QUANTITATIVE METHODS IN ECONOMICS
Volume XXVI, No. 2, 2025, pp. 85 – 97

Received: 24.03.2025
Accepted: 09.05.2025

CAPITAL MARKETS' REACTION TO COVID-19 PANDEMIC AND WAR IN UKRAINE

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Abstract: The paper aims to investigate how the capital markets in different parts of the world reacted on economic problems caused by COVID-19 pandemic and the war in Ukraine. We investigate the daily quotations of 28 stock indexes from October 2019 till the end of 2022. In our research we apply tests comparing expected rates of return and risk in 4 distinguished subperiods. We conclude that Russian-Ukrainian war causes the increase of capital markets volatility but the decreases of index values caused by pandemic was higher than after the Russian invasion in all countries but Russia and Greece.

Keywords: pandemic, war in Ukraine, capital markets, statistical tests

JEL classification: G15, C12

INTRODUCTION

In 2020, the entire world was hit by the COVID-19 pandemic, causing a significant economic slowdown worldwide as a result of lockdowns and disrupted supply chains. To mitigate the economic and social impact of the downturn, countries mobilized their reserves and in 2021 most economies recorded positive GDP growth, which, however, was still negative in many countries if 2019 GDP is taken as the basis. In February 2022 Russia attacked Ukraine, and the effects of the

https://doi.org/10.22630/MIBE.2025.26.2.8

war were felt in many countries because the economies of both countries produced in 2019, 3.5% of global GDP, which at the same time was 22.7% of the GDP produced by the European Union, including being significant exporters of food, and Russia additionally of oil and gas.

Effects of the COVID-19 pandemic and the armed conflict in Europe have been affecting capital markets. Our study aims to answer the questions how the selected capital markets reacted on economic problems caused by pandemic and the war in Ukraine together with comparison of the strength and direction of reaction on both events. The novelty of the research is to compare the reaction of capital markets world-wide on mentioned above two dramatic situations. In our research we analyze data concerning 28 blue-chip indexes of selected world-wide capital markets from the period 30.09.2019-31.12.2022, applying statistical tests.

LITERATURE REVIEW

There is quite rich literature concerning world-wide crisis caused by the COVID-19 pandemic and Russia-Ukraine war. In the works [Aslam et al. 2020] and [Topcu, Gulal 2020] their authors find contagion transmission from the original source (i.e., China) to the global, emerging and the Asian stock markets. Contessi and De Pace (2021) identify periods of mildly explosive dynamics and collapses in the stock markets of 18 countries during the first wave of the COVID-19 pandemic in 2020. They find statistical evidence of instability transmission from the Chinese stock market to all other markets. In studies [Liu et al. 2020], [Liu et al. 2022b], [Zhang et al. 2020] and [Chowdhury et al. 2020], the authors examine the pandemic induced shock on the stock market volatility.

Abuzayed et al. [2021] look the contagion of systemic risk spillover of pandemic crises between the global stock market and stock markets hit hardest by the pandemic and found that systemic risk contagion intensifies more between the global stock market and individual markets between North American and Europe than Asian stock markets. Foo and Witkowska (2024) show that the COVID-19 pandemic financial crisis had a similar impact on 12 the analyzed capital markets (5 developed and 4 post-communist European and 3 non-European). Pappas et al. [2013] analyzing CEE markets in terms of their synchronization and contagion, find a significant strengthening of the correlation between markets (especially for young EU members). Whereas Żebrowska-Suchodolska et al. [2021] analyze situation in European post-communist countries during pandemic in comparison to the most developed European stock markets.

At the beginning of 2022, countries were still dealing with the effects of the pandemic when the world was hit by the news that Russia had invaded Ukraine. Therefore, the question arises about the impact of Russian-Ukrainian war on financial and commodity markets all over the world, and if this impact has global or local character. Balbaa et al. [2022] and Ozili [2022] claim that Russia's invasion

and sanctions imposed on Russia have a spillover effect on the global economy because it caused energy and commodity supply shocks, rising the prices of energy, food and commodities. Izzeldin et al. [2023] reveal that the intensity of the post-invasion crisis is noticeably smaller compared to both the Covid-19 and the 2007 global financial crisis.

Boungou and Yatie [2022] show a negative relationship between the Ukraine-Russia war and world stock market returns which was the largest during the first two weeks after the invasion of Ukraine. They also notice that these effects were most pronounced for countries bordering Ukraine and Russia, as well as for those UN member states that demanded an end of the Russian offensive in Ukraine.

Karamti and Jeribi [2023] claim that the Russo-Ukrainian conflict's influence on global equity markets is heterogeneous and based on countries' economic-political connection or proximity to the war zone. They investigate the G7 countries (i.e., Canada, France, Germany, Italy, Japan, UK and the USA) which sanctioning Russia and 3 non-sanctioning countries i.e., Russia, China and India (abr. RIC). Their results suggest that the war has a stronger influence on the G7 stock and the whole financial markets through commodity prices, with a greater impact of natural gas and wheat prices for this group of states than in the case of the RIC countries.

Literature review shows that the impact of pandemic and Russian aggression on capital markets is usually analyzed separately [Li et al. 2024; OECD 2022]. It is also worth mentioning that majority of publications consider the war in Ukraine in terms of oil, gas and food supply.

METHODOLOGY AND DATA

In our research we look at capital markets in some countries which were selected because of their position in world-wide economy, their role or situation caused by pandemic or Russia-Ukrainian war. For instance, USA is the biggest financial market whereas France, Germany and UK are the most developed capital markets in Europe. China is the biggest world economy but capital market there is still treated as an emerging one. Pandemic started in China in 2019, and it was spread all over the world. Israel was the leader in covid vaccination thus it was expected to recover after the lockdown fast. Russia invaded Ukraine on February 24, 2022, that affects economies in states which have borders with Russia or their economy depends on Russian oil and natural gas.

We investigate the daily quotations of stock indexes in 19 European and 9 non-European capital markets for the period from the third quarter of 2019 till the end of 2022. The indexes selected for analysis represent:

(1) European post-communist countries (Poland, Czechia, Hungary, Romania, Bulgaria, Russia and Croatia),
(2) other European countries (the United Kingdom, Germany, Holland, Finland, Norway, Denmark, Iceland, France, Italy, Spain, Portugal and Greece) and

(3) non-European countries (the USA, Australia, New Zealand, China, India, Singapore, Turkey, South Africa and Israel).

In our research we distinguish four subperiods of investigated capital markets behavior. The first one (denoted hereafter as I) is the pre-pandemic period contains the time span from 30.09.2019 to the date when the stock index reached the maximum peak value in the first quarter of 2020. The second subperiod (II), called the pandemic shock is defined as the time span between the dates when the maximum and minimum values of stock indexes in 2020 were observed[1]. The third subperiod (III) - pandemic stabilization and post-pandemic (pre-war) period covers the time span from the date of minimal index value to the beginning of war, and the last period (IV) from February 24 to the end of 2022 is a war period.

To investigate the situation in the selected capital markets in the subperiods distinguished above, we verify the following hypothesis to identify the market trend.

$$H_0: \mu = 0, \tag{1}$$

with the test statistics:

$$u = \frac{\bar{y}}{S}\sqrt{T}, \tag{2}$$

where for the distinguished subperiods, μ - the expected return, $\bar{y}$ - average rates of return μ_i obtained in the sample, S - standard deviation of returns in the sample, T - number of observations in the certain period of time.

We also test if there are significant changes in the diverse capital markets in the distinguished subperiods by verifying the following hypotheses:

$$H_0: \mu_1 = \mu_2, \tag{3}$$

$$H_0: \sigma_1^2 = \sigma_2^2, \tag{4}$$

The test statistics for both hypotheses are as following:

$$t = \frac{\bar{y}_1 - \bar{y}_2}{\sqrt{\frac{S_1^2}{T_1} + \frac{S_2^2}{T_2}}}, \tag{5}$$

$$F = \frac{S_1^2}{S_2^2}, \tag{6}$$

where, μ_1, μ_2, σ_1^2, σ_2^2 - the expected returns, and variances of returns in the two comparable subperiods, $\bar{y}_1, \bar{y}_2$, S_1^2, S_2^2 - average rates of return and variances in the samples, T_1, T_2 - number of observations in both compared samples.

The proposed research methodology (1)–(6) is used for analyses that aim to determine the strength and direction of reactions to specific events [Tarczyński, Witkowska, & Kompa 2013]. And since the goal of our research is to draw general conclusions, we decided that using simple analytical tools instead of event studies or Perron tests would suffice.

