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WHAT WAS THE IMPACT OF THE RUSSIAN WAR IN UKRAINE ON GLOBAL STOCK MARKET SECTORS IN 2022?

MILYEN HATÁSA VOLT AZ OROSZ-UKRÁN HÁBORÚNAK A GLOBÁLIS TŐZSDEI SZEKTORRA 2022-BEN?

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ABSTRACT

The Russian Federation's war of aggression against Ukraine has prompted reallocations in equity investments around the world. Overall portfolios were adjusted globally. There were many losses but also gains. This article analyzes the impact of the Russian war in Ukraine on global stock market sectors. With this, we would like to answer the following questions: what impact did the Russian war have on the biggest companies worldwide, and what expectations do investors have about the development of the respective business models operating in different stock market sectors. In addition to analyzing the major stock market indices in other studies, we focus on the impact on various market sectors. This is important as sector indices are used to apply a specific stock strategy and to hedge the risk of individual stocks belonging to a particular sector. By doing an event study, we analyzed abnormal returns and cumulative abnormal returns of the 11 different MSCI World sector indices. We have evidence that on 24th February, the beginning of the Russian attack, almost all sectors had negative abnormal returns. The development would be more differentiated from the stock market sectors in the following days. Our analysis of cumulative abnormal returns shows to what extent the abnormal returns are sustainable.

ABSZTRAKT

Oroszország Ukrajna elleni agressziós háborúja világszerte átrendeződéseket eredményezett a részvénybefektetések terén. Az összesített portfóliókat globálisan módosították. Számos veszteség, de nyereség is előfordult. Ez a cikk az orosz háború globális részvénypiacokra gyakorolt hatását elemzi. Ezzel szeretnénk választ adni a következő kérdésekre: milyen hatással volt az orosz háború a világ legnagyobb vállalataira, és milyen elvárásai vannak a befektetőknek a különböző részvénypiaci szektorokban működő üzleti modellek fejlődésével kapcsolatban. Más tanulmányokban a főbb részvénypiaci indexek elemzése mellett mi a különböző piaci szektorokra gyakorolt hatásra összpontosítunk. Ez azért fontos, mert a szektorindexeket specifikus részvénystratégiák alkalmazására és az adott szektorhoz tartozó egyedi részvények kockázatának fedezésére használják. Eseményvizsgálatot végezve elemeztük az MSCI World 11 különböző szektorindexének rendkívüli hozamait és kumulált rendkívüli hozamait. Az adatok azt mutatják, hogy február 24-én, az orosz támadás kezdetén, szinte

minden szektor negatív rendkívüli hozamokat mutatott. A fejlemények a következő napokban szektoronként különböző módon alakultak. A kumulált rendkívüli hozamok elemzése megmutatja, hogy a rendkívüli hozamok mennyire fenntarthatók.

INTRODUCTION

The Russian invasion of Ukraine on February 24th, 2022 represents a geopolitical turning point in European development since the 1990s, which is, after the collapse of the Soviet Union, characterized, among other things, by increasing integration of the markets (Mbah & Wasum, 2022). Although the Russian state became increasingly autocratic and Russia already made territorial conquests, such as the annexation of Crimea in 2014, and the conflict in the Donbas has been ongoing since 2016, Europe was still closely linked to Russia, mainly through its trade relations, e.g., by the import of natural gas and other commodities. Although the Russian army has been encircling Ukraine since 2021 as part of a military maneuver, the Russian attack on February 24th, 2022, was a big surprise worldwide. Uncertainty regarding Russia's behavior had already been partly priced in days earlier through selloffs on the major stock indices, but this step was often not expected. This could be seen particularly in the diverse reactions of market participants, which reallocated equity investments worldwide. All major stock indices lost on the day: Dow Jones (-1.4%), S&P 500 (-1.8%), Nasdaq (-2.6%), FTSE 100 (-6.0%), DAX (-4.4%), Nikkei (-1.8 %) and Hang-Seng (-3.2%) (Bloomberg). At the same time, the price of crude oil initially rose to over USD 100 per barrel (+3.8%), and so did natural gas (+40% - 50%) (Bloomberg). As is typical in crises, investors prefer liquidity and certainty from a risk perspective. So, equity shares were sold off in many cases. Still, there were also a lot of companies that benefited from this situation, e.g., companies in the energy, materials, and utilities sectors. Since expectations are traded in the markets, these transactions provide information about the expected impact on the different business models and geopolitical factors and the underlying risk of the investment. In addition to

the general adverse effects of the war on the stock markets, we want to go deeper and analyze how market participants assess future developments under the changed conditions for individual industries. So, we want to answer the following research questions:

Research Question 1: Are there significant abnormal returns on the 24th of February 2022 in the sectors of the MSCI World index, respectively?

Research Question 2: Are there significant cumulative abnormal returns in the MSCI World index sectors up to 25 days after the 24th of February 2022?

To investigate these questions, we conduct an event study based on the approach of Fama et al. (1969) and Campbell & Lo (1996), where we calculate abnormal returns and cumulative abnormal returns around 5 days before and up to 25 days after the 24th of February 2022. Our main findings are that many MSCI World index sectors had abnormal returns when Russia started its war against Ukraine. On 24th February 2022, the financial services sector posted the worst performance (-3.00% abnormal returns), while the telecommunications sector performed best (+1.99% abnormal returns). In addition, when calculating cumulative abnormal returns, we can see that the developments of 24th February 2022 are persistent in specific sectors and are not compensated by short-term countermovements of buyers or sellers. We contribute to the literature by providing a deeper insight into the reactions of particular market sectors and the world's biggest companies. These insights are essential from an investor's perspective because investments are often made in more specific sector strategies and broadly diversified portfolios. In this context, the MSCI World sector indices we use most developed markets. The paper is organized as follows. The bibliographic review covers the relevant literature. Research methodology presents the applied methods. In the results section, we present our findings in detail. Moreover, we describe the data and provide summary statistics about our dataset. The conclusion summarizes the article and gives remarks for further research.

