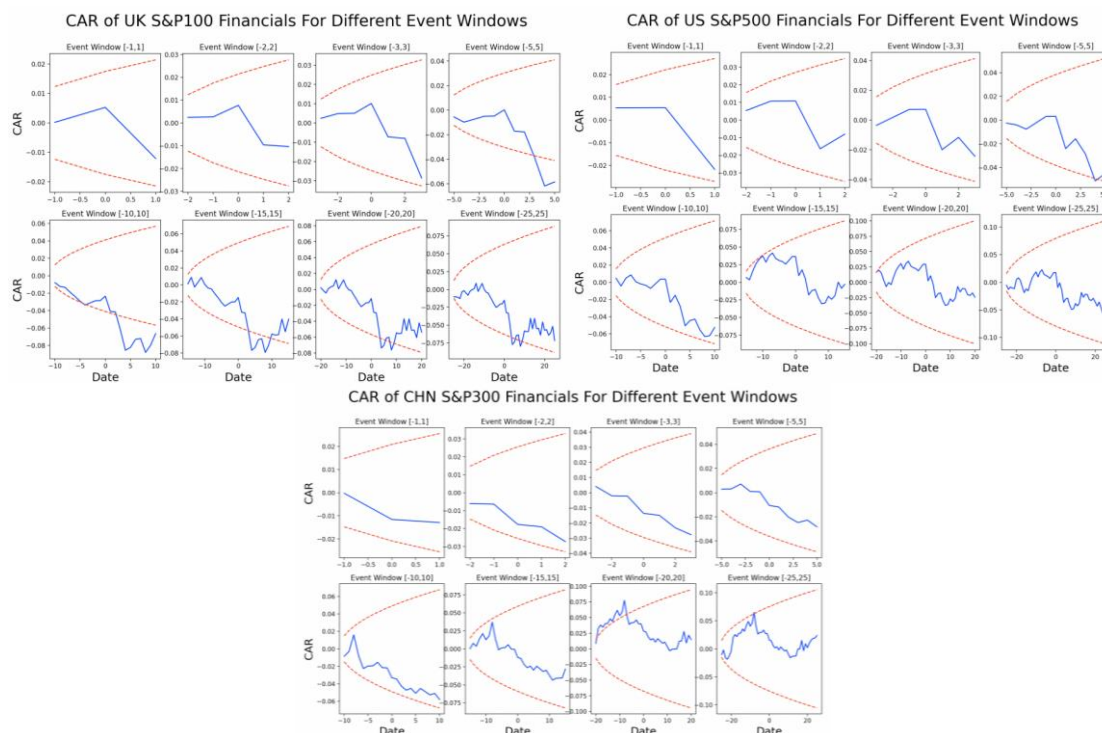
Figure 13. Cumulative Abnormal Returns (CAR) in Financials

Figure 12 shows the CAR of the financial industry. The CAR of the UK falls significantly 4 to 8 days after the event, while the US experiences no significant CAR.

On Feb 25, the UK announced it would work "all the way" to persuade European states to cut Russia off the international SWIFT payment system, which is the world's leading banking messaging service and is the global financial artery that allows the smooth and rapid transfer of money across borders. However, this approach may have complicated impacts on US and Europe, especially on Europe, which is highly dependent on Russia in terms of fossil fuels. Once SWIFT is prohibited for Russia, it may lead to negative affect on both petroleum oil and natural gas imports.

Moreover, European banks face huge risk exposure because they hold many Russian enterprises and financial institutions' debts. The rising risk will affect the global financial system's stability and thus have a relatively noticeable impact on the economy. China's economic recovery due to the epidemic tends to result in a slight significance of CAR before the event day.

