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Event study on the reaction of the Balkan stock markets to the conflict between Russia and Ukraine

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Abstract
The aim of this paper is to examine the reaction of South Eastern European stock markets to the armed conflict between Russia and Ukraine. With a sample of seven stock market indices, the event study methodology is applied to examine the influence of the conflict between two countries on European ground over stock indices of emerging markets in South Eastern Europe. Results indicate that beginning of the conflict in late February brought a very strong significant price correction and stock markets in the examined countries became maximum oscillatory and subjected to light and rapid changes on a daily level. The findings contribute to the research on economic impact of the armed conflict by providing empirical evidence that conflict between two European (Non-European Union members) countries has spill-over effects on stock markets on other European (European Union members and Non-European Union members) countries. The findings have important implications for portfolio diversification and thus can serve in the asset allocation decision of investment managers.

Keywords: emerging markets, event study methodology, stock indices, war intervention.

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Introduction
Armed conflicts have devastating consequences such as deaths, civilian victims, displacement of people and destruction of public infrastructure and physical and social capital. Also, conflicts weaken the institutions and erode social trust. The destruction of infrastructure and institutions leaves the population living in conditions

that increase crime, political instability, disease and further conflict. In all ages the armed conflict has been an important topic of analysis. Analysis of conflict may be divided in several categories: political, legal, technological, economic, psychological and etc. This distinction indicate the varying focuses of interest and different analytical categories employed by theoreticians.

In the current international climate of conflict and confrontation, political events such as armed conflicts and terrorist attacks have become important factors in the performance of international capital markets. Given the structural imbalances, social and political fragility, and financial dependence of many emerging economies, these economies may be particularly vulnerable to such events.

From a fundamental perspective, following an unexpected event such as a beginning of armed conflict, market agents of the capital market would need to assess corporate profit expectations and how these may be revised downwards due to the destruction of physical and intangible capital, greater security measures, changes in production and transaction costs. Moreover, they would need to assess whether the market risk premium increases since armed conflict as an event involves greater uncertainty about the future prospects of firms. This assessment is likely to influence the actions of market participants and eventually the way the market reacts to the specific event, including the time it will require to "bounce back". Another dimension is the psychological or behavioral effect, which refers to the fact that conflicts can have a significant influence on the mood of investors. Behavioral economists argues that negative investor sentiment can have an effect on investment decisions, which in turn is likely to influence prices of assets and hence the stock market as a whole.

Geopolitics plays an important role in shaping the information available to investors, in the development of assumptions used in risk assessment (Suder, 2004). Armed conflict reshapes the investment activity in the stock market. Armed conflict may constrain or revise investment behaviour and may impact the asset allocations at home and abroad. Wealth, generated through company stock investment is either redistributed from one investment community to another, or lost, as a result of armed conflict consequences and subsequent market reactions. In the financial literature can be seen a growing attention to the impact of socio-political events that they have on stock market behavior and broadly speaking, it has been shown that mayor events such as armed conflict and terrorism influence capital market and asset prices (Choudhry, 1995; Frey, Kucher, 2001; Aminud, Wohl, 2004).

Working with a cross-section of countries with well-defined periods before and during the armed conflict, this study uses an event study methodology to examine the reaction of South Eastern European stock markets, more precisely Balkan countries, to the armed conflict between Russia and Ukraine in 2022. A research question that we want to answer with this study is whether the beginning of an armed conflict cause immediate reaction by investors, measured trough abnormal returns on stock market indices and how long volatility (caused from the beginning of the conflict) last? Our hypothesis is that armed conflicts cause immediate reaction of the investors as soon as the event happens. The goal of the research is by applying the event study methodology to provide original empirical results on the effects that the onset of armed conflict has on stock market indices. It is investigated whether the effects of armed conflict over the value of main stock indices of SEE stock markets cause abnormal returns. Also, cumulative abnormal return (CAR) was tested for each stock index. The paper has the following structure. In the next section, a more detailed literature review on this topic is provided and associate the authors conclusions to the contribution of this research. In the Methodology section

it's described the data and the model. Results section displays the findings and in the last section point out the conclusions.