LITERATURE REVIEW

There is already some research on this topic. For 25 country-based stock and 20 commodity markets, Abbassi, Kumari & Pandey (2022) analyzed the reaction of a sample of different companies to the Russian attack. Agyei, S. K. (2023) investigated the connection between geopolitical risk and stock market reactions. They found a high correlation between geopolitical events and market volatility. Ahmed et al. (2023) examined the effect of the disappearance of the local Russian stock market on the global stock market. They showed that this disappearance had a low impact on the whole market. Ahmed, Hasan & Kamal (2022) analyzed the effect of the Russian war on the STOXX Europe 600 and its sectors. They found evidence that the Russian war negatively influenced 7 of 11 sectors: materials, consumer staples, financials, healthcare, industrials, telecommunication, and utilities. The consumer staples industry had the worst average abnormal return on the event day (24th February 2022), while the energy industry experienced an insignificant positive average abnormal return. Alam et al. (2022) analyzed the interdependence between commodity and stock markets during the Russian war at the beginning of 2022. They found that there is a high correlation between these markets. Ali et al. (2023) investigated the impact of stock markets and sectors on geopolitical threats between 1987 and 2021. They found that US stocks mostly profited from geopolitical threats. In particular, the financial and information technology sectors. Antonakakis et al. (2017) examined the influence of geopolitical events on the stock and oil markets and found that geopolitical risks trigger negative effects on returns and variance. Będowska-Sójka, Demir & Zaremba (2022) analyzed the sensitivity of different asset classes to geopolitical risks. They found that green bonds, gold, silver, Swiss franc, and real estate most resist geopolitical risk. Berninger, Kiesel & Kolaric (2022) investigated the share price reactions of firms with Russian operations when releasing whether to stay or leave in Russia. They observe positive stock returns for leave decisions but no significant effect for staying. Bhattacharjee, Gaur & Gupta (2023) analyzed the

impact of the Russian war on several sectoral indices of the Indian economy and found overall positive abnormal returns in the post-event timeframe. Bossman & Gubareva (2023) found positive reactions to conflict-induced geopolitical risks for G7 countries in bearish market cycles. Boubaker et al. (2022) investigated the impact of the Russian war on the global stock market indices of 23 developed and 24 emerging markets (due to the MSCI classification). They found that almost all markets recorded negative abnormal returns on event day (24th February 2022). The impact on emerging markets was stronger overall. They also found evidence that there were negative cumulative returns from the event day in all markets except Asia and the Middle East. Boungou & Yatié (2022) analyzed the impact of the Russian war in Ukraine on global stock markets for a sample of 94 countries over the period from 22nd January 2022 to 24th March 2022. They found empirical evidence that the Russian war negatively influenced these stock returns. Duong (2023) studied bond market convergence in East Asia and found that convergence speed increased during the Russian attack on Ukraine in February 2022. El Khoury et al. (2023) analyzed spillover effects between FinTech, Environmental, Social, and Governance (ESG), renewable energy, gold, and MSCI indices in developed and emerging countries. By investigating volatility in the commodity markets during the Russian war, Fang & Shao (2022) found that the higher the global market share of a Russian commodity, the higher the market volatility. Federle et al. (2022) analyzed stock market reactions depending on its proximity to the conflict area in Ukraine. They found that the closer the market, the more negative the equity returns. Fiszeder & Malecka (2022) forecasted volatility for commodities, (crypto-) currencies and stock indices. Gaio et al. (2022) investigated the efficiency of the stock markets in Russia-Ukraine for six developed countries. They found evidence of multifractality in periods of crisis, which rejects the market efficiency hypothesis. The relationship between proximity to the crisis center Ukraine and stock market volatility was examined by Gheorghe & Panazan (2023). They found that countries closer to Ukraine

anticipated the conflict earlier than others and thus discovered more volatile markets before the Russian attack. Hassan et al. (2022) analyzed the reactions of Indian stock sector indices to Sino-Indian border conflicts in 2020. They observed positive abnormal returns for automotive, IT, media, and energy but negative abnormal returns for banking, financial services, and the private bank sector. Izzeldin et al. (2023) investigated the reactions of market participants to the Russian attack in terms of speed and duration and compared their results with the financial crisis in 2008 and the beginning of the COVID-19 pandemic in 2020. They found that the reaction of the market participants in the case of the Russian attack was much faster than for the financial crisis or the COVID-19 pandemic. On the other hand, the duration in the crisis mode (in terms of volatility) after the Russian attack was lower than in the other crises. The most affected commodities were wheat and nickel. Kamal, Ahmed & Hasan (2023) observed negative abnormal returns around the Russian attack on Ukraine in February 2022 for the Australian stock market. This negative reaction disappeared in the post-event timeframe. Keleş, E. (2023) examined the impact of the Russian war on Turkish companies. The research found a growing adverse reaction starting before the 24th of February 2022. This reaction is mitigated for larger and more profitable firms but stronger for firms with high debt-holding. Non-financial companies were particularly hard hit. A statistical dependence between public attention to the Russian war, cryptocurrencies, and G7 stock returns was found by Khalfaoui et al. (2022). Using a quantile co-spectral analysis and constructing the Google Trend Russia-Ukraine index, they found evidence that increased attention to the war in Ukraine in normal or bear markets led to negative returns in cryptocurrencies and the G7 stock indices. Impact on the leading European Union stock market indices was analyzed by Kumari, Kumar & Pandey (2023). They found an adverse impact on the indices on the event day. However, positive cumulative abnormal returns were observed in Poland, Denmark, and Portugal during the post-event timeframe. Liu et al. (2023) have examined the impact of the COVID-19

pandemic on different types of companies in the Chinese economy. In their study, they show, e.g., that the stock performance for labor-intensive state-owned firms worsened due to increasing labor costs. Martins, Correia & Gouveia (2023) analyzed the impact of the Russian attack in 2022 on the largest European listed banks and which bank-specific determinants were influencing the effect's magnitude. They observed negative stock price reactions at and around the military conflict. Maurya, Bansal & Mishra (2023) found evidence for the impact of the Russian Invasion on global inflation. The proximity and intensity of trade with the parties to the conflict can explain the country-specific inflation. An analysis of the macroeconomic impact of the Russia-Ukraine conflict on countries that have imposed sanctions on Russia was carried out by Mbah & Wasum (2022). The effects of stock indices on cryptocurrencies during the Russian war in 2022 were analyzed by Mgadmi (2023). They found evidence that the German, Russian, and Ukrainian stock markets influenced the most famous cryptocurrencies in the short run. American, Canadian, French, and Ukrainian stock markets influenced cryptocurrencies in the long run. Pandey, Lucey & Kumar (2023) provided a systemic literature review on border disputes, conflicts, war, and their effects on financial markets. Silva, Wilhelm & Tabak (2023) analyzed the impact of trade exposure and proximity on global stock markets during the Russian-Ukrainian conflict. They found that both factors determine different stock market reactions. Sun et al. (2022) investigated the reaction of different countries, regions, and sectors to the Russian war in Ukraine. They found various reactions of market participants and established a connection between the strength of the market reaction and, thus, how much the respective country was involved in the war. Accordingly, the European stock markets showed a negative reaction, while the reaction of the U.S. stock markets was only weakly negative. The same pattern emerges when looking at individual sectors. However, it was noticeable that the financial services sector reacted more negatively overall than, for example, manufacturing, while energy companies (especially gas and crude oil) benefited.

Umar, Riaz & Yousaf (2022) examined the impact of the Russian-Ukraine conflict on clean energy, conventional energy, and metal markets. They found positive abnormal returns for the renewable energy and gas and oil markets. Yousaf, Patel & Yarovaya (2022) analyzed the reaction of the stock market of the G20+ countries to the Russian war. By performing an event study, they found a strong negative impact on the overall stock markets, but the greatest adverse impact was on Russia itself, Poland, Hungary, and Turkey. They also showed that the event positively impacted the US stock markets. Focusing on the consumer staples industry, Yudaruddin et al. (2023) analyzed cumulative abnormal returns for a sample of over two thousand companies during the Russian attack on Ukraine. A negative effect can be observed across the entire consumer staples market. However, the beverages and household goods industries are particularly affected.