5.9 Communication Services

The GICS regulates the Communication Service sector to contain companies that provide content, such as information, advertising, entertainment, news, and social media, delivered on networks, primarily through internet, broadband, cellular, cable, and land lines.
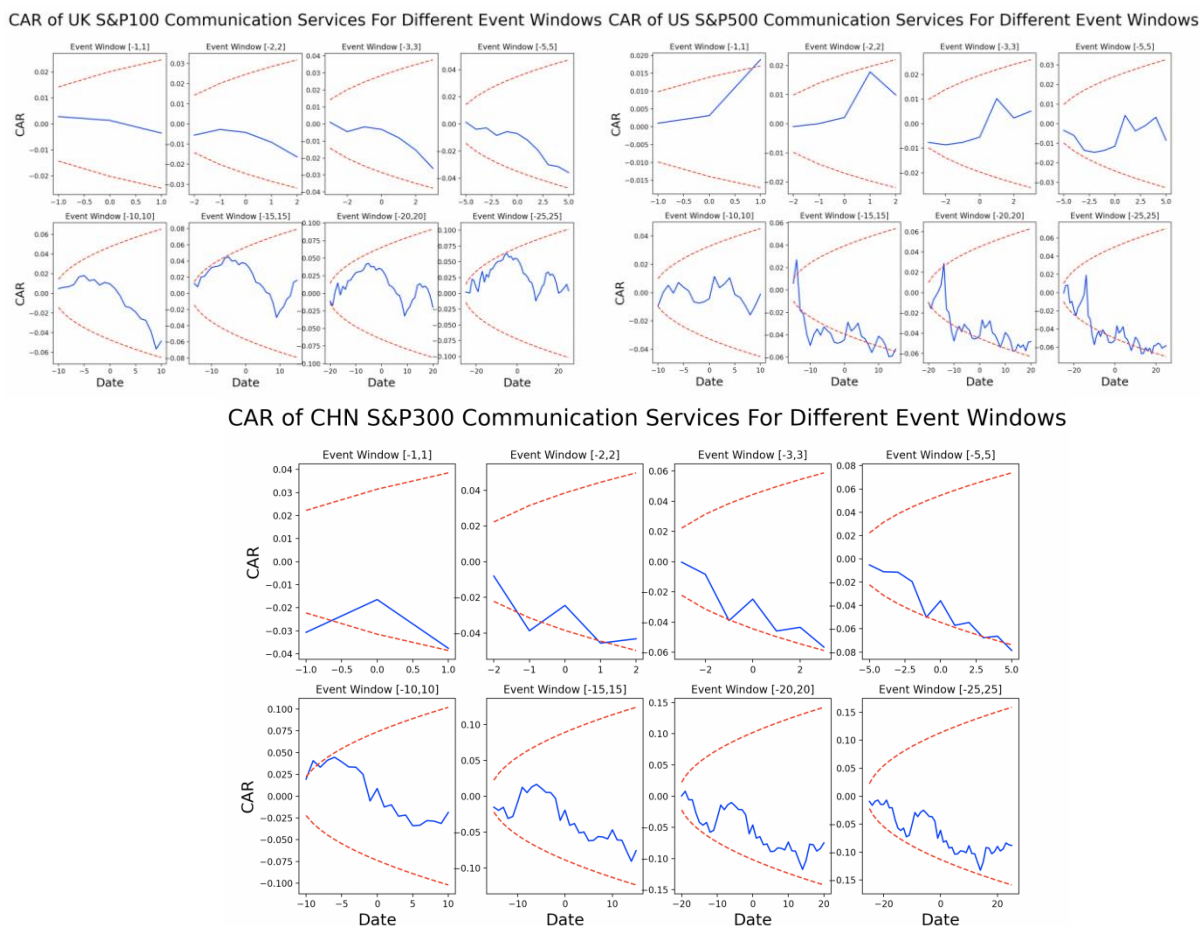
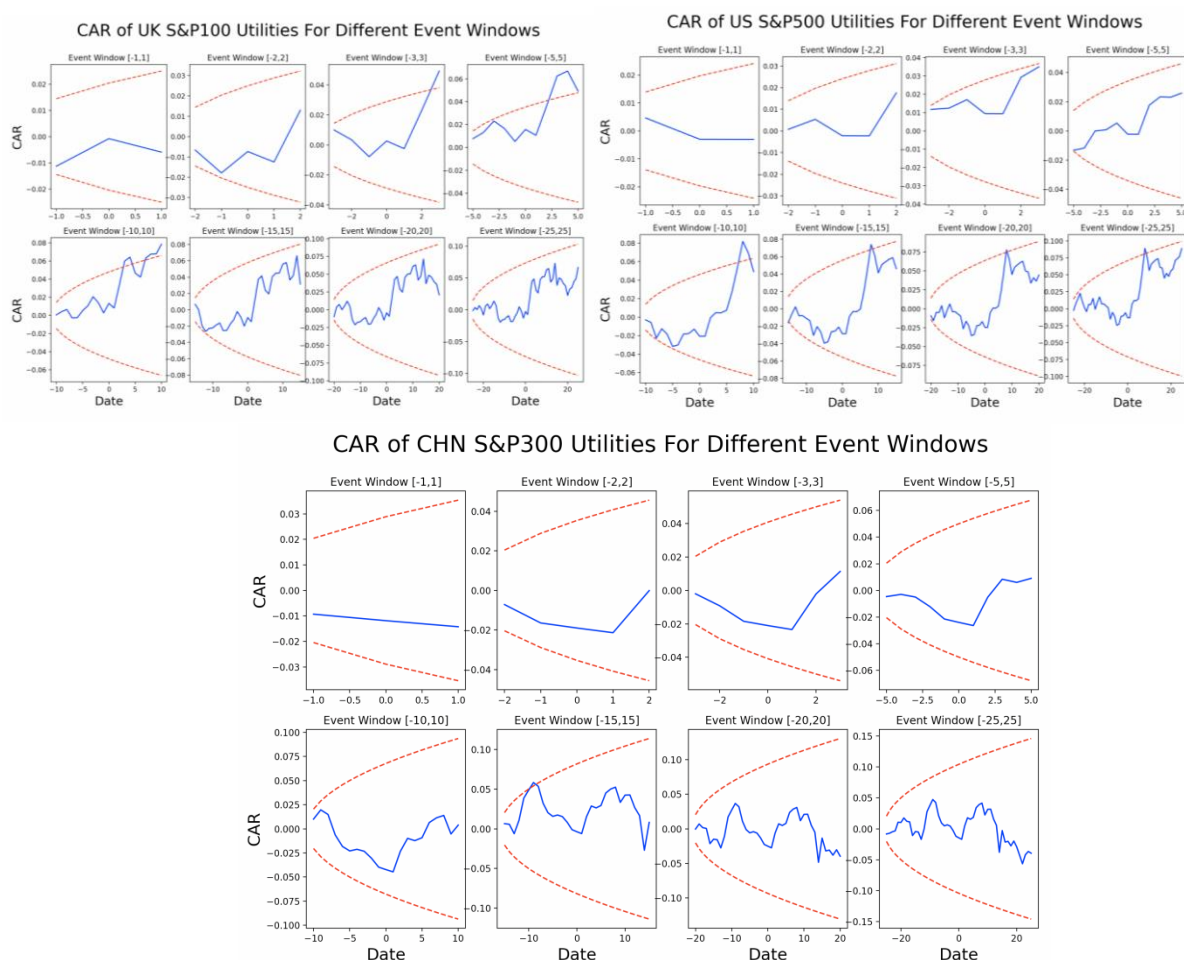**Figure 14.** Cumulative Abnormal Returns (CAR) in Communication Services