Literature review

The growing interest in the economic causes and consequences of armed conflicts has spurred a large number of studies in economic science. Some of these studies focus on effects of armed conflicts on neighboring countries. Research findings (Murdoch, Sandler, 2002) shows that conflicts reduce growth over an entire region of neighboring countries. The economic effects of both world wars (Organski, Kugler, 1977) were analyzed on a sample of mainly European countries. They find that the effects of war dissipate in the long run (15-20 years) for both losers and winners, with both types of countries usually returning to pre-war growth trends.

Impact of the armed conflict over the capital market (Kollias et al., 2010) in the case of the Israeli military offensive in the Gaza strip has been examined. This paper examines the effects of this armed conflict on the return and volatility of the general index of the Tel Aviv Stock Exchange (TASE), as well as on the government bond index. In the paper "War and the World Economy", authors (Schneider, Troeger, 2006) study the reactions of three stock market indices (Dow Jones, FTSE and CAC) to the intensity of conflicts in Iraq, Israel and in the former Yugoslavia in the period 1990-2000.

Armed conflicts increase the level of uncertainty, which can affect investment decisions, and the subsequent volatility of stock returns. Indeed, this study examines the implications of armed conflict on stock indices values in emerging economies.

Several studies (Chen, Siems, 2004) assess the effects of terrorism on global capital markets. They examine the U.S. capital market's response to 14 terrorist attacks since 1915 and the response of global capital markets to Iraq's invasion of Kuwait in 1990 and the September 11, 2001, terrorist attacks in the United States. They have found that modern U.S. capital markets are more resilient than they were in the past and that they recover sooner from terrorist/military attacks than other global capital markets. In the case of India as an emerging economy (Clark, Lakshmi, 2003), the estimation of the effects of Iraq's invasion of Kuwait in 1990 shows strong evidence of India's extreme vulnerability to the invasion's effects and suggests that over-estimation was present. The lagged reaction of the market to invasion effects on India's default probabilities is strong evidence that the markets were unable to effectively assess this vulnerability in a timely manner.

In the following part of this paper is applied the event study methodology to examine the reaction of the Emerging stock markets to the armed conflict. The event study methodology is applied on 7 indices of the SEE countries. Event studies typically examine the effect of an event - or a set of events - on the value of assets, such as stock market indices (as in this paper), stock prices, bond prices, commodity prices, and exchange rates. In the paper "Efficient Capital Markets: A Review of Theory and Empirical Work" (Fama, 1970), the event study methodology is based on the efficient market hypothesis where author states that as new information arrives at the market, investors immediately assess its current and future impact. This assessment results in prices changing to reflect the effect of this new information on the discounted value of the future performance of the asset under consideration. As such, significant price changes can be attributed to specific events that resulted in the release of this new information. Herewith lies the main strength of the event study methodology: its ability to identify such significant changes, based on the overall assessment of many investors.

Research methodology

In this part of the paper the reaction of South Eastern European stock markets to the armed conflict between Russia and Ukraine is examined. Following indices are considered in this research: MBI 10 Index consisted of 10 most liquid shares on the Macedonian Stock Exchange, Belex15 Index consisted of 10 most liquid shares of Belgrade stock exchange, SBITOP Index consisted of 8 most liquid shares on the Ljubljana Stock Exchange, SOFIX Index consisted of 15 most liquid shares of Bulgarian stock exchange, CROBEX Index consisted of 21 most liquid shares on Zagreb Stock Exchange, BIRS Index consisted of 12 largest companies listed on Banja Luka Stock Exchange and SASX-10 Index consisted of 10 largest companies listed on Sarajevo Stock Exchange. To empirically conclude the reaction of these indices, the leading index from the SEE countries needs to be considered. The details of sample are given in Table 1.