RESEARCH METHODOLOGY

We investigate the reactions of the market participants to the Russian attack on Ukraine by using the event study approach by Fama et al. (1969), Campbell & Lo (1996), and MacKinley (1997). For this, we first define t = 24th February 2022 (e.g., Ahmed, Hasan & Kamal, 2022; Kumari et al., 2023). Then, we define three time periods of our time series of daily closing prices for the MSCI World sector indices (Table 1). The pre-event window: t-255 days to t-6 days. The event window: t-5 days to t+5 days. And the post-event window: t+6 days to t+25 days. The pre-event and event window size is based on the current literature (e.g., Ahmed, Hasan & Kamal, 2022; Kumari et al., 2023). We use the pre-event window to estimate the parameters of the OLS market model and the event and post-event window to calculate abnormal and cumulative abnormal returns.

First, we calculate the returns of the given MSCI sector indices by:

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

where $P_{s,t}$ is the price of the sector index s at time t.

Then, for each of the 11 MSCI sectors, we construct an OLS market model

(Dyckman et al., 1984; MacKinlay, 1997) with:

$$R_{s,t} = \alpha_s + \beta_s R_{m,t} + \varepsilon_{s,t} \quad (2)$$

with $\varepsilon_{s,t} \sim (0, \sigma_s^2)$, $R_{s,t}$ is the individual sector index return of sector s at time t and $R_{m,t}$ is the market return at time t and α_s, β_s the parameters of the market model. For the overall market returns $R_{m,t}$ we use the MSCI World Index. In addition to the OLS market model used here, there are other variants of excess return measures (e.g., Brown & Warner, 1985; MacKinlay, 1997). However, Dyckman et al. (1984) have shown that this model delivers good results. By applying the OLS market model, we further assume that the conditional expectation of $R_{s,t}$, given I_{t-1} follows:

$$E(R_{s,t}|I_{t-1}) = \alpha_s + \beta_s R_{m,t} \quad (3)$$

After this, we calculate the abnormal returns:

$$AR_{s,t} = R_{s,t} - E(R_{s,t}) = R_{s,t} - (\hat{\alpha}_s + \hat{\beta}_s R_{m,t}) \quad (4)$$

with $\hat{\alpha}_s$ and $\hat{\beta}_s$ are estimated OLS market model parameters for the respective market model for MSCI sector s and cumulative abnormal returns:

$$CAR_{s,\tau_1,\tau_2} = \sum_{t=\tau_1}^{\tau_2} AR_{s,t} \quad (5)$$

with $\tau_1 = t - 5$ and $\tau_2 = t - 5, t - 4, \dots, t + 25.$

The average abnormal returns AAR_t is calculated as follows:

$$AAR_t = \frac{1}{J} \sum_{j=1}^{J} AR_{j,t} \quad (6)$$

where S is the total number of sector indices.

At this point, we will describe the dataset and discuss statistical analysis of the data. Our dataset contains twelve times series from 4th March 2021 to 31st March 2022. Overall, 11 MSCI sector indices $(R_{s,t})$ and the MSCI World index $(R_{m,t})$ nominated in USD. Each index time series gives us closing prices for 281 trading days in our data set. We have collected the necessary data via Reuters. For our event study, we split the dataset into three parts for every index time series. The

first part is the pre-event phase, which includes data from 4th March 2021 to 16th February 2022, and thus 250 observations. This part of the data is used to estimate the OLS market model.

Table 1. MSCI World sector indices

Index	ISIN	Abbreviation
MSCI World Index	MIWO00000PUS	MSCI
MSCI World Consumer Discretionary Index	MIWO0CD00PUS	CD
MSCI World Consumer Staples Index	MIWO0CS00PUS	CS
MSCI World Energy Index	MIWO0EN00PUS	EN
MSCI World Financials Index	MIWO0FN00PUS	FN
MSCI World Health Care Index	MIWO0HC00PUS	HC
MSCI World Industrial Index	MIWO0IN00PUS	IN
MSCI World Information Technology Index	MIWO0IT00PUS	IT
MSCI World Materials Index	MIWO0MT00PUS	MT
MSCI World Real Estate Index	MIWO0RE00PUS	RE
MSCI World Telecommunications Index	MIWO0TC00PUS	TC
MSCI World Utilities Index	MIWO0TC00PUS	UT

Source: Morgan Stanley Capital International (MSCI), Reuters

The second part of the data is the event phase. It contains the data from 17th February 2022 to 3rd March 2022 and thus a total of 11 trading days. 5 days before 24th February 2022 and 5 days after (e.g., Yousaf, Patel & Yarovaya, 2022). This phase includes the market development immediately around the event we are analyzing, the Russian attack on Ukraine, and is used to calculate Abnormal Returns. In setting the event date to 24th February 2022, we oriented by the available literature (e.g., Federle et al., 2022; Yousaf, Patel & Yarovaya, 2022; Izzeldin et al. 2023). Last, the post-event phase includes the trading days from 4th March 2022 to 31st March 2022 - a total of 20 observations. We use this phase to analyze the cumulative abnormal returns for t+6 to t+25 and thus investigate to what extent the effects around the event day were only temporary or persistent.
Now, we want to provide an analysis of summary statistics of the MSCI World Index returns and MSCI sector indices (Table 2-4).

Table 2. Summary statistics (%) for pre-event phase 03/04/21 – 02/16/22

	MSCI	CD	CS	EN	FN	HC	IN	IT	MT	RE	TC	UT
Min	-2.22	-2.92	-2.36	-4.54	-3.41	-1.92	-2.55	-2.22	-2.82	-2.22	-5.85	-2.20
1.Q	-0.31	-0.47	-0.22	-0.77	-0.47	-0.34	-0.37	-0.33	-0.47	-0.33	-0.44	-0.40
Med.	0.10	0.12	0.07	0.13	0.10	0.06	0.02	0.09	0.08	0.11	0.01	0.12
Mean	0.04	0.03	0.05	0.11	0.06	0.05	0.02	0.03	0.03	0.04	-0.01	0.03
3.Q	0.50	0.68	0.40	1.00	0.70	0.45	0.56	0.50	0.61	0.50	0.57	0.53
Max	2.12	3.20	1.55	3.38	2.42	1.68	1.71	2.12	2.17	2.12	2.54	1.64
StD	0.73	1.00	0.54	1.47	0.90	0.66	0.77	0.73	0.92	0.74	1.01	0.70

Source: Reuters, own calculations

We found that the median and mean of the MSCI World index returns are positive in the pre-event (Table 2) and post-event (Table 4) phases but clearly negative for the event phase (Table 3).

Table 3. Summary statistics (%) for event phase 02/17/22 – 03/03/22

	MSCI	CD	CS	EN	FN	HC	IN	IT	MT	RE	TC	UT
Min	-1.69	-2.51	-2.82	-1.46	-3.41	-1.25	-1.63	-1.69	-2.63	-1.69	-2.63	-1.97
1.Q	-1.13	-2.15	-0.72	-0.79	-1.64	-0.42	-1.14	-1.13	-0.72	-1.13	-1.12	-0.45
Med.	-0.74	-0.91	-0.23	-0.17	-0.62	-0.29	-0.86	-0.74	-0.46	-0.74	-0.88	-0.11
Mean	-0.36	-0.77	-0.14	0.27	-0.77	-0.01	-0.29	-0.36	-0.09	-0.32	-0.37	0.05
3.Q	-0.10	0.48	0.13	0.88	-0.30	-0.10	0.23	-0.10	0.50	0.06	0.29	0.22
Max	2.52	2.25	3.20	2.79	2.95	3.07	2.94	2.52	3.24	2.52	1.87	3.50
StD	1.19	1.55	1.36	1.38	1.73	1.09	1.29	1.19	1.43	1.20	1.30	1.31

***Source*:** Reuters, own calculations

Table 4. Summary statistics (%) for post-event phase

	MSCI	CD	CS	EN	FN	HC	IN	IT	MT	RE	TC	UT
Min	-2.69	-4.58	-2.28	-2.48	-3.46	-1.68	-2.11	-2.69	-1.84	-2.69	-3.56	-0.67
1.Q	-0.81	-1.25	-0.89	-0.74	-0.46	-0.47	-0.47	-0.81	-0.59	-0.81	-1.08	-0.12
Med.	0.12	0.12	0.36	-0.04	0.15	0.36	0.02	0.12	0.25	0.12	-0.03	0.45
Mean	0.18	0.26	0.03	0.24	0.14	0.21	0.14	0.18	0.19	0.18	0.12	0.33
3.Q	1.10	1.87	0.63	1.70	1.21	0.85	0.51	1.10	0.81	1.10	1.41	0.89
Max	2.96	3.80	2.14	3.37	4.04	2.22	2.72	2.96	2.41	2.96	3.43	1.32
StD	1.39	2.13	1.12	1.80	1.71	1.07	1.18	1.39	1.15	1.39	1.74	0.61

Source: Reuters, own calculations

Regardless of our later analysis of abnormal returns, we already see that MSCI World returns are clearly negative during the period around the Russia attack. As an overall index, the MSCI World Index represents a sector indices average.

However, we can also observe this phenomenon directly in the individual sector indices.

Further, there is no clear structure about the minima, which corresponds to the highest daily loss. However, this is also because the number of observations of the analyzed phases is very different, and thus, there are many more possibilities for a strong daily loss, especially in the pre-event phase. Financials had the highest daily loss in the event phase(-3.41%). However, Telecommunications exceeded this in the pre-event phase (-5.85%). When analyzing the first and third quantiles, it can be observed that the data of the event phase are on a lower level than those of the pre-event and post-event phases. This applies to the MSCI World index and the MSCI World sector indices. That corresponds with our intuition that the Russian attack has negatively affected the markets. Also, interesting to examine is the spread of the data. For this purpose, we look at the difference between minimum and maximum (range), as well as the difference between the first quantile and the third quantile. For the range, we need clear evidence. But for the difference between the first and third quantiles, we can see that it is increasing in the event- and post-event phases. Last, we examine standard deviation as a measure of volatility. We can observe that the standard deviation is significantly higher for the event- and post-event phases, suggesting an increase in uncertainty associated with the event. The standard deviation is highest for Financials in the event phase (1.73%) and Consumer Discretionary in the post-event phase (2.13%). Like the rising range of the data, these are signs of increasing uncertainty about the true value of the assets under consideration.

RESULTS

We provide our findings regarding the abnormal returns AR for the individual MSCI sector index. As shown above, we analyzed a period from t-5 to t+5 days around 24th February 2022 for this purpose. Additionally, we calculated and presented a t-test for the significance of abnormal returns. First, we can see that

on and shortly after 24th February 2022, the greatest cluster of significant abnormal returns occurs. On 24th February 2022, in 7, a total of 11 considered MSCI World sector indices show significant abnormal returns (Table 5). On 25th February 2022 (t+1) in 5 out of 11 cases. On the following three days (t+2, t+3, t+4), just a few cases.

Table 5. Abnormal returns (%) and t-test significance levels 10% (*), 5% (**) and 1% (***)

	CD	CS	EN	FN	HC	IN	IT	MT	RE	TC	UT
t-5	0.00	1.41*	1.04	-0.36	-0.15	0.34	0.88	0.58	1.14	-0.71	1.09
t-4	0.12	0.54	-0.24	0.26	-0.41	-0.33	0.20	-0.97	-1.72	0.06	-0.07
t-3	-0.11	-0.11	0.06	0.02	0.07	-0.40	-0.07	-0.65	-1.60	0.23	-0.29
t-2	-1.44	-0.33	-0.04	0.16	0.48	-0.06	-0.09	-0.43	1.99**	0.13	0.32
t-1	-0.84	0.29	1.64	0.03	0.50	-0.09	0.74	-1.72*	0.51	0.09	-0.41
t	-0.14	-2.76***	-1.35	-3.01***	-0.36	-0.87**	-2.53***	1.66*	-1.69*	2.00***	-0.30
t+1	3.04	2.08***	0.50	0.70	1.43***	0.66	1.05	2.44***	1.54	-1.16**	2.28***
t+2	-0.09	-0.69	1.38	-1.35**	-0.24	0.71	0.48	-1.55	0.80	0.17	1.01*
t+3	-1.92	-0.14	1.73	-1.99***	0.66	-0.19	0.29	-0.42	0.22	0.55	-1.19**
t+4	1.37	-0.40	1.80	0.32	0.08	0.05	0.29	1.88**	-0.50	-0.79	-0.49
t+5	-0.89	0.34	-0.13	0.27	0.36	0.48	1.22	0.80	0.13	-0.12	0.53

Source: Own calculations

The day before the attack, we can observe a significant abnormal return on materials. In the broader range (t-5, t-4, t+4, t+5) around the event day, we can only observe two significant abnormal returns (consumer staples and materials). Analyzing the average abnormal returns AAR can also be easily recognized (Table 6).

Table 6. Average abnormal returns (AAR %) for MSCI sector indices around event day t and t-test statistics with significance levels at 10% (*), 5% (**) and 1% (***)

	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
AAR	0.29	-0.34	-0.28	0.10	-0.01	-0.85**	1.32***	0.06	-0.22	0.33	0.27
t-test	0.81	-0.94	-0.77	0.27	-0.02	-2.37	3.68	0.15	-0.61	0.91	0.76

Source: Own calculations

In the first few days before the event, we see fluctuations in AAR, with both gains and losses. All of them are insignificant. On the day of the event (t), there is a

substantial and significant negative average abnormal return (AAR = -0.85%) compared to the previous days. The following day (t+1), we see a recovery with a significant AAR = +1.32%, which compensates for the last day's drop. In the following days (t+2,…,t+5), we see more minor and insignificant AAR with gains and losses again. There are various explanations for these reactions. Firstly, it can be assumed that, as is often the case when there are heavy losses, there are market participants who see an opportunity to buy assets that may be undervalued. In addition, the loss on 24th February 2022 was possibly an overreaction strongly supported by the media and led to irrational behavior. After the brief shock of the Russian attack and the resulting fear, rationality followed, which led to assets being bought again. Another approach to explain the strong gains in t+1 is that the MSCI World index and the MSCI World sector indices have an overweight of U.S. companies (Figure 1), which benefiting from the geopolitical threat in the expectation that their market share and profits will improve as a result.

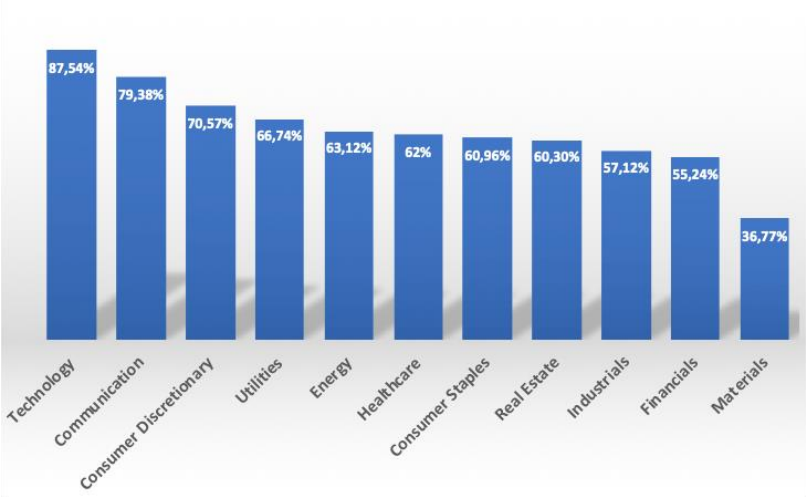

Figure 1. Weighting by market capitalization of U.S. companies in MSCI World sector indices as at 02/2022 (%)
Source: Own edition

This is consistent with the findings of Ali et al. (2023). After a brief shock about Russia's activities, investors expect U.S. companies to be more favorable to Russia. We can see similar results in other studies for the market reaction at the event day.

For example, Ahmed, Hasan & Kamal (2022) analyzed the response of the STOXX Europe 600 Index around the 24th of February 2022 by using average abnormal returns. They observed a drop of the index with -0.41%. This movement is similar but less pronounced than the one we observed in our data. However, the reaction before and after the event day differs in the article of Ahmed, Hasan & Kamal (2022). In the days before the event, AAR only has a very weak positive value the following day. In the days leading up to the event, they observed clearly negative AAR. The difference to the reaction in our article is undoubtedly because the companies in the STOXX Europe 600 are closer to the conflict, and investors expect a negative impact here compared to the MSCI. Let us take a closer look at the abnormal returns of the individual indices (Table 6). Real estate is the index with the most frequent significant abnormal returns. This is followed by the financials and utilities. No significant abnormal returns occurred in consumer discretionary and energy. The direction of the market movement on the event day is negative in total but different for MSCI World sector indices. Consumer staples (-2.76%), financials (-3.01%), industrials (-0.87%), materials (-1.66%) and information technology (-2.53%) had significant negative abnormal returns. In contrast, real estate (1.66%) and telecommunications (2.00%) had significant positive abnormal returns. For the non-significant abnormal returns, we can observe four cases of negative market reaction: consumer discretionary (-0.14%), energy (-1.35%), healthcare (-0.36%) and utilities (-0.30%). Thus, we have evidence that there were abnormal returns in the MSCI World sector indices at the day of the Russian attack on 24th February 2022 (Research Question 1). We now take a closer look at the performance of the individual sectors around the event day and the underlying expectations of market participants. To analyze the immediate behavior of the individual sectors to the event, we observe the abnormal returns around the event day (Table 5). To find out whether the Russian attack has a longer-term effect on the sector indices, we look at the cumulative abnormal returns (Table 7).

Table 7. Cumulative abnormal returns (%) and t-test significance levels 10% (*), 5% (**) and 1% (***).

	CD	CS	EN	FN	HC	IN	IT	MT	RE	TC	UT
t-5	0.00	1.41	1.04	-0.36	-0.15	0.34	0.88	0.58	1.14	-0.71	1.09
t-4	0.11	1.95	0.80	-0.10	-0.56	0.01	1.07	-0.39	-0.58	-0.65	1.02
t-3	0.00	1.84	0.86	-0.08	-0.49	-0.39	1.00	-1.04	-2.18	-0.42	0.73
t-2	-1.43	1.51	0.82	0.08	-0.01	-0.45	0.91	-1.47	-0.19	-0.29	1.05
t-1	-2.27	1.79	2.46	0.11	0.49	-0.54	1.64	-3.19	0.32	-0.20	0.64
t	-1.65	-0.97	1.11	-2.89	0.13	-1.40	-0.89	-1.53	-1.37	1.79	0.34
t+1	-2.44	1.11	1.61	-2.19	1.56	-0.75	0.16	0.90	0.18	0.63	2.62
t+2	-1.86	0.42	2.99	-3.55	1.31	-0.04	0.64	-0.65	0.98	0.80	3.63**
t+3	-1.88	0.28	4.72	-5.54***	1.97	-0.23	0.93	-1.07	1.19	1.35	2.44
t+4	-2.37	-0.12	6.51	-5.22***	2.06	-0.18	1.21	0.81	0.69	0.56	1.94
t+5	-3.75	0.21	6.39	-4.95***	2.42	0.30	2.44	1.61	0.82	0.44	2.48
t+10	-3.81	-2.93**	11.79***	-5.69***	2.49	0.83	2.28	1.25	-2.21	0.51	5.26***
t+15	-3.31	-1.85	5.87	-3.16*	4.46***	1.91	1.58	2.87	-2.21	-1.10	4.79***
t+20	-3.27	-2.36	8.79**	-4.22**	3.25**	0.46	3.03	1.45	0.00	-0.53	3.71**
t+25	-2.94	-0.74	8.03**	-5.50***	4.13***	-0.29	3.03	4.74	2.44	-1.38	7.30***

Source: Own calculations

If there is only a short up and down of the markets due to the event, we should not observe significant cumulative abnormal returns at t+25. If the effect is more sustained, we should. The abnormal returns and cumulative abnormal returns for each sector index are also shown in separate charts (Figure 2-11).

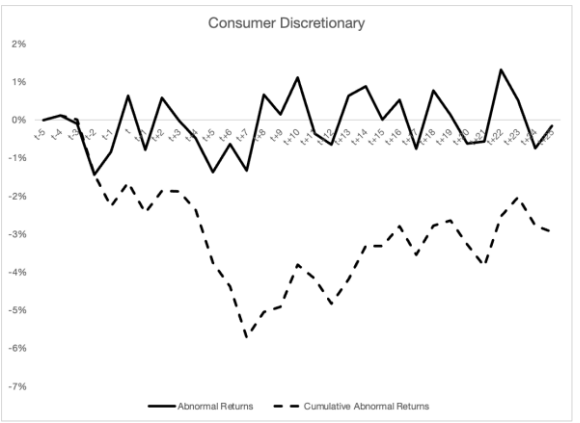

Figure 2. Abnormal and cumulative abnormal returns around event day forMSCI World Consumer Discretionary Index (%)

Source: Own edition

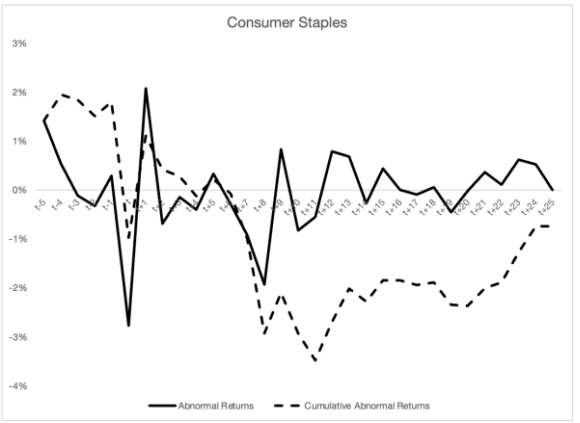

Figure 3. Abnormal and cumulative abnormal returns around event day for MSCI World Consumer Staples Index (%)

Source: Own edition

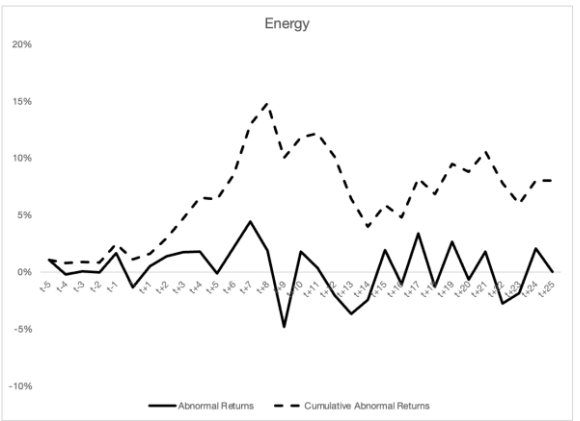

Figure 4. Abnormal and cumulative abnormal returns around event day for MSCI World Energy Index (%)

Source: Own edition

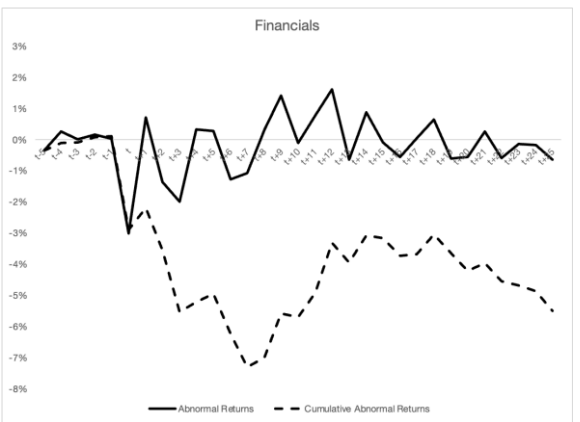

Figure 5. Abnormal and cumulative abnormal returns around event day for MSCI World Financials Index (%)

Source: Own edition

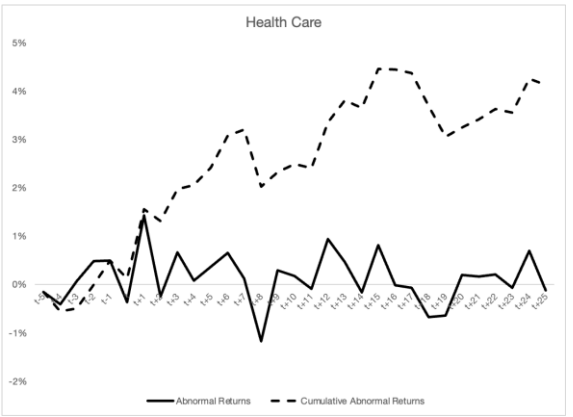

Figure 6. Abnormal and cumulative abnormal returns around event day for MSCI World Health Care Index (%)
Source: Own edition

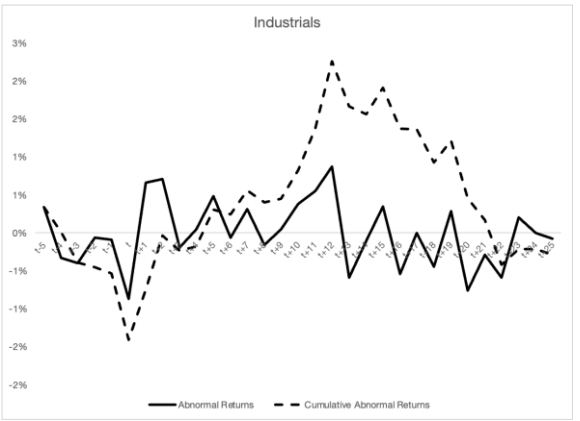

Figure 7. Abnormal and cumulative abnormal returns around event day for MSCI World Industrials Index (%)
Source: Own edition

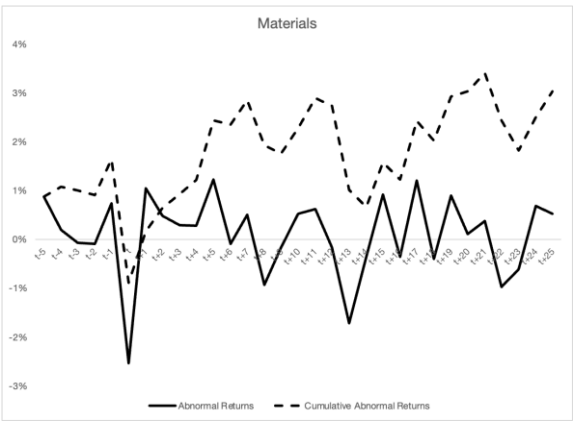

Figure 8. Abnormal and cumulative abnormal returns around event day for MSCI World Materials Index (%)
Source: Own edition

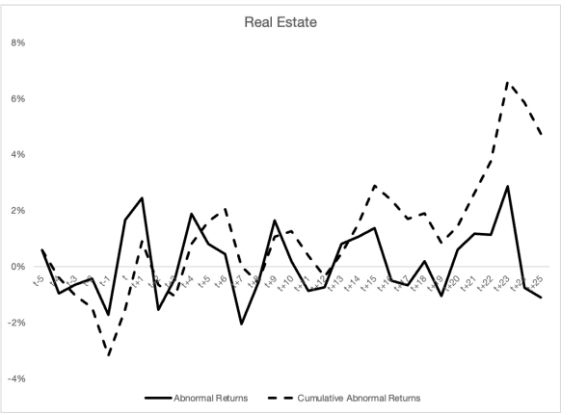

Figure 9. Abnormal and cumulative abnormal returns around event day for MSCI World Real Estate Index.
Source: Own edition

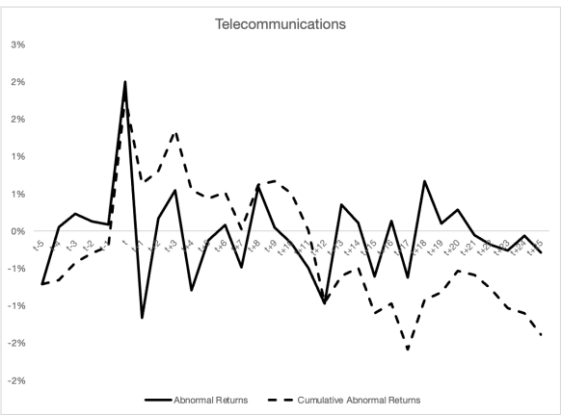

Figure 10. Abnormal and cumulative abnormal returns around event day for MSCI World Telecommunications Index (%)
Source: Own edition

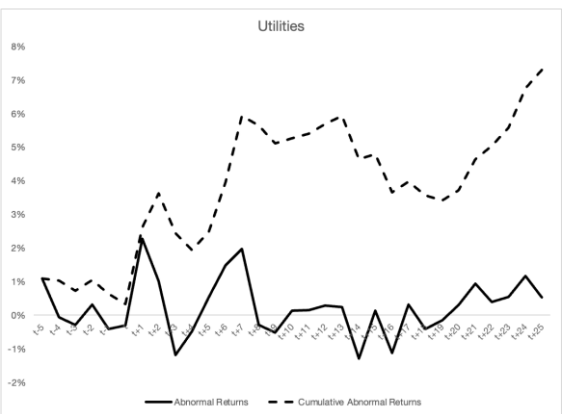

Figure 11. Abnormal and cumulative abnormal returns around event day for MSCI World Utilities Index (%)
Source: Own edition

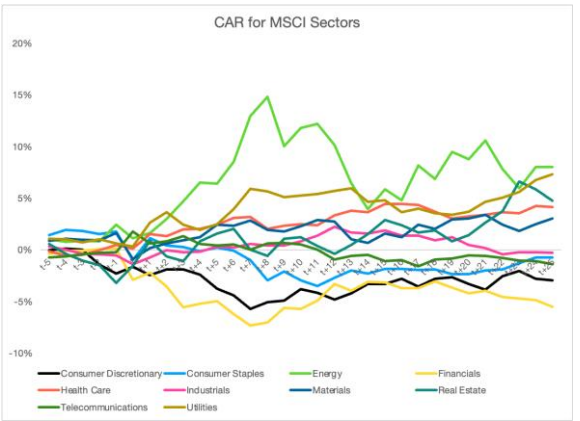

Figure 12. Cumulative abnormal returns around event day for all MSCI World sector indices (%)
Source: Own edition

In contrast to the most other sector indices, the Consumer Discretionary Index was sold off sharply even before the event ($CAR_{CD,t-1}$ = -2.27%). On the day of the event itself, the index had a positive, but insignificant movement ($AR_{CD,t}$ = 0.63%). The index then sold off sharply again ($CAR_{CD,t+25}$ = -2.94%). Consumer discretionary companies providing items buyers want but are less crucial for day-to-day life. Consumer discretionary includes home electronics, leisure services, restaurants, travel companies and even automakers. One possible explanation for this is that market participants' expectations for sales of durable but defensible goods are negative in times of crisis, as consumption may be reprioritized and thus the outlook for the market development of these companies is likely to be negative. Consumer staples companies reacts produce goods for daily living. These products are considered staple products because people will continue to purchase them, even during economic downturns. The consumer staples sector reacted mostly positively until the event day ($CAR_{CS,t-1}$ = 1.79%). At event day we see a significant negative AR ($AR_{CS,t}$ = -2.76%). Since we see a significant positive AR on the next day ($AR_{CS,t+1}$ = 2.07%), it can be argued that the sell off at event day was more of an overreaction. As a result, the sector was seen as undervalued, which led to buying in t+1. Overall, we see a slightly negative trend

for consumer staples over time, although this is limited ($CAR_{CS,t+25}$ = -0.73%). This is certainly because the companies in this sector produce goods for everyday use that cannot be easily dispensed with. Accordingly, the forecast for further performance is not overly negative. The energy sector posted a positive performance before the day of the event ($CAR_{EN,t-1}$= 1.64%). There was then a sell-off in the sector on the day of the event, although this was not significant ($AR_{EN,t}$ = -1.35%) and certainly only due to general selloffs of the whole market. The performance after the event day was very positive and the CAR is significant at t+25 ($CAR_{EN,t+25}$ = 8.02%. This development is very understandable for several reasons. Firstly, an increase in demand can be assumed in connection with military activities, as the mobility of military equipment requires a lot of resources. In addition, the sanctioning of Russian energy companies was also to be expected, which led to a decreasing supply for Russian energy and an increasing demand for western energy, which is only taken into account in the sector under consideration. This will increase profits for the remaining western energy companies and thus increase their value. The financial sector was neutral until the day of the event ($CAR_{FN,t-1}$= 0.11%). A significant negative performance was recorded on the event day ($AR_{FN,t}$ = -3.00%). This continued over the following days and led to a very negative performance in this sector ($CAR_{FN,t+25}$ = -5.50%). Also, the CAR is significant at t+25. This is possibly based on the expectation that the crisis will cause companies to get into trouble and thus default on bank loans, leading to value adjustments to bank balance sheets and lower profits. This affects existing loans for retail customers to the same extent. As a result, the major credit card companies are also affected. In addition, a decline in investments, also due to more restrictive risk policy is to be expected, which will have a negative impact on banks' new business. The performance of the healthcare sector was slightly positive until the day of the event ($CAR_{HC,t-1}$= 0.49%). Afterwards, on the event day, there was a slight sell-off ($AR_{HC,t}$ = -0.36%), followed by a positive trend on the following

days and a significant cumulative abnormal return in t+25 ($CAR_{HC,t+25}$= 4.12%. In connection with the military conflict, market participants may expect an increase in demand for medicines, medical equipment and services. In addition, reallocation effects from riskier to crisis-proof business models may also be assumed here. The real estate sector performed negatively until the day of the event ($CAR_{RE,t-1}$= -3.19%). This may be due to uncertainty among market participants ahead of the looming conflict. The reaction on the event day is more interesting. A significant abnormal return was observed here ($AR_{RE,t}$= 1.65%). There was also a positive performance on the following days with only minor reversals ($CAR_{RE,t+25}$= 4.74%). An explanation for this development can be found by taking a closer look at the components of the index. Retail real estate, industrial real estate, and telecommunications facilities account for significant parts of the index. These are very conservative business models, meaning that the entire sector has benefited from a shift away from riskier sectors. The industrial sector performed rather inconspicuously. Although there were some setbacks in the days leading up to the event, these were not particularly negative or significant ($CAR_{IN,t-1}$= -0.53%. On the event day, the sector also showed a rather moderate negative and insignificant reaction ($AR_{IN,t}$= -0.87%). This was followed by a positive trend with slight setbacks a few days after the event ($CAR_{IN,t+25}$= -0.29%). In contrast to other sectors, we see only minor reactions to the event here. In this context, it can be assumed that market participants will hardly change their valuation of companies in this sector. This indicates a stable business model, but no growth is expected. This is surprising, as a significant proportion of the companies are in the defense sector. The alternative explanation is that the gains and losses are balanced. As the country weighting of U.S. companies with about 60% is lower than in other sectors (in comparison, 88% for the information technology sector), the losses of companies with origins outside the U.S. (e.g., France and the UK) could have an influence. The development of the information technology sector before the event day is characterized by high volatility

($CAR_{IT,t-1}$= 0.32%). A negative significant abnormal return is recorded on the event day ($AR_{IT,t}$= -1.68%). The following positive development shows market participants expect a rather positive development for technology companies because of this crisis ($CAR_{IT,t+25}$ = 2.44%). This is not surprising, as companies in system software, hardware, semiconductor technology, and application software make up the largest part of the sector. The Materials Sector Index performed well in the five days leading up to the event day ($CAR_{MA,t-1}$= 1.64%). The sector index includes companies that manufacture chemical products, offer metal processing and industrial gases, and mine gold and metals. As a result of the upcoming event, market participants were expecting the possible exclusion of Russian companies and, thus, supply shortages, which would improve the market position of the companies listed in the index and, thus, their profits. However, on the day of the event, the index recorded significant losses, as did most others ($AR_{MA,t}$= -2.53%). If we look at the sector's performance over the following days, we can conclude that the loss on the event day was more due to the general market dynamics, where stocks were sold on a large scale. The sector appears to benefit from the event, with a positive performance over the next 25 days ($CAR_{MA,t+25}$= 3.02%). This shows that market participants expect a more positive development from the underlying companies. Of course, there may also have been reallocations from other sectors, as the companies are expected to deliver a more stable result compared to other sectors. The days leading up to the event day for the utilities sector are characterized by upward and downward movements ($CAR_{UT,t-1}$= 0.64%). This shows that market participants are divided over the potential impact of the Russian invasion on companies in the sector. On the event day, however, the sector only suffered a weak and insignificant loss ($AR_{UT,t}$= -0.30%). The subsequent development up to 25 days after the event was characterized by a clearly positive performance. Alongside the energy sector, the utilities sector was the second strongest gainer and had a significant cumulative absolute return in

t+25 ($CAR_{UT,t+25}$= 7.29%). Companies that generate electricity, build electric power plants or expand and operate the electricity grid are an essential part of the sector. However, these companies are not included in the Energy sector. The explanation for the positive performance is therefore comparable. The expected shortage of energy will give existing companies an improved market position, making it easier for them to increase their profits. In addition, the demand for electricity is also continuing to rise due to increasing electrification. The last sector we looked at, telecommunications, had a rather quiet negative development before the event day ($CAR_{TC,t-1}$= -0.20%). On the event day, the sector recorded a significant positive return ($AR_{TC,t}$= 1.99%), with only a few others (consumer discretionary and real estate). This is surprising in that this sector includes large technology companies such as Alphabet (index weighting of over 19%), Meta (index weighting of over 19%) and Netflix (index weighting of over 17%). These are considered to be rather risky and do not automatically benefit from crises. However, all of these companies generate stable profits, and their debt ratio is that of a developed company, meaning that rising interest rates due to a crisis do not acutely reduce profitability. We have now been able to show that there are significant abnormal returns around the event day. According to the event studies method, we were able to show the influence of the event, the Russian attack on Ukraine, on the individual MSCI World sector indices. We also found that the MSCI World sector indices energy, financials, health care and utilities sectors had significant cumulative abnormal returns at t+25. This shows that the Russian attack had a longer-term impact in these sectors as market participants adjusted their expectations regarding the underlying developments and bought or sold the securities of the underlying companies. As we can see, the expectation of market participants for each sector is different and so is the development of the cumulative abnormal returns around the event day. The overall picture can be found in Figure 12.

CONCLUSION

In this paper, we have examined the behavior of investors in the largest international companies in response to the Russian Federation's attack on Ukraine on 24th February 2022. To this end, we analyzed the market reaction 5 days before and up to 25 days after the attack by Russia using an event study. We looked at the reaction of 11 different market sectors of the MSCI World index. We were able to show that investors reacted predominantly negatively to the Russian attack on February 24th 2022. We found negative and mostly significant abnormal returns in the consumer staples, energy, financials, healthcare, industrials, materials, information technology and utilities sectors. Only the consumer discretionary, real estate and telecommunications sectors recorded positive abnormal returns. It is noteworthy that on the following day (t+1) we observed positive abnormal returns in nine out of 11 sectors, five of which were significant, thus correcting part of the previous day's reaction. The significant abnormal returns are concentrated in the time window (t, t+1) around the event day. We were thus able to show that there were abnormal returns around February 24th 2022, which indicates a special reaction of investors to the warlike event. Using cumulative abnormal returns (CAR), we also analyzed the extent to which investors had already anticipated the event up to day t-1 and how persistent the reactions of the event day were after the event up to day t+25. The latter is intended to provide information about investors' expectations of the various business models in connection with the changed economic conditions. Regarding the period before the event, we were not able to observe a clear reaction, but rather sector-specific developments. There were 4 negative and 7 positive CAR up to day t-1. The development for the period up to t+25 is equally differentiated, with a total of five negative and six positive CAR. The consumer discretionary, consumer staples, financials, industrials, and telecommunications sectors recorded negative cumulative abnormal returns. In contrast, the healthcare, materials, real estate, information technologies and utilities sectors had positive cumulative abnormal returns. We have significant

cumulative abnormal returns at t+25 for the energy, financials, materials and utilities sectors. This shows a particularly sustained reaction from investors. As we have seen, after the event day there are clearly heterogeneous reactions to the expected impact of the event on the different business models. Furthermore, we often find positive performance which can be linked to the composition of the MSCI World index and the MSCI World sector indices. This is because there is an overweighting of U.S. companies, which have certainly benefited from the conflict, varying from sector to sector. By analyzing the effects on the world's largest companies, we were able to close a research gap with this article, as the focus of existing research to date has been on the analysis of country indices or individual markets, e.g., the commodity markets. Our results also have a practical benefit. For example, they can serve as a guide for hedging strategies for market participants who are invested in individual sectors. An analysis of the impact on the most important sectors was limited to individual countries. In our view, further research can be carried out into the reaction of country-specific sectors to this event. This can reduce the bias caused by the overweighting of US companies and investigate whether the results are dependent on individual countries about the performance of the sector indices.

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