Figure 13 shows the CAR in the industry of communication services. Unlike all the other industries we have investigated, which mainly present the downside for Britain, the US appears to be negatively affected most by the crisis in terms of the communication service industry. This phenomenon can be attributed to the persistent shortages of electronic equipment manufacturing materials led by the semiconductor chip since COVID-19, aggravated by the Russia-Ukraine crisis. In addition, it can be inferred that possessing 60% of the global 5G base stations may have helped China alleviate the

situation, based on National Internet Information Office, Digital China Development Report (2021). Thus, a negative CAR can be observed but not significant.

5.10   Utilities

The S&P Index of Utilities covers utility companies such as electric, gas, and water utilities. It also includes independent power producers, energy traders, and companies that generate and distribute electricity using renewable sources.


Figure 15. Cumulative Abnormal Returns (CAR) in Utilities

Figure 14 shows a sharp, significant increase in the UK's CAR between February 24th and the following day. However, the significance gradually diminishes as the horizon expands. On 24 February, after the Russian troops landed in Ukraine to fight, the anxiety of the British people that they could not afford to pay their energy bills was further raised, and the CAR increased significantly. However, people may expect a price rise.

The US also experienced a positive CAR increase, which may be related to the rise of installed utility energy systems. According to the latest Energy Infrastructure Update report (data as of 28 February 2022) released by the Federal Energy Regulatory Commission (FERC), the total installed capacity of utility-scale PV systems and wind facilities in the United States during the first two months of this year was 3,976MW. The US Energy Information Administration (EIA) reported a 35.6% increase in installed PV capacity (including small PV systems) in the first two months of 2022 compared with the same period last year, with total wind and PV capacity up by more than a third (33.8%).

China's self-sufficiency of energy supply remains high, making the fluctuations of the utility industry tend to react indistinctively.

6. Empirical Findings II

In this section, we examine whether the reaction of each industry to the Russia-Ukraine crisis differs across countries. Our main goal is to test the significance of the difference between the cumulative abnormal returns (CAR) in the same industries in two different countries. We apply the method of Hypothesis Test II in the Methodology part and repeat the calculation for three pairs of nations. The CAR of 10 industries in every two countries is visualized as the green curve in following figures, while the boundaries of the confidence band are in red.
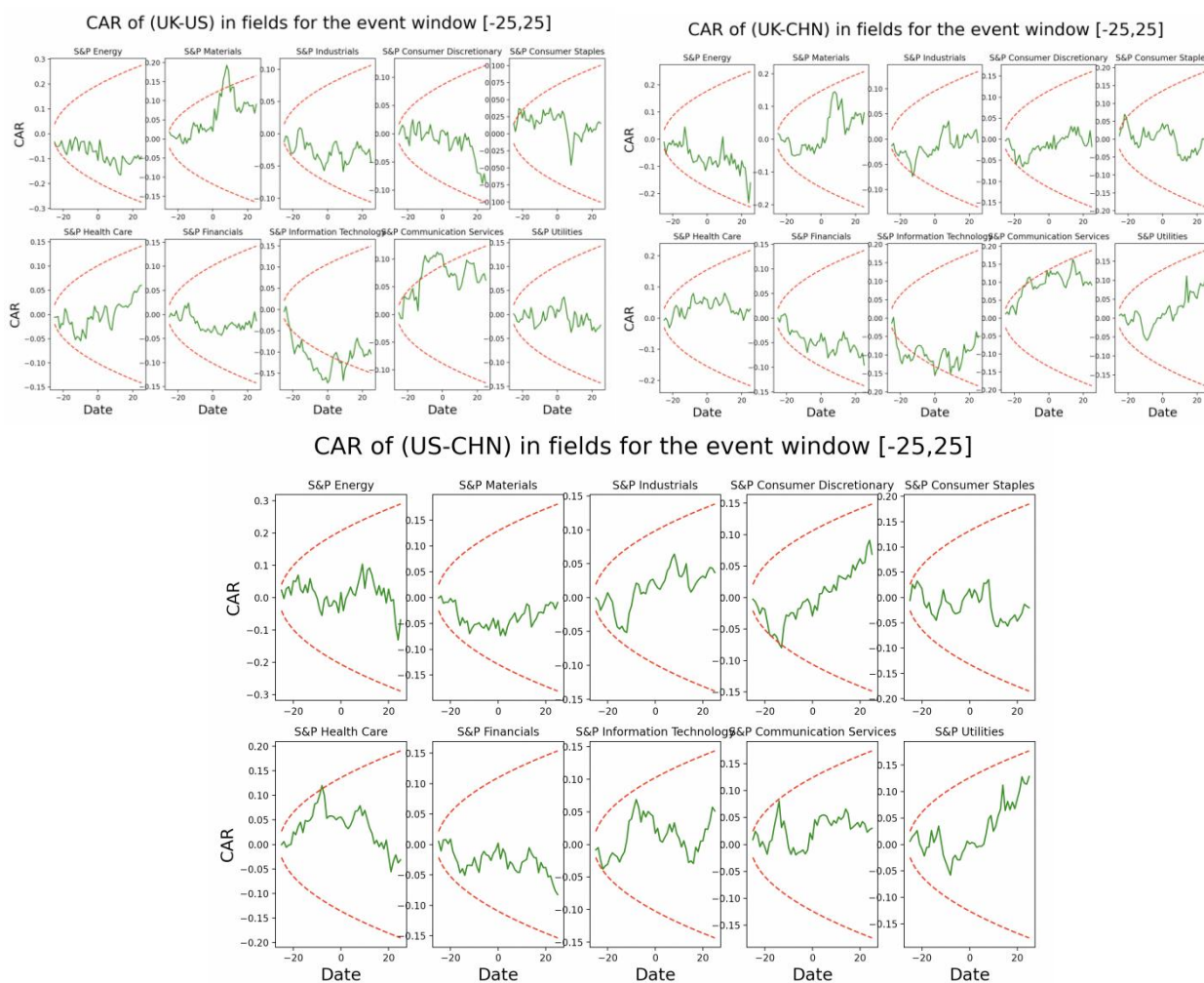
Figure 16. Differences Between the CAR in country pairs

The top figure shows that the most significant differences between the CAR of the UK and the US appear in mainly three industries: the materials, information technology, and communication service industries.

From the perspective of materials, the most significant disparity of the CAR emerges on 4 March, ten days after the event date, which can be related to the substantial appreciation of prices of aluminum and copper experienced by Britain because of the escalating crisis between Russia and Ukraine, according to the London Metal Exchange, inclining that British consumers are likely to face higher prices especially for canned food and copper wire. The results also provide empirical evidence that the UK's location in Europe makes it more vulnerable once the import of materials was shut down because of the war.

The differences between Britain's and America's CAR in the information technology and communication service fields last long around the event day. America's strength in the information technology manufacturing industry guaranteed its stability during the war, while Britain was relatively more negatively affected, which may be related to the fact that the EU region is the second

largest exporter of iron and metal from Ukraine and Russia in the world according to WTO, while the US is not.

The central figure presents a relatively significant difference in the technology industry between the UK and China. It can be attributed to Ukraine's important role in Europe's technology and programming field. The fact is that there are over 200 thousand technology and programming workers are Ukraine across the world and mainly in Europe, and Ukraine owns the world's largest C++ developer community and second-largest JavaScript developer community. The war may cause them to stop working, making the UK as a European country, more negatively affected than China.

Interestingly, no significance is found when investigating the differences between the ten industries' CARs of the US and China. Large domestic markets and the maturity of the economic structure of the two top economies make their overall gap indistinctive, although the influence of the war exists for both nations.

7. Conclusion Remarks and Future Research Agenda

Our study examines how the stock markets varying in industries in the UK, the US, and China reacted to the Russia-Ukraine crisis. We predicted that the industries in the UK would respond more negatively and significantly to the war, compared with stock markets in the US and China, owing to its close connection with the European continent and strong dependency on imports from disparate industries.

We employ the S&P Industry Index as a proxy in the industry-level as well as each country's stock market index as a market proxy to collect daily data from 10 industries in the 3 countries from 1 November 2020 to 20 March 2022. By applying the event study methodology, we calculate the cumulative abnormal returns (CAR) and confidence intervals in different lengths of the event window around the chosen event day, 22 February 2022, with the actual stock data through industries and then compare them through countries. Notably, the UK is mainly more affected by the crisis than China and the US, especially in the material, technology, and consumer staples industries. Further, we observe that the energy and materials industries are seriously impacted by the crisis, especially the energy industry. In the energy industry, all three countries show positive and significant CARs, providing strong evidence of the adverse impact of the Russia-Ukraine crisis on the global energy markets. The industrial, technology and financial industries all display different degrees of significant and negative CARs varying from countries, suggesting the negative effect of the crisis imposed on diverse industries.

Our study confirms and expands the conclusion made by Ahmed et al. (2022) in a broader industry-level perspective that, in general, investors in the three countries have taken the Russia-Ukraine crisis seriously enough. The war's adverse impact has already spread from political field to panics about energy supply, financial stability, and long-term economic development. The war between Russia and Ukraine has once again pushed forward the progress of developing renewable energy, as policymakers in the three selected countries and even the whole Europe have to deal with the soaring petroleum oil and gas prices. The incredibly high oil and gas prices could lead to inflation and recession, making people reflect on the value of peace and political stability worldwide.

In the end, it is possible that our research might not entirely reflect the outcome of the crisis since it was conducted at the very beginning of the ongoing Russia-Ukraine crisis. Furthermore, we may need to collect data from more regions to verify the differences among countries affected by the war. At the same time, it is expected that more methods, such as the volatility analysis, may be used to test the impact of war on the stock market more specifically, as we also observed a distinctive variation in the volatility of stock markets during our study. Fourth, we may need to refer to more theoretical methods to work further on our explanation of cumulative abnormal returns.

Acknowledgement

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