[1] Two first subperiods are distinguished following the idea presented in [Żebrowska-Suchodolska et al. 2021].

EMPIRICAL FINDINGS

Analysis of quotation of selected stock indexes was used to distinguished four subperiods which are used for further investigation. In all considered countries, but 9 states, the highest quotation appeared in the third period i.e., after pandemic shock i.e., before the Russian invasion in Ukraine. In Spain global maximum is observed before lockdown (19.02. 2020). While in the remaining countries, global maximum appeared during the war, i.e. in the year 2022 - South Africa (2.03.), Iceland (4.04.), Singapore (5.04.), Norway (13.04.), UK (8.04.), Portugal (7.06.), India (1.12.) and Turkey (30.12.). Minimal quotations during lockdown appeared in majority of markets between 12th and 23rd of March 2020 except Greece (26.03.), and during the war between 29th of September and 14th of October 2022 with exception of Turkey (28.02.), Bulgaria (7.03.), China (26.04.), India (20.06.), Greece, Australia and New Zealand (all three 20. 06.), Singapore (21.10.), Israel (25.12.) and USA (28.12). It is noticeable that during pandemic minimal values of indexes were smaller than during the war in all countries except Greece and Russia.

Table 1. Test statistics to verify hypotheses (1), (3) and (4)

Periods	I	II	III	IV	I	II	III	IV
	BUX Hungary				PX Czechia			
E(R)=0	**1.852**	**-2.081**	1.516	0.233	**1.859**	**-3.398**	**2.965**	-0.453
Compared periods	I&II	II&III	III&IV	I&IV	I&II	II&III	III&IV	I&IV
$E(R_t)=E(R_{t+1})$	**2.539**	**-2.290**	0.423	1.084	**3.662**	**-3.738**	**1.796**	1.462
$D^2(R_t)=D^2(R_{t+1})$	**9.197**	**4.536**	**2.060**	**4.176**	**16.853**	**5.063**	**1.539**	**5.1219**
	WIG20 Poland				CROBEX Croatia			
E(R)=0	0.234	**-2.625**	1.144	0.079	1.130	**-2.160**	**2.404**	0.000
Compared periods	I&II	II&III	III&IV	I&IV	I&II	II&III	III&IV	I&IV
$E(R_t)=E(R_{t+1})$	**2.567**	**-2.786**	0.482	0.111	**2.282**	**-2.339**	1.430	0.862
$D^2(R_t)=D^2(R_{t+1})$	**7.398**	**3.080**	**1.440**	**3.4596**	**36.787**	**14.607**	**1.261**	**1.997**
	BET Romania				SOFIX Bulgaria			
E(R)=0	1.645	**-2.086**	**2.915**	-0.368	0.568	**-2.475**	**2.297**	0.149
Compared periods	I&II	II&III	III&IV	I&IV	I&II	II&III	III&IV	I&IV
$E(R_t)=E(R_{t+1})$	**2.283**	**-2.385**	**1.722**	1.222	**2.538**	**-2.696**	0.924	0.308
$D^2(R_t)=D^2(R_{t+1})$	**30.941**	**7.423**	**1.475**	**6.146**	**13.007**	**8.380**	**1.629**	**2.529**

Note: Bolded values indicate rejection of the null hypothesis at the α=0.05 level. Shading denotes events when the standard deviation in the first period compared is smaller than in the second period. The Roman marks I–IV denote the research periods defined in the text.

Source: own calculations on the basis of data in Appendix

Testifying results (Tables 1-4) show that in the covid shock period (i.e., the second one) there were bear markets in all considered 28 countries except Greece, China and the USA, where rates of return were insignificantly different from zero.

Table 2. Test statistics to verify hypotheses (1), (3) and (4)

Periods	I	II	III	IV	I	II	III	IV
	OMX Helsinki Finland				AEX Holland			
E(R)=0	**1.651**	**-3.309**	**1.897**	0.105	1.089	**-2.993**	**2.162**	0.000
Compared periods	I&II	II&III	III&IV	I&IV	I&II	II&III	III&IV	I&IV
$E(R_t)=E(R_{t+1})$	**3.533**	**-3.500**	0.894	1.017	**3.111**	**-3.174**	1.110	0.724
$D^2(R_t)=D^2(R_{t+1})$	**10.726**	**4.190**	1.196	**3.063**	**13.535**	**5.776**	**1.221**	**2.861**
	OMX Oslo Norway				ICEX Iceland			
E(R)=0	0.551	**-2.296**	**1.980**	0.000	**1.985**	**-1.726**	**3.577**	-0.238
Compared periods	I&II	II&III	III&IV	I&IV	I&II	II&III	III&IV	I&IV
$E(R_t)=E(R_{t+1})$	**2.361**	**-2.551**	1.044	0.392	**2.197**	**-2.200**	**1.892**	1.618
$D^2(R_t)=D^2(R_{t+1})$	**10.355**	**4.164**	1.134	**2.821**	**7.955**	**5.040**	**1.550**	**2.446**
	OMX Copenhagen Denmark				DAX Germany			
E(R)=0	**2.282**	**-2.600**	**2.271**	0.674	1.253	**-3.113**	**1.720**	0.100
Compared periods	I&II	II&III	III&IV	I&IV	I&II	II&III	III&IV	I&IV
$E(R_t)=E(R_{t+1})$	**2.929**	**-2.817**	0.579	1.066	**3.237**	**-3.247**	0.841	0.751
$D^2(R_t)=D^2(R_{t+1})$	**9.221**	**4.607**	**1.256**	**2.513**	**15.538**	**5.699**	1.086	**2.962**
	PSI Portugal				IBEX35 Spain			
E(R)=0	1.444	**-2.617**	0.382	0.537	1.119	**-2.821**	1.086	0.119
Compared periods	I&II	II&III	III&IV	I&IV	I&II	II&III	III&IV	I&IV
$E(R_t)=E(R_{t+1})$	**2.731**	**-2.637**	-0.220	0.515	**2.906**	**-2.889**	0.567	0.688
$D^2(R_t)=D^2(R_{t+1})$	**28.502**	**8.004**	1.131	**3.148**	**25.000**	**7.716**	**1.349**	**2.403**
	FTSEMIB Italy				FTSEATHEX20 Greece			
E(R)=0	1.640	**-2.777**	1.545	-0.094	1.046	-1.626	0.582	0.688
Compared periods	I&II	II&III	III&IV	I&IV	I&II	II&III	III&IV	I&IV
$E(R_t)=E(R_{t+1})$	**2.899**	**-2.868**	0.936	1.139	**1.863**	**-1.703**	-0.499	-0.513
$D^2(R_t)=D^2(R_{t+1})$	**25.331**	**8.297**	1.026	**2.977**	**3.0112**	**6.725**	**5.104**	**103.361**
	CAC40 France				FTSE United Kingdom			
E(R)=0	1.008	**-2.899**	**1.957**	0.106	0.484	**-2.667**	1.576	0.286
Compared periods	I&II	II&III	III&IV	I&IV	I&II	II&III	III&IV	I&IV
$E(R_t)=E(R_{t+1})$	**2.984**	**-3.039**	0.974	0.566	**2.706**	**-2.888**	0.775	0.185
$D^2(R_t)=D^2(R_{t+1})$	**20.881**	**6.943**	1.044	**3.141**	**10.563**	**3.449**	**1.526**	**2.007**

Note: Bold, shading and Roman marks as in Table 1.
Source: own calculations on the basis of data in Appendix

Also returns from stock indexes in the first and the third subperiods are significantly bigger than in the second one in all stock exchanges but SSE (China) and NASDAQ100 (USA) where differences of returns in comparable periods are insignificant. After Russia invasion, returns from all considered indexes insignificantly differ from zero with exception of XU100 (Turkey), which generated significantly higher returns during the war than in the third period. Comparison of returns in the pre-pandemic to the pandemic stabilization period shows insignificant differences between these both periods in all considered markets, whereas returns in the war period are significantly higher than during the covid shock period in all countries but Iceland, the USA, Greece and China. Chinese capital market was the only one which shows stable situation in the whole analyzed period.

Table 3. Test statistics to verify hypotheses (1), (3) and (4)

Periods	I	II	III	IV	I	II	III	IV
	TA35 Israel				NASDAQ 100 USA			
E(R)=0	1.387	**-2.741**	**2.085**	-0.383	**3.086**	-1.232	**2.150**	-0.642
Compared periods	I&II	II&III	III&IV	I&IV	I&II	II&III	III&IV	I&IV
$E(R_t)=E(R_{t+1})$	**2.899**	**-2.929**	**1.481**	1.221	1.447	-1.366	1.533	**2.059**
$D^2(R_t)=D^2(R_{t+1})$	**16.834**	**5.890**	1.054	**2.713**	**44.560**	**11.140**	**1.772**	**7.088**
	S&PNZX50 New Zealand				S&ASX20 Australia			
E(R)=0	1.565	**-3.316**	**1.680**	-0.225	0.924	**-6.075**	**1.659**	0.309
Compared periods	I&II	II&III	III&IV	I&IV	I&II	II&III	III&IV	I&IV
$E(R_t)=E(R_{t+1})$	**3.488**	**-3.453**	1.228	1.328	**6.106**	**-6.279**	0.828	0.502
$D^2(R_t)=D^2(R_{t+1})$	**13.1406**	**5.572**	**1.467**	**1.608**	**3.240**	1.2656	**1.530**	**1.673**
	SSE China				STI Singapore			
E(R)=0	1.222	-1.117	1.297	-0.503	**1.828**	**-2.535**	**1.760**	0.000
Compared periods	I&II	II&III	III&IV	I&IV	I&II	II&III	III&IV	I&IV
$E(R_t)=E(R_{t+1})$	1.410	-1.310	1.087	1.227	**3.122**	**-2.923**	1.211	**1.660**
$D^2(R_t)=D^2(R_{t+1})$	**7.807**	**3.610**	**1.323**	**2.860**	**7.739**	**2.341**	**2.041**	**1.620**
	SA40 TOP40 South Africa				XU100 Turkey			
E(R)=0	1.206	**-2.318**	**2.394**	0.100	1.514	**-2.494**	**2.409**	**4.542**
Compared periods	I&II	II&III	III&IV	I&IV	I&II	II&III	III&IV	I&IV
$E(R_t)=E(R_{t+1})$	**2.526**	**-2.656**	1.182	0.737	**2.885**	**-2.948**	**-2.555**	-0.348
$D^2(R_t)=D^2(R_{t+1})$	**11.595**	**3.800**	1.119	**3.416**	**3.179**	**1.930**	1.109	**1.826**
	SENSEX India				MOEX Russia			
E(R)=0	1.477	**-2.216**	**2.636**	0.846	**2.756**	**-2.854**	0.214	0.283
Compared periods	I&II	II&III	III&IV	I&IV	I&II	II&III	III&IV	I&IV
$E(R_t)=E(R_{t+1})$	**2.452**	**-2.564**	1.071	0.556	**3.366**	**-2.815**	-0.150	0.833
$D^2(R_t)=D^2(R_{t+1})$	**19.076**	**4.987**	**1.667**	**2.294**	**11.725**	1.181	**1.410**	**14.006**

Note: Bold, shading and Roman marks as in Table 1.

Source: own calculations on the basis of data in Appendix

Risk, measured by standard deviation, is significantly bigger in the pandemic shock period than in the pre-pandemic one in all countries. Similar relation appears if risk in the pandemic shock period compares to the pandemic stabilization period with exception of Greece where situation is opposite and Russia together with Australia which show insignificant differences of risk in both compared periods.

Table 4. Test statistics to verify hypotheses (3) and (4)

Compared periods	Country	$E(R_t)=E(R_{t+1})$	$D^2(R_t)=D^2(R_{t+1})$	Country	$E(R_t)=E(R_{t+1})$	$D^2(R_t)=D^2(R_{t+1})$
I&III	BUX Hungary	0.979	**19.94**	BET Romania	-0.567	**440.35**
II&IV		**-2.045**	**358.77**		**-1.977**	**2081.44**
I&III	PX Czechia	-0.250	**119.99**	SOFIX Bulgaria	-0.509	**63.76**
II&IV		**-3.207**	**672.34**		**-2.456**	**448.96**
I&III	WIG20 Poland	-0.343	**26.40**	OMX Helsinki Finland	0.292	**80.39**
II&IV		**-2.519**	**113.50**		**-3.272**	**164.63**
I&III	CROBEX Croatia	-0.319	**2152.90**	AEX Holland	-0.301	**122.95**
II&IV		**-2.149**	**850.64**		**-2.961**	**272.97**
I&III	OMX Oslo Norway	-0.564	**83.34**	PSI Portugal	0.860	**1039.72**
II&IV		**-2.238**	**137.97**		**-2.658**	**634.71**
I&III	ICEX Iceland	0.198	**26.35**	IBEX35 Spain	0.194	**1136.69**
II&IV		-1.612	**152.00**		**-2.821**	**343.65**
I&III	OMX Copenh. Denmark	0.710	**53.90**	FTSEMIB Italy	0.345	**674.97**
II&IV		**-2.677**	**134.12**		**-2.757**	**609.97**
I&III	DAX Germany	0.000	**204.60**	FTSEATHEX20 Greece	0.000	**2.87**
II&IV		**-3.100**	**284.90**		-1.359	**236.24**
I&III	CAC40 France	-0.399	**399.84**	S&PNZX50 New Zealand	0.321	**371.70**
II&IV		**-2.891**	**475.50**		**-3.270**	**80.22**
I&III	FTSE United Kingdom	-0.498	**259.79**	S&ASX20 Australia	-0.215	**24.59**
II&IV		**-2.670**	**47.91**		**-5.989**	**4.48**
I&III	TA35 Israel	-0.112	**314.99**	SSE China	0.425	**34.85**
II&IV		**-2.659**	**254.95**		-0.942	**106.60**
I&III	NASDAQ 100 USA	0.861	**632.35**	STI Singapore	0.970	**249.42**
II&IV		-1.141	**6234.79**		**-2.425**	**14.38**
I&III	SA40 TOP40 South Africa	-0.361	**107.30**	SENSEX India	-0.394	**1011.69**
II&IV		**-2.274**	**168.42**		**-2.324**	**130.90**
I&III	XU100 Turkey	0.233	**8.22**	MOEX Russia	1.573	**69.14**
II&IV		**-3.837**	**12.43**		**-2.685**	**273.40**

Note: Bold, shading and Roman marks as in Table 1.
Source: own calculations on the basis of data in Appendix

Also risk in the pre-pandemic period is smaller than during the pandemic stabilization in all markets but Greek. Risk in the last period is significantly higher than in the pandemic shock period in all considered countries. Similarly, when it is

compared to the pre-pandemic period but with the exception of Germany. Whereas comparing risk during the war to the one in pandemic stabilization period, it is significantly higher in 12, lower in 7 and insignificant in 9 states.

CONCLUSION

Our research shows that the decreases of index values caused by COVID-19 pandemic were higher than after the Russian invasion in all countries but Russia and Greece. Although, the expected returns from indexes in the war period were significantly higher than in the pandemic shock period in all analyzed markets but Greece, Iceland, the USA and China. After Russia invasion, returns from the majority of considered indexes insignificantly differ from zero, except NASDAQ100 and XU100 (Turkey) which reported significantly positive expected returns in the war period. Expected rates of return during pandemic were much smaller than during the war. Investigating returns from the selected markets it is noticeable that the highest returns in all periods with the positive maximum values appear in non-European markets whereas the smallest returns in the post-communist European countries. In the covid shock period there were bear markets in all considered countries except Greece, China and the USA. During the war, stagnation of capital markets is visible with exceptions of Turkey. The USA and Singapore create the group of markets with significantly higher returns during the war than in the pre-pandemic period.

Risk measured by standard deviation is significantly smaller in all countries in the pre-pandemic period comparing to both the second and third periods with exception of Russia and Greece for the latter. In the war period risk was bigger than in the pre-pandemic period in all considered markets. Although risk in the pandemic shock period was significantly bigger than risk in the last period for all markets.

To sum up our research, it is visible that Russian-Ukrainian war causes perturbances and increase of volatility of capital markets but the impact of the war on selected markets is significantly smaller than Covid-19 pandemic what is in line with results obtained by Izzeldin et al. (2023). After invasion, rates of return from stock indexes observed in countries which were dependent on Russian oil sent via pipelines or neighboring Russia do not significantly differ from zero. Although indexes BUX (Hungary), PX (Czechia) together with OMX from Norway and Finland characterized negative asymmetry. Our results therefore do not indicate a significantly stronger response from countries that appear to be more affected by the Russia-Ukraine war due to their proximity to hostilities and dependence on Russian and Ukrainian supplies.

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APPENDIX

Table A1. Daily rates of return characteristics in the sample 30.09.2019 – 31.12.2020

Subperiods	I	II	III	IV	I	II	III	IV
Index	**BUX (Hungary)**				**PX (Czechia)**			
Average	0.0022	-0.0079	0.0009	0.0003	0.0012	-0.0129	0.0014	-0.0004
Stan. dev.	0.0092	0.0279	0.0131	0.0188	0.0057	0.0234	0.0104	0.0129
Asym.	0.0693	-1.3533	-0.5783	-0.7838	-0.4840	-1.3154	0.6616	-0.2275
Kurtosis	-0.5281	3.9067	7.1792	5.6244	1.7177	1.7943	7.5454	2.7268
N	60	54	487	213	78	38	485	213
Index	**WIG20 (Poland)**				**CROBEX (Croatia)**			
Average	0.0003	-0.0102	0.0008	0.0001	0.0006	-0.0093	0.0008	0.0000
Stan. dev.	0.0100	0.0272	0.0155	0.0186	0.0046	0.0279	0.0073	0.0065
Asym.	0.6862	-2.2085	-0.4428	0.5382	0.9483	-1.5016	-0.6205	0.3117
Kurtosis	1.7911	8.0242	6.0657	1.2197	4.6765	3.9814	18.4768	3.8858
N	61	49	491	213	75	42	481	209
Index	**BET (Romania)**				**SOFIX (Bulgaria)**			
Average	0.0009	-0.0087	0.0013	-0.0003	0.0004	-0.0084	0.0008	0.0001
Stan. dev.	0.0048	0.0267	0.0098	0.0119	0.0061	0.0220	0.0076	0.0097
Asym.	-0.4191	-0.8812	-0.0362	0.0876	1.4346	-2.5621	-0.0174	-0.6485
Kurtosis	0.7325	2.9913	5.5685	7.0379	4.3928	9.3294	3.1676	11.6569
N	77	41	483	213	75	42	476	208
Index	**AEX (Holland)**				**FTSEMIB (Italy)**			
Average	0.0009	-0.0186	0.0012	0.0000	0.0015	-0.0318	0.0021	-0.0002
Stan. dev.	0.0081	0.0298	0.0124	0.0137	0.0091	0.0458	0.0183	0.0200
Asym.	-0.5428	-1.3709	0.6209	0.0621	-0.5938	-2.0352	0.3486	-2.2742
Kurtosis	1.9667	2.1253	5.7059	1.1986	1.4366	4.3984	3.6187	19.8472
N	96	23	499	218	99	16	499	217
Index	**DAX (Germany)**				**CAC40 (France)**			
Average	0.0011	-0.0236	0.0011	0.0001	0.0008	-0.0234	0.0012	0.0001
Stan. dev.	0.0086	0.0339	0.0142	0.0148	0.0079	0.0361	0.0137	0.0140
Asym.	-0.5424	-1.3192	0.8297	0.6141	-1.1017	-1.0903	0.5035	0.5225
Kurtosis	2.2941	2.1669	8.4758	3.6001	3.2576	1.3993	5.8567	3.3736
N	96	20	493	218	99	20	499	218
Index	**OMX Helsinki (Finland)**				**OMX Oslo (Norway)**			
Average	0.0014	-0.0170	0.0011	0.0001	0.0005	-0.0090	0.0011	0.0000
Stan. dev.	0.0080	0.0262	0.0128	0.0140	0.0078	0.0251	0.0123	0.0131
Asym.	-0.3021	-1.5992	0.1489	-0.1249	-0.2434	-1.4098	0.1018	-0.2658
Kurtosis	0.6220	3.1254	3.8120	0.6918	0.5903	2.8851	2.8359	0.4432
N	89	26	487	214	74	41	490	214
Index	**ICEX (Iceland)**				**OMX Copenhagen (Denmark)**			
Average	0.0018	-0.0056	0.0016	-0.0002	0.0019	-0.0135	0.0012	0.0006
Stan. dev.	0.0078	0.0220	0.0098	0.0122	0.0082	0.0249	0.0116	0.0130
Asym.	0.2969	-0.7588	-0.0421	0.1041	-0.3735	-0.6263	-0.0452	-0.1009

Kurtosis	-0.0672	1.0529	3.0602	0.5455	1.0876	0.8949	0.4850	0.4037
N	74	46	480	211	97	23	482	213
Index	**MOEX (Russia)**				**XU100 (Turkey)**			
Average	0.0021	-0.0102	0.0002	0.0005	0.0021	-0.0084	0.0018	0.0053
Stan. dev.	0.0066	0.0226	0.0208	0.0247	0.0125	0.0224	0.0161	0.0170
Asym.	-0.0787	-1.7613	-8.5645	2.3574	-0.3063	-1.3360	-1.4611	-0.2163
Kurtosis	-0.0462	3.3485	134.375	22.503	4.8284	2.7359	7.8626	2.5552
N	75	40	493	196	79	44	482	213
Index	**FTSE100 (United Kingdom)**				**PSI (Portugal)**			
Average	0.0004	-0.0092	0.0009	0.0002	0.0009	-0.0189	0.0002	0.0004
Stan. dev.	0.0072	0.0234	0.0126	0.0102	0.0062	0.0331	0.0117	0.0110
Asym.	-1.0369	-1.5528	0.5396	-0.2865	0.0635	-0.6332	0.6623	-0.1704
Kurtosis	4.7843	3.5309	6.0469	1.4234	1.1136	0.6770	3.9610	0.4159
N	76	46	487	212	99	21	498	218
Index	**IBEX35 (Spain)**				**FTSEATHEX20 (Greece)**			
Average	0.0009	-0.0266	0.0007	0.0001	0.0012	-0.0060	0.0012	0.0049
Stan. dev.	0.0080	0.0400	0.0144	0.0124	0.0102	0.0177	0.0459	0.1037
Asym.	-0.4589	-1.2656	0.6864	0.0346	0.0814	-2.5049	3.7710	1.9275
Kurtosis	1.3076	2.4428	4.9674	1.3333	0.8880	9.1084	74.620	13.762
N	99	18	499	218	79	23	495	212
Index	**S&PNZX50 (New Zealand)**				**S&PASX20 (Australia)**			
Average	0.0008	-0.0132	0.0006	-0.0001	0.0007	-0.0171	0.0009	0.0002
Stan. dev.	0.0056	0.0203	0.0086	0.0071	0.0075	0.0115	0.0120	0.0097
Asym.	-0.8385	-0.4375	1.2349	0.0920	-0.9998	0.2534	0.4426	-0.2611
Kurtosis	2.5178	0.3253	9.2568	0.7875	1.6326	0.4214	6.9833	1.2487
N	120	26	580	255	98	23	489	224
Index	**NASDAQ100 (USA)**				**SENSEX (India)**			
Average	0.0024	-0.0135	0.0033	0.0018	0.0012	-0.0095	0.0016	0.0006
Stan. dev.	0.0077	0.0514	0.0183	0.0207	0.0068	0.0297	0.0133	0.0103
Asym.	-0.3861	0.2280	0.1642	-0.5904	0.0710	-1.8269	0.4368	0.0150
Kurtosis	0.5425	0.1838	2.8010	7.7712	0.7953	6.0087	7.1502	0.2524
N	98	22	487	214	70	48	480	211
Index	**SSE (China)**				**STI (Singapore)**			
Average	0.0010	-0.0032	0.0015	0.0007	0.0019	-0.0040	0.0008	0.0000
Stan. dev.	0.0068	0.0190	0.0113	0.0121	0.0055	0.0153	0.0100	0.0070
Asym.	-0.2633	-1.3950	0.3006	-0.8771	-0.9531	-1.9204	0.7951	-0.1497
Kurtosis	0.2648	3.9653	4.2698	7.6720	0.4921	7.3469	6.4841	-0.1028
N	69	44	467	209	28	94	484	213
Index	**SA 40TOP 40 (South Africa)**				**TA35 (Israel)**			
Average	0.0011	-0.0094	0.0015	0.0001	0.0010	-0.0150	0.0004	-0.0003
Stan. dev.	0.0079	0.0269	0.0138	0.0146	0.0068	0.0279	0.0126	0.0112
Asym.	-0.1063	-1.6978	1.0583	0.4016	-0.6714	-0.0278	-0.5039	-0.2712
Kurtosis	-0.2537	2.8948	7.1556	0.8359	3.3810	-0.4379	6.1161	-0.1099
N	75	44	485	211	89	26	475	204

Source: own calculations on basis of https://stooq.pl/