Table 1 Selected indices for affected countries in South-East Europe

Definition	Abbreviation	Country
Macedonian stock market index	MBI10	North Macedonia
Belgrade stock exchange blue-chip index	Belex15	Serbia
Ljubljana stock exchange blue-chip index	SBITOP	Slovenia
Bulgarian stock market index	SOFIX	Bulgaria
Zagreb stock exchange index	CROBEX	Croatia
Banja Luka Stock Exchange benchmark index	BIRS	Bosnia and Herzegovina
Sarajevo stock exchange index	SASX-10	Bosnia and Herzegovina

Source: See Link, 2022.

What should be benchmark to measure the performance of several indices in this study? Equal weighted index is an option. The SEELinX Equal-Weighted Index (EWI) which is based on the price performance of shares included in the index portfolio, as each constituent shall have equal weight has been used as the benchmark estimate of the expected returns of the indices in the sample. The benchmark index is composed of the 18 most actively traded regional companies listed on 7 participating stock exchanges: 5 from Croatia, 4 from Slovenia, 3 from Bulgaria, 2 from Macedonia, 2 from Serbia, 2 from Bosnia and Herzegovina (one from Banja Luka Stock Exchange and one from Sarajevo Stock Exchange). Hence, with a sample of 7 stock indices where each of the indices represents stock market of one country, the impact of armed conflict between Russia and Ukraine over country specific stock market is examined.

Event study methodology is widely used in the economics and finance literature to assess the impact of a wide range of events like announcement of mergers and acquisitions (Brown, Warner, 1980), stock splits (Fama et al., 1969), regulatory changes (William, 1981), the effect of macroeconomic announcements on the foreign exchange market (Evans, Lyons, 2008). There are studies (Markoulis, Katsikides, 2018; Chen, Siems, 2004; Guidolin, Ferrara, 2010) that employ the event study methodology to study the effect of armed conflicts, terrorist attacks on stock markets. In this paper, market model of the event study methodology is applied.

Data

Time series of the stock indices are daily data with 224 observation or 224 trading days. The analyzed period is from June 1st, 2021 until April 8th, 2022. The data are taken from SEE link statistics for the SEELinX EWI (SEE Link, 2022) and from Thomson Reuters database (Refinitiv, 2022) for 7 indices considered in this research. The reason

of analyzing the values of the stock indices since June, 2021 is because the process of vaccination of the population in protecting the spread of the Covid-19 virus has begun in all countries covered with this analysis. The vaccination process has contributed to mitigating restrictive measures which were used to prevent the spread of the virus among the population. Measures such as restrictions on the movement of the population created difficulties in realization of the economic processes. Number of new Covid-19 cases and restrictive measures directly influenced over stock indices volatility.

Event study methodology

There is not a unique structure for carrying out an "event study", there is a general framework of the flow of analysis that needs to be followed (MacKinlay, 1997; Kothari, Warner, 2007). First, the date of the event must be specified. For the purposes of this paper, this is the day on which Russia invaded Ukraine on February 24th, 2022. Following that, the "estimation-period" and the "event-period" need to be defined for the purposes of the time-series analysis. Typically, the "estimation-period" and the "event-period" do not overlap. The "estimation-period" is the time period that is used to calculate the estimated return predicted by the market around the "announcement date," i.e., the date of the event. In this paper, a period of 31 trading days after the date of the event is "event period" and 192 days before the event day is "estimation-period". In estimating the values of the estimation period in the represented countries of this indices, when they had a national holiday on some regular trading day, for those days the value of specific index was represented same as the index value of the day before the national holiday.

It is customary to define the "event-period" to be larger than the specific period of interest to facilitate the examination of periods surrounding the event, hence capturing possible effects of insider trading before the event as well as the long-term effects of the event. Given the unfortunate fact that beginning of armed conflict cannot be foreseen, the analysis of the impact of the conflict between Russia and Ukraine on the various stock market indices from the date of the event and apart, employ "event window" of 31 days after the event. The reason for employing this "event window" is to assess how well and how quickly the market "digested" the news. It is possible that on some occasions initial worries and uncertainties might persist, thus keeping the market index down, while, on other occasions, uncertainties might be quickly alleviated through the release of new information, thus causing the market to recover. This event window includes 5 packages of sanctions adopted by EU over Russia. The timeline of EU restrictive measures (Europa.eu, 2022) over Russia is: first package adopted on February 23rd, second package adopted on February 25th, third package adopted on February 28th, fourth package adopted on March 15th and 5th package adopted on April 8th.

All the above stock market indices were transformed into daily returns in line with the following formula:

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

where R_{it} are, the daily index returns of the market index of country i, and P_{it} and P_{it-1} are the daily values of the market index of country i at time t and t-1, respectively.

The reaction to the announcement of a conflict is obtained by predicting a "normalized" return for each stock market index during the "event windows" and

then subtracting this return from the actual return, Ri,t, observed on the day of the event and on the days that followed the event. Therefore:

$$AR_{i,t} = R_{i,t} - \left(\alpha_i + \beta_i R_{m,t}\right) \quad (2)$$

where $AR_{i,t}$ = the abnormal (or excess) return of stock market index of country i at time t. The abnormal return on a distinct day within the event window represents the difference between the actual stock return $R_{i,t}$ on that day and the normal return, which is predicted based on two inputs; the typical relationship between the stock index return and its benchmark index (expressed by the α_i and β_i parameters), and the actual reference market's return $(R_{m,t})$.

"Event-day" abnormal returns are of interest to assess the immediate reaction of investors to the event. However, the cumulative abnormal returns (CAR) over the next days or weeks can provide a stronger indication of the market's resilience and ability to "bounce back". As such, once the time-series of abnormal returns has been established, it would also be interesting to test whether CAR are equal to zero over each of the "event windows". CAR can be estimated as follows:

$$CAR_{(t1,t2)} = \sum_{t=t1}^{t2} AR_{it} \quad (3)$$

where t1 and t2 the start and end of the "event window," respectively. Therefore, the null and alternative hypotheses are the following:

$$H_0: CAR = 0 \; vs. \; H_1: CAR \neq 0 \quad (4)$$

The relevant t-statistic is calculated as follows:

$$t - statistic = \frac{CAR_{(t1,t2)}}{\sigma^2_{(t1,t2)}} \quad (5)$$

where $\sigma^2_{(t1,t2)} = L\sigma^2(AR_t)$, $\sigma^2(AR_t)$ is the variance of the one-period average abnormal return over the "estimation window" and L are the number of days corresponding to each "event window," i.e., the CAR will have a higher variance the longer is L.

Effectively the question answered here is whether the CAR of each of the stock market indices included in this study, given the effect of the armed conflict, is significantly different than zero on the day of the event and during the various "event windows."

Results

Following the event study methodology, the Table 2 show the daily abnormal returns and statistical significance level for the event day and 10 days after the beginning of armed conflict between Russia and Ukraine. On the event day all indices experienced significant abnormal return. BELEX15 and SASX-10 indices at 0.05 significance level and SOFIX index at 0.1 significance level had positive abnormal return on the event day. From other side, CROBEX, MBI10, SBITOP and BIRS indices had negative abnormal return at significance level of 0.05. Reason why we want to show the results of event day and 10 days after the beginning of the conflict in the

event window that employ 31 days after the event, is, because most of the abnormal returns (3 days with AR for BELEX15, 7 days with AR for CROBEX, 3 days with AR for MBI10, 3 days with AR for SASX-10, 8 days with AR for SBITOP, 7 days with AR for SOFIX and 1 day with AR for BIRS) happened in the first 11 days since the beginning of the conflict between Russia and Ukraine. Results shows that, indices that represent EU member countries such as CROBEX for Croatia, SBITOP for Slovenia and SOFIX for Bulgaria have more abnormal returns and their volatility is stronger as a result of the conflict.

Table 2 Daily abnormal return and t-statistics of the indices

Abbreviation	Days										
	Event day	After the event									
		1	2	3	4	5	6	7	8	9	10
BELEX15	2.2%* (4.51)	-1.7%* (-3.63)	-0.2% (-0.41)	-0.3% (-0.6)	0.1% (0.23)	0.2% (0.36)	0.0% (-0.01)	0.9%* (1.97)	0.7% (1.36)	-0.6% (-1.24)	-0.5% (-0.98)
CROBEX	-3.6%* (-7.22)	1.4%* (2.78)	-1.4%* (-2.74)	-1.1%* (-2.16)	-0.1% (-0.14)	0.2% (0.46)	-1%* (-1.99)	-1%* (-2.09)	0.5% (1.04)	1.6%* (3.18)	-0.2% (-0.39)
MBI10	-6.2%* (-10.35)	2.7%* (4.55)	-0.2% (-0.33)	-0.2% (-0.4)	-0.1% (-0.22)	0.0% (0.06)	1.2%* (1.98)	0.6% (1.05)	-0.1% (-0.10)	-0.7% (-1.21)	-0.5% (-0.77)
SASX-10	2.3%* (2.3)	-3.5%* (-3.49)	MH	NH	-0.9% (-0.9)	-1.7%** (-1.7)	0.2% (0.17)	0.8% (0.79)	0.0% (0.01)	-0.2% (-0.17)	-0.3% (-0.25)
SBITOP	-1.7%* (-2.8)	1.2%** (1.9)	-5.1%* (-8.18)	2.2%* (3.48)	2.2%* (3.52)	0.8% (1.33)	-1.1%** (-1.74)	-2.4%* (-3.79)	-1.6%* (-2.53)	0.0% (-0.08)	0.9% (1.52)
SOFIX	1.2%** (1.7)	0.3% (0.4)	-1.3%** (-1.8)	-0.6% (-0.8)	NH	-0.3% (-0.3)	-1.3%** (-1.85)	-5.4%* (-7.68)	1.6%* (2.33)	4.2%* (6.04)	-1.2% (0.45)
BIRS	-3.8%* (-2.2)	-0.6% (-0.36)	-1.2% (-0.67)	-0.1% (-0.03)	-2.3% (-1.34)	0.3% (0.19)	-0.9% (-0.51)	0.1% (0.03)	2.7% (1.55)	0.8% (0.45)	-0.8% (-0.45)

Note: t-statistics are in parenthesis; * statistically significant at the 0.05 level; ** statistically significant at the 0.1 level; MH - Market Holiday; NH - National Holiday.
Source: Authors' calculations.

Table 3 Cumulative abnormal return (CAR) and t-statistics of the indices

Abbreviation	Cumulative abnormal returns (CAR)					
	(-1, 0, 1)	(0, 2)	(0, 5)	(0, 10)	(0, 15)	(0, 31)
BELEX15	- 0.01% (-0.01)	0.2% (0.25)	0.2% (0.17)	0.74% (0.42)	-3.49%** (-1.66)	-1.51% (-0.5)
CROBEX	-0.8% (-0.87)	-3.58%* (-3.77)	-4.5%* (-3.35)	-4.63%* (-2.54)	-2.82% (-0.36)	-1.12% (-0.36)
MBI10	-3.37%* (-3.29)	-3.67%* (-3.58)	-4.02%* (-2.77)	-3.44%** (-1.75)	-1.56% (-0.66)	-1.63% (-0.48)
SASX-10[1]	-0.77% (-0.54)	-1.18% (-1.02)	-3.79%* (-2.31)	-3.24% (-1.32)	-6.13%* (-2.00)	-8.28%** (-1.84)
SBITOP	-1.93%** (-1.71)	-5.63%* (-4.98)	-0.45% (-0.28)	-4.57%* (-2.11)	-1.92% (-0.76)	-0.79% (-0.21)
SOFIX[2]	0.5% (0.51)	0.2% (0.17)	-2.42% (-1.52)	-2.04% (-0.95)	-0.16% (-0.06)	-0.8% (0.22)
BIRS	-4.98%* (-2.22)	-5.6%* (-2.52)	-7.7%* (-2.43)	-5.85% (-1.36)	-6.6% (-1.28)	-7.05% (-0.96)

Note: t-statistics are in parenthesis; * statistically significant at the 0.05 level; ** statistically significant at the 0.1 level; [1] Estimation of CAR's (0,5), (0,10), (0,15) and (0, 31) for SASX-10 is with -2 days in each estimation; [2] Estimation of CAR's (0,5), (0,10), (0,15) and (0, 31) for SOFIX is with -1 day in each estimation.
Source: Authors' calculations.

While the event day and other daily AR's shows immediate investor reaction to unexpected military attacks, the cumulative abnormal return (CAR) provide a stronger indication of the capital market resilience to bounce back from the military attacks. Table 3 show 6 different combinations of Cumulative abnormal returns

(CAR) in the event period of 31 days after the event, the day of the event and day before the event. Results of different CAR's show following:

- CAR (-1, 0, 1) shows that MBI10, BIRS and SBITOP indices have significant CAR's in this period.
- Most of the indices (CROBEX, MBI10, SBITOP, BIRS) have significant CAR's (0, 2) in the first three days of the invasion and first 6 days - CAR's (0, 5) of invasion (CROBEX, MBI10, SASX-10 and BIRS).
- Extension of the period in calculating CAR lead to less significant CAR's among the indices. CROBEX, MBI10 and SBITOP has significant CAR's (0,10), Belex15 and SASX-10 has significant CAR's (0,15) and SASX-10 has significant CAR (0, 31).

Applied combinations of Cumulative abnormal returns shows that MBI10, SBITOP and CROBEX indices have siginificant CAR's that are consisting AR of trading days that are immediately after the beginning of the event, but as we extend the period for calculating CAR, the Belex15 and SASX-10 indices shows significant CAR's. It's important to point out that SOFIX index does not show any significant CAR.

Discussion

Comparing the AR's and CAR's between the indices lead to interesting conclusions. Countries like Serbia and Bulgaria that have closer political, historical and economic relations with Russian federation, their stock indices (BELEX15 and SOFIX) experienced positive abnormal returns at the beginning of invasion and they don't have significant CAR's (except CAR (0,15) for BELEX15). From other side, stock indices that represent Croatia, Slovenia, North Macedonia and Bosnia and Herzegovina experienced very significant abnormal returns and CAR's in the analyzed period.

It's important to relate the results of the event window with the restrictive measures adopted by EU countries against aggression of Russia over Ukraine. After the adoption of the 1st package and 3rd package of restrictions, a negative AR's of the stock indices in case of Croatia and Slovenia as EU members are calculated and after the 2nd package and the 4th package of restrictions a positive AR's of the stock indices in this countries are calculated. In case of Bulgaria as EU member country, only after the adoption of the 3rd package of restrictive measures negative AR follows. The adoption of 3rd package of restrictive measures characterizes with negative AR's in the EU countries covered with this research, because this package covers strict measures such as suspension of airline transportation between EU and Russia, SWIFT ban for Russian banks, ban on transactions with Russian central bank and those measures constrain the economic activities between EU members and Russia.

Conclusion

Russian invasion in Ukraine caused an unexpected shock for stock markets and investors. In fact, it is known that the markets hardly predict the armed conflicts and as soon as this events happened, investors are always surprised. This might be result because of the perception of the most investors as rational people, focused on economics and finance, people who know that the conflict is not good for the economy.

The beginning of the armed conflict in late February brought a very strong significant downward correction of stock indices values in pro-western countries such as Croatia, North Macedonia and Slovenia. Countries that maintain close historical, political and economic relations with Russian Federation such as Serbia and Bulgaria, have been less negatively affected by analyzing their stock indices. Even restrictions

adopted by the EU countries during the "event window" have similar influence among this group of countries. It can be concluded that risk perception of armed conflict among investors can be differently evaluated if we analyze countries separately.

From economic perspective, armed conflict primarily mean uncertainty and most projections and perceptions become negative. What is obvious according to the results of this study is that stock markets are becoming maximum oscillatory, that the market sentiment is unstable and subjected to light and rapid changes on a daily level and that the whole environment is extremely fragile. On other hand, these conditions caused by the conflict between Russia and Ukraine just followed the previous uncertainty caused by the COVID-19 virus, inflation, