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Impact of Geopolitical Turmoil in the Developing European Stock Markets vs. the Global Benchmark Indices: An Event Study Analysis of the Russo-Ukrainian War

Meinardas Grinius, Tomas Baležentis

ABSTRACT The capital markets are sensitive to geopolitical events. It is important to provide evidence of reactions to specific geopolitical events in order to identify general patterns and effective risk management strategies. This study follows the event study approach to assess the reactions of different stock markets to the Russo-Ukrainian war in 2022. The 12 stock markets are represented by the relevant indices and benchmarked against the MSCI World Index. The markets considered include developed, emerging, and frontier ones. The results suggest the presence of the proximity penalty. Especially, Poland showed the highest correction during the event day. The markets outside Europe (the US, Canada, and Australia) did not show significant cumulative abnormal returns for the whole event window, yet such corrections were noted for certain sub-periods within the window. These results can be used for designing risk management strategies in the Central and Eastern Europe.

KEY WORDS: market efficiency, stock index, event study, abnormal return, Baltic States, Central and Eastern Europe, geopolitical event.

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Vilnius University, Vilnius, Lithuania

1. Introduction

The capital markets are affected by a number of geopolitical factors that include international conflicts. Indeed, the economies have become interconnected due to the capital flows, yet such links are rather sensitive to the institutional environment. These can be easily affected even by regional -scale events such as political crises, not to mention international full-fledged wars. The exact impact of such events is hard to estimate due to the lack of empirical evidence of such instances, especially in the emerging and frontier economies. However, Russia's invasion in Ukraine in 2022 has appeared as yet another case of regional conflict that has had repercussions regionally and internationally. Specifically, the neighbouring Eastern European countries, albeit members of the European Union and NATO, were affected by internal and external developments. For instance, companies with business relations to Russia have faced effects of sanctions, the labour force supply has increased due to heightened refugee flows, foreign and local investors began to see the region as that of an increased risk, whereas military expenses and investments into arm companies have increased. This complex picture calls for further analysis of the impacts of the military conflict in Ukraine on the capital markets of the Central and Eastern European countries.

The issue of the effects of the military conflict in Ukraine has been widely addressed in the literature of financial research from the perspectives of different regions. Abbasi et al. (2022) focused on the listed companies of G7 markets. They found that

Correspondence concerning this article should be addressed to:
Tomas Baležentis, Universiteto g. 3, LT-01513 Vilnius, Lithuania.
E-mail: tomas.balezentis@evaf.vu.lt

negative abnormal returns were rendered by the military conflict in Ukraine for companies featuring higher trade dependence and risk exposure. Especially, the book-to-market ratio indicated a deviation from the valuation of companies under normal circumstances. Interestingly, smaller companies were found to be more resilient to such shocks. Boubaker et al. (2022) looked at the effects of the conflict on the indices across various regions. They suggested that the military conflict in Ukraine has had diverse effects across the continents. For instance, Asian economies showed no significant response to the conflict, whereas the US markets reacted positively. Countries in the NATO bloc and oil producing countries showed higher performance in terms of the abnormal returns. Also, countries with higher integration in international trade (in relation to GDP) showed worse performance indicating that market expectations were suggesting a higher impact of the war for globalized economies.

Boubaker et al. (2023) examined the banking sector performance amid the Russo-Ukrainian war. Again, regional disparities were noted with European bank stock showing a higher decline in their price compared to the global (negative) shock. In the latter case, the Asian banks were also affected by the conflict. Yousaf et al. (2023) et al. confirmed the effects of the war for both Russian and European stock markets. They had different timelines as the pre-event days were already indicating abnormal returns for Russia, Hungary, Poland, and Slovakia. Joshi et al. (2023) noted that certain Asian markets also exhibited significant negative abnormal returns, whereas such countries as India, the Philippines, Australia, and Bangladesh remained unaffected. Yilmazkuday (2024) conducted a comparison of multiple markets and confirmed the presence of abnormal negative returns with variations across the regions. Also, such sectors as tourism saw significant effects as suggested by Pandey et al. (2023).

This paper estimates the abnormal returns for the Baltic States (Estonia, Lithuania, and Latvia). Indeed, this region has not received attention in earlier literature on the effects of the Russo-Ukrainian war. Baltic countries provide an interesting case as they are members of the European Union and NATO and still catching up with the economic development level of the old EU member states. Consequently, these economies are regarded as the frontier economies. The aforementioned countries are also located in the vicinity of Russia and Belarus. In this context, the flows of the (foreign) investment are particularly important. In order to assess the relative performance of stock markets in these countries, the benchmarks (indices) from globally important economies are also included in the analysis. Specifically, stock indices from Poland, Hungary, Romania, Lithuania, Latvia, Estonia (i.e., from neighbouring countries of conflict participants) are compared to those from Developed markets, such as the US, the UK, Germany, France, Australia, and Canada. This contribution follows similar studies on the effects of shocks on the stock markets and relies on measurement of abnormal returns (Fama et al., 1969).

The paper proceeds as follows: Section 2 provides a literature review with focus on the event studies and the Russo-Ukrainian war. The methodological preliminaries are discussed in Section 3. The data used are described in Section 4. Results are discussed in Section 5. Discussion is presented in Section 6. Finally, Section 7 concludes.

2. Literature Review

2.1. Geopolitical Risk and Event Studies

Even though economic integration—which has been evident by creation of, for example, the European Union - was supposed to induce deeper political integration, the first two decades of the 21st century have seen the opposite trends. Recently, geopolitical risk emerged as an important type of risk besides equity risk (Pringpong et al., 2023). This implies that research on the effects of the geopolitical event has become even more important. Even such developed economies as the US have been affected by terrorist attacks in 2001.

The latter event suggests yet another important trend viz., mutation of the full-scale war into conflicts supported by sub-national groups (political movements, rouges, corporations). The increasing cases of terrorist attacks have expanded

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the notion of the geopolitical risks along with creation of specialised indicators to track such events. It has been used to predict the effects on financial markets (Caldara, Iacoviello, 2018; Salisu et al., 2022). The empirical models showed that financial markets are affected by news and expectations preceding the real events (Keleş, 2023; Salisu et al., 2022).

The regional analysis is also important as the likelihood of the geopolitical events varies substantially across different levels of aggregation. It is due to Berkman et al. (2011) that probabilities of an international crisis and a domestic war differ by the magnitude of 10 times with the latter one being some 0.008. The timing of the shocks and recoveries also vary (WH Ireland, 2022). Taking

Table 1

Event Studies for the Effects of the Russo-Ukrainian War on the Stock Markets

Reference	Estimation window	Event window	Coverage (market portfolio)	Methods
Abbassi et al. (2022)	[-240;-6]	[-5;+8]	531 companies (country-specific indices)	1, 2, 3
Ahmed et al. (2023)	[-275;-25]	[-25;+25]	587 companies (STOXX Europe 600)	1, 4, 5, 6
Boubaker et al. (2022)	[-140;-6]	[-5;+5]	46 country-specific indices (MSCI All Country World Index)	1, 3
Boubaker et al. (2023)	[-230;-11]	[-10;+20]	2341 banks (country-specific indices)	1, 7, 2
Chowdhury and Khan (2023)	[-38;-1]	[+1;+56]	23 country-specific indices (Dow Jones Industrial Average)	1, 2
Yousaf et al. (2023)	[-125;-6]	[-5;+5]	26 country-specific indices (MSCI All Country World Index)	1, 2
Joshi et al. (2023)	[-160;-11]	[-10;+10]	30 country-specific indices (MSCI All Country World Index)	1, 2
Keleş (2023)	[-150;-51]	[-15;+15]	438 or 100 companies (a weighted index)	1
Kumari et al. (2023)	[-230;-6]	[-5;+30]	25 country-specific indices (MSCI Europe Index)	1, 2, 3
Martins et al. (2023a)	[-140;-21]	[-1;+10]	100 companies (STOXX Europe 600)	1, 8, 2, 9
Martins et al. (2023c)	[-140;-21]	[-1;+10]	165 companies (STOXX Europe 600)	1, 2, 9
Pandey et al. (2023)	[-97;-8]	[-7;+5]	134 companies (country-specific indices)	1, 2
Median	[-145;-10]	[-5;+10]		

Note: the studies covered used Feb 24, 2022 with exception for Ahmed et al. (2023) who used Feb 21, 2022; a negative (resp. positive) sign indicates the number of days prior (resp. post) the event; the methods include: 1 – market model, 2 – Student's t-test, 3 – Corrado rank test, 4 – BMP standardized cross-section test, 5– KP cross-section correlation test, 6 – Wilcoxon rank-sum test, 7 – net market return model, 8 – Fama-French 3-factor model, 9 – z-test.

the events from 1973-2014 reported by WH Ireland (2022) and JP Morgan and their effect of S&P 500 index as an example, the median duration of sell-off turned to be 8 trading days, whereas that of the recovery was 12.5 days. Also, JP Morgan (2024) reported that the shocks created by geopolitical events lead to recovery in between 3 and 6 months.

Even study is the major approach for estimating the impact of geopolitical events on the stock markets. MacKinlay (1997) identified two strands of methods for event studies, that is, statistical and economic approaches. The statistical approaches deal with the time-series data taking into account their temporal variation. The economic approach takes into account fundamental properties of companies when assessing their expected and abnormal returns.

The statistical approaches include the market model, market-adjusted model, net-of-market model, model with Scholes-Williams beta estimation, and model with GARCH(1, 1) and EGARCH(1, 1) error estimation. The market model relies on the market portfolio (index) returns as an independent variable when explaining variance in the stock price (or yet another index). The net-of-market model (Brown, Warner, 1985) involves calculation of the abnormal returns that are obtained by comparing the observed returns (in the estimation window) to the weekday averages from the evaluation window.

The economic models (Fama, French, 1993) include additional variables besides the market portfolio returns. These variables are related to the market capitalization and book-to-value ratio. The regression coefficients estimated in the estimation window are then used to generate expected values in the evaluation window. The economic models may seem appealing in that they involve more variables and go beyond stock-index relationship, Brenner (1997), MacKinlay (1997), and Chowdhury and Khan (2023) argued that the additional variables often provide relatively little reduction in the unexplained variance and the market model is practically the preferred one.

2.2. Event Studies for the Case of the Russo-Ukrainian War

The empirical studies on the effects of the Russo-Ukrainian war on the stock markets differ in their methodological premises. The relevant event studies are summarized in Table 1. As one can note, the median estimation and event windows were [-145, -10] and [-5, +10] respectively (with event date set to February 24, 2022). Thus, the event window covered a week prior and two weeks after the event (considering trading days only).

As regards the sample used, the relevant studies focused on both company- and index-level data. Some studies used company-level data and compared it against indices for specific countries (Abbassi et al., 2022; Boubaker et al., 2023; Keleş, 2023; Pandey et al., 2023). In such case, there is no single "global" benchmark used. For another group of studies, company-level data were compared against a single index (Ahmed et al. 2023; Martins et al., 2023a; Martins et al., 2023c) or country-specific indices were compared against a single index (Boubaker et al., 2022; Chowdhury & Khan, 2023; Yousaf et al., 2023; Joshi et al., 2023).

Even though there have been studies involving frontier markets (Kumari et al., 2023), there are still certain gaps in the literature that can be addressed by performing additional even studies. Specifically, we seek to compare the performance of frontier markets in the Central and Eastern Europe with the internationally leading markets. Therefore, we embark on the comparison with the global index in subsequent sections.

3. Methods

The study is carried out at the index level based on MacKinlay (1997) and Chowdhury and Khan (2023). Thus, country specific indices are compared to the global one. First, the data are logged:

$$R_{\cdot,t} = \ln \frac{p_{\cdot,t}}{p_{\cdot,t-1}} \tag{1}$$

where $p_{\cdot,t}$ stands for the value of a certain index for trading day t and $R_{\cdot}$ can be considered as daily return for that index. Second, the following market model is fitted using data from the estimation window:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t}, t \in [t_{-2}, t_{-1}] \tag{2}$$

where $R_{i,t}$ and $R_{m,t}$ are returns of the country-specific index and global index (i.e., a market portfolio)

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respectively, and α and β are the coefficients estimated via the Ordinary Least Squares; t_{-2} and t_{-1} denote the endpoint periods of the estimation window. Note that the latter coefficient measures the responsiveness of the country-specific index to the global one. Third, the residual term rendered by the estimates of (2) and data from the evaluation window can be considered as abnormal returns for the i-th index:

$$AR_{i,t} \equiv \hat{\varepsilon}_{i,t} = R_{i,t} - \left(\hat{\alpha}_i + \hat{\beta}_i R_{m,t}\right) \equiv R_{i,t} - \hat{R}_{i,t}, \; t \in [t_1, t_2] \tag{3}$$

where t_1 and t_2 indicate the endpoint period for the evaluation window. Finally, the cumulative returns are computed for each index to assess their (relative) performance within the evaluation window. The cumulative abnormal returns rely on the additive aggregation:

$$CAR_i^{t_1,t_2} \equiv \sum_{t=t_1}^{t_2} AR_{i,t} \tag{4}$$

A more conservative approach is to embark on aggregation in a multiplicative manner where more extreme values have a higher impact on the resulting returns. This is done by computing the buy-and-hold abnormal returns within the evaluation window (Keleş, 2023):

$$BHAR_i^{t_1,t_2} = \prod_{t=t_1}^{t_2}\left(1+R_{i,t}\right) - \prod_{t=t_1}^{t_2}\left(1+\hat{R}_{i,t}\right) \tag{5}$$

where $\hat{R}_{i,t}$ is the fitted returns based on the estimates of (2) and data from the evaluation window.

The t-test is applied to test the significance (i.e., equality to zero) of the AR and CAR in (3) and (4). For AR, the following test statistic is used:

$$t\left(AR_{i,t}\right) = \frac{AR_{i,t}}{s_i} \tag{6}$$

As for the CAR, the following test statistic is defined:

$$t\left(CAR_i^{t_1,t_2}\right) = \frac{CAR_i^{t_1,t_2}}{\sqrt{t_2 - t_1}\, s_i} \tag{7}$$

Note that the test statistics in (6) and (7) follow a t-distribution with $t_2 - t_1 - 2$ degrees of freedom. The abnormal returns obtained for the estimation window are used to calculate the standard deviation:

$$s_i = \left(\frac{\sum_{t=t_{-2}}^{t_{-1}} \left(R_{i,t} - \hat{R}_{i,t}\right)^2}{t_{-1} - t_{-2} - 2} \right)^{1/2} \tag{8}$$

4. Data

Morgan Stanley Capital International (MSCI) identifies three types of markets (MSCI, 2023). The study represents all the three types of markets by using the following indices:

- Developed Markets – US (S&P500), UK (FTSE100), Germany (DAX40), France (CAC40), Australia (S&P/ASX 200), and Canada (S&P/TSX Composite).
- Emerging Markets – Poland (WIG30) and Hungary (BUX).
- Frontier Markets – Romania (BET), Lithuania (OMX Vilnius GI), Latvia (OMX Riga GI), Estonia (OMX Tallinn GI).

The MSCI World Index was used as the market portfolio for all the markets, i.e., its returns entered (2) as the independent variable.

The event date was set to February 24, 2022, whereas the estimation and event windows were set to [–145, –10] and [–5, 10] respectively (note that the intervals are defined in terms of the trading days). As a result, the estimation window covers the period of August 5, 2021, to February 10, 2022 (136 trading days), whereas the event window covers the period of February 17, 2022, to March 10, 2022 (16 trading days). There were exceptions for France and Estonia where the event windows included a day off. As a result, their event windows started on February 16, 2022. The data come from the Bloomberg Terminal.

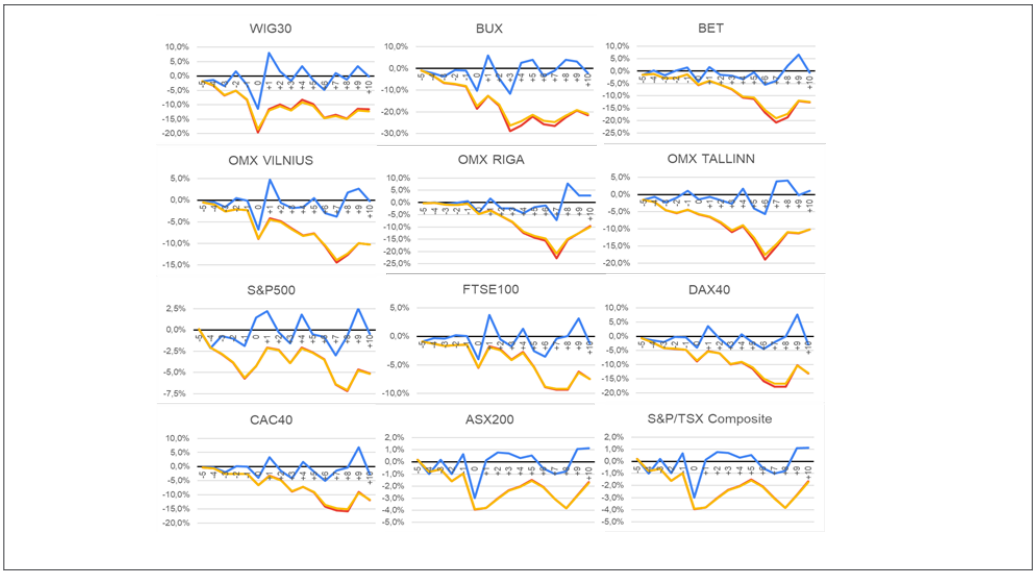
5. Results

The data for the estimation window were processed by fitting the linear model in (2) according to the setting in Section 4. Then, the abnormal returns, cumulative abnormal returns, and BHAR were calculated for each market. Results for the event window are provided in Fig. 1. Note that time period zero denotes the even date in the figure.

The results imply that the war had a rather heterogeneous impact (in the sense of magnitude) on the stock markets covered, yet it was negative or zero everywhere. The steepest decline was noted for

Figure 1

The Abnormal Returns (Blue Line), Cumulative Abnormal Returns (Red Line), and BHAR (Yellow Line) in the Analysed Markets (Evaluation Window)



Poland (-11.4%) and Hungary (-10.3%). Negative returns were observed for Lithuania (-6.7%), Romania (-4.3%), Latvia (-4.2%), Germany (-4.1%), United Kingdom (-4%), France (-4%), and Australia (-3%). The US and Canada showed no significant change in returns as the abnormal returns were positive yet stood close to zero. Estonian market posted a negative result that was not significant. The latter finding may be related to the fact that Tallinn exchange was closed on February 24, 2022, and the major effect of the crisis was avoided.

Significance of the daily abnormal returns is tested in Table 2. The five days prior to the war marked different patterns of reaction across the countries. The exchanges of Riga, London, Sydney, and Toronto showed no significant decline in the relevant indices. A significant negative effect was noted for Warsaw on days -3 and -1, Budapest on -4 and -3, and New York on -4 and -1. Frankfurt, Vilnius and Tallinn saw a negative return on day -3 (for the latter case, it was significant at a 10% level). Paris posted a negative return on day -3 (significant at a 10% level). Frankfurt market showed both upturns and downturns before the war: negative returns were observed on days -5 and -1, whereas a negative return was noted on day -1 (two instances were significant at a 10% level).

Days after the war showed rather diverse results as well. The key developments appeared on the first day after the war and then around days +5 to +7. In general, the first wave of reactions marked a rebound (positive returns), whereas the second wave was related to negative or neutral reactions.

The first trading day after the war marked a significantly positive returns for most of the markets covered within the range of 8.1% for Poland and 1.6% for Canada. The exceptions include Australia and Estonia where no significant abnormal returns were observed. These results imply that markets generally overreacted to the beginning of the war. This was caused by the course of the war and responses of the Western countries.

As regards the second wave of reactions, the significantly negative returns were noted for Poland, Romania, Lithuania, Latvia, Estonia, US, UK, Germany, and France. Indeed, day +5 saw a takeover of Zaporizhzhia Nuclear Power Station, whereas sanctions against exports of Russian energy sources were announced on day +7. Hungary showed an exception to this pattern

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Table 1

Daily Abnormal Returns (AR) and their Significance Within the Event Window

Index	Indicator	Days in the Event Window														
		-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10
WIG30	AR	-1.8%	-1.4%	-3.5%	1.6%	-3.1%	-11.4%	8.1%	1.6%	-1.7%	3.4%	-1.4%	-4.8%	1.0%	-1.3%	3.4%	-0.2%
	p-value	0.117	0.214	0.003	0.157	0.009	0.000	0.000	0.162	0.146	0.004	0.214	0.000	0.404	0.279	0.004	0.872
BUX	AR	-0.9%	-2.1%	-3.6%	-0.7%	-0.9%	-10.3%	6.0%	-4.6%	-11.7%	2.7%	4.1%	-3.5%	-0.9%	4.0%	3.3%	-2.1%
	p-value	0.392	0.046	0.001	0.543	0.396	0.000	0.000	0.000	0.000	0.014	0.000	0.001	0.376	0.000	0.003	0.049
BET	AR	-1.5%	0.3%	-1.7%	0.1%	1.4%	-4.3%	1.7%	-1.5%	-2.0%	-3.3%	-0.5%	-5.6%	-4.0%	2.1%	6.6%	-0.6%
	p-value	0.061	0.733	0.033	0.849	0.076	0.000	0.035	0.062	0.014	0.000	0.559	0.000	0.000	0.008	0.000	0.453
OMX. VIL	AR	-0.5%	-0.4%	-1.6%	0.5%	-0.1%	-6.7%	4.8%	-0.6%	-1.8%	-1.6%	0.5%	-2.9%	-3.8%	1.8%	2.7%	-0.3%
	p-value	0.436	0.511	0.015	0.481	0.849	0.000	0.000	0.365	0.009	0.018	0.446	0.000	0.000	0.010	0.000	0.703
OMX. RIG	AR	-0.3%	0.1%	-0.7%	-0.2%	0.5%	-4.2%	1.5%	-2.4%	-2.4%	-4.4%	-2.0%	-1.2%	-7.2%	7.7%	2.8%	2.8%
	p-value	0.707	0.884	0.350	0.823	0.492	0.000	0.042	0.002	0.002	0.000	0.010	0.106	0.000	0.000	0.000	0.000
OMX. TAL	AR	-1.5%	-0.7%	-2.3%	-0.9%	1.0%	-1.4%	-0.7%	-1.7%	-2.6%	1.7%	-4.0%	-5.7%	3.9%	4.0%	-0.2%	1.1%
	p-value	0.284	0.604	0.092	0.533	0.467	0.316	0.597	0.212	0.060	0.216	0.004	0.000	0.006	0.004	0.888	0.440
S&P500	AR	0.1%	-2.2%	-0.7%	-1.0%	-1.9%	1.5%	2.2%	-0.3%	-1.6%	1.8%	-0.5%	-0.8%	-3.0%	-0.7%	2.5%	-0.4%
	p-value	0.938	0.019	0.419	0.256	0.041	0.109	0.017	0.774	0.085	0.046	0.551	0.372	0.001	0.415	0.006	0.623
FTSE100	AR	-1.0%	-0.3%	-0.4%	0.2%	0.1%	-4.0%	3.7%	-0.5%	-1.8%	1.3%	-2.6%	-3.5%	-0.4%	0.0%	3.1%	-1.3%
	p-value	0.204	0.651	0.599	0.794	0.929	0.000	0.000	0.485	0.020	0.081	0.001	0.000	0.572	0.978	0.000	0.097
DAX40	AR	-0.7%	-1.5%	-2.1%	-0.2%	-0.4%	-4.1%	3.6%	-0.8%	-3.9%	0.7%	-2.2%	-4.5%	-2.0%	0.0%	7.6%	-2.9%
	p-value	0.495	0.149	0.043	0.864	0.716	0.000	0.001	0.450	0.000	0.478	0.035	0.000	0.051	0.991	0.000	0.004
CAC40	AR	-0.4%	-0.3%	-2.0%	0.1%	-0.1%	-4.0%	3.4%	-1.5%	-4.1%	1.6%	-1.9%	-5.1%	-1.3%	-0.4%	6.8%	-2.8%
	p-value	0.730	0.803	0.051	0.918	0.958	0.000	0.002	0.145	0.000	0.128	0.075	0.000	0.200	0.732	0.000	0.007
ASX200	AR	0.2%	-1.0%	0.2%	-1.0%	0.6%	-3.0%	0.1%	0.8%	0.7%	0.3%	0.5%	-0.5%	-1.0%	-0.8%	1.1%	1.1%
	p-value	0.815	0.221	0.813	0.225	0.429	0.000	0.862	0.344	0.387	0.702	0.525	0.504	0.223	0.325	0.189	0.168
S&P/TSX	AR	-0.6%	-1.0%	-0.8%	-0.5%	-0.8%	0.0%	1.6%	0.0%	-0.6%	1.2%	-0.1%	0.7%	-0.5%	-0.4%	1.2%	0.4%
	p-value	0.419	0.148	0.240	0.490	0.253	0.961	0.026	0.956	0.381	0.102	0.936	0.333	0.484	0.592	0.096	0.583

as its stock market plummeted on day +3 by -11.7% when institutional investors sold out their portfolios and the largest company in BUX index – the OTP bank which was also involved in operations in Russia – announced its financial results.

The last three trading days in the event window were mostly associated with positive abnormal returns. This can be related to realisation of the situation in the Ukraine and, more specifically, the failure of Russia to occupy the whole Ukraine. The only countries that showed no significant negative abnormal returns were Australia and Canada, where positive returns were noted for days +1 and +9. This indicates that such markets can be considered as options for hedging in case geopolitical events in the Central and Eastern Europe take place.

The cumulative returns can be analysed to track the performance of a stock market over a certain period. In this case, the daily returns are accumulated providing one with a means to assess the whole period under

consideration. The CARs for the analysed markets are presented in Table 3. Five markets showed significant negative cumulative abnormal returns (CAR) viz., Poland and Hungary (-8.2%), the US (-5.7%), Germany (-4.7%), and Australia (-3.7%). As one can note, the frontier markets did not appear among those affected in the pre-war period if the CAR is considered. During the post-war period (days +1 to +10), the three markets showed significant CARs. Poland rebounded (8.1%) which may be related to serious changes in the market expectations compared to the pre-war days in the event window. Indeed, the rebound was almost equal to the correction in the pre-war period. Latvia and Romania posted a decline (-7%) which can be explained by relatively moderate reaction in the pre-war period.

Looking at the whole event window covering days -5 to +10, one can note that 8 out of 12 markets covered in the analysis showed significantly negative CARs. The Hungarian stock market appeared as the most affected one with the CAR of -21.5%. this can be related to high dependence on Russian energy resources (pipe oil). The other countries with significantly negative CARs showed corrections in the range of -7.5% for the UK to 13.1% for Germany. Note that Poland was the only market in the sample that showed significant CARs for each of the sub-periods covered in Table 3. These results show that both distant and re-

Table 3
Cumulative Abnormal Returns (CAR) and Their Significance Within the Event Window

Index	Indicator	Days in the Event Window			
		[-5, -1]	0	[+1, +10]	[-5, +10]
WIG30	CAR	-8.2%	-11.4%	8.1%	-11.6%
	p-value	0.002	0.000	0.03	0.014
BUX	CAR	-8.2%	-10.3%	-2.9%	-21.5%
	p-value	0.001	0.000	0.385	0.000
BET	CAR	-1.4%	-4.3%	-7.0%	-12.6%
	p-value	0.443	0.000	0.006	0.000
OMX.VIL	CAR	-2.3%	-6.7%	-1.2%	-10.2%
	p-value	0.133	0.000	0.562	0.000
OMX.RIG	CAR	-0.5%	-4.2%	-4.9%	-9.6%
	p-value	0.753	0.000	0.042	0.002
OMX.TAL	CAR	-4.4%	-1.4%	-4.4%	-10.2%
	p-value	0.156	0.316	0.321	0.068
S&P500	CAR	-5.7%	1.5%	-0.9%	-5.1%
	p-value	0.006	0.109	0.767	0.161
FTSE100	CAR	-1.5%	-4.0%	-2.0%	-7.5%
	p-value	0.395	0.000	0.416	0.015
DAX40	CAR	-4.7%	-4.1%	-4.3%	-13.1%
	p-value	0.037	0.000	0.179	0.001
CAC40	CAR	-2.6%	-4.0%	-5.2%	-11.9%
	p-value	0.263	0.000	0.112	0.005
ASX200	CAR	-1.0%	-3.0%	2.3%	-1.7%
	p-value	0.598	0.000	0.372	0.61
S&P/TSX	CAR	-3.7%	0.0%	3.5%	-0.2%
	p-value	0.02	0.961	0.12	0.944

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mote countries in the EU were affected by the Russo-Ukrainian war in the sense of the stock market corrections, yet no such effects were noted for the other continents covered in the analysis.

The BHARs were calculated for the event window, yet their values are close to those of the CARs (Fig. 1) as the event window is relatively short. In this case, we do not proceed with discussion the results across the three sub-periods as they bring the same conclusions as discussed above.

6. Discussion

All in all, most of the markets covered showed a significantly negative reaction towards the Russo-Ukrainian war. On the day of war, the steepest corrections were observed in the neighbouring countries (i.e., Poland, Hungary, Romania, Lithuania, and Latvia). These results are in lines with the proximity penalty observed by Federle et al. (2022). The day of event marked an important correction in the major European economies (e.g., UK, France, Germany) alongside the Australian market. The US, Canada, and Estonia did not show significant effects on the event day. The pattern observed for of Estonia can be linked to the closure of its stock market on the event day.

Noteworthy, the pre-war period covering days -5 to -1 already indicated significantly negative effect on the stock markets in Poland, Hungary, US, and Australia. Among these, the case of the Poland was related to the steepest decline in the corresponding stock index. This confirms the effect of the proximity. This finding confirms results reported by Ahmed et al. (2023), Boubaker et al. (2022), Yousaf et al. (2023), and Kumari et al. (2023).

With the course of event, however, it became evident that the Polish market had overreacted as the post-event trading days were related to the highest positive returns among the markets analysed. Looking at the whole event window, the Hungarian market showed the steepest decline. At the other end of spectrum, the US, Canadian, and Australian markets showed the lowest responsiveness to the Russo-Ukrainian war. Even though the non-European market did not show significant cumulative abnormal returns for the whole event window, they saw significant corrections during certain sub-periods. For instance, US and Canadian markets were negatively affected during the pre-war trading days, whereas Australia saw the same effect during the day when the war started. In any case, the magnitude of these effects was much lower than that observed in the European countries.

These results have implications for risk management. More specifically, investors seeking to hedge against the risk associated to geopolitical events may adjust their portfolios by moving towards markets that operate in different continents. However, overreaction of the markets near the geopolitical events may also occur.

7. Conclusions

Geopolitical events may affect stock markets even some time before they actually occur. Therefore, the event studies are applied with event windows spanning time period before and after the events. The study looked into the effects of the Russo-Ukrainian war which took place in 2022 on the European, American, and Australian stock markets. The frontier, emerging, and developed markets were taken into consideration when calculating the abnormal returns.

In general, the frontier markets are considered as being risky ones. The carried-out analysis confirmed that frontier markets showed higher volatility in the event window associated with the Russo-Ukrainian war. However, these countries are also located in proximity to the event. Therefore, both proximity penalty and the nature of the frontier markets rendered a convoluted effect.

The results showed that 3 out of 12 markets were negatively affected within the window of five trading days prior to the war. These markets include Poland, Hungary, and the US. The frontier markets covered in the study had been affected by the war to higher extent compared to developed and emerging markets. Indeed, frontier and emerging markets covered in this study (Hungary, Romania, Estonia, Latvia, and Lithuania) showed significantly negative cumulative abnormal returns for the whole event window. This finding follows the earlier literature. In addition, certain developed markets (the UK, Germany, France) also showed significant negative impact for the whole event window.

All in all, the proximity penalty has been confirmed in the case of Russo-Ukrainian war as the immediate neighbour country–Poland–showed the steepest correction on the event day. Interestingly, developed markets outside Europe were also affected at least during

certain intervals within the event window. However, the latter effects showed much lower magnitudes compared to those for the frontier markets.

The results imply that diversification of portfolio should be implemented when geopolitical events are expected. The markets of continents that are not directly involved in the event can be targeted in such cases. Besides, the emerging markets with relatively high liquidity (e.g., Polish market) should also be considered as they are often overreacting to geopolitical events. In such cases, one can embark on investments with a discount.

The study focused on country-level analysis. Indeed, further research could embark on company-level analysis. That would allow one to identify the sectors and companies which are more resilient to geopolitical shocks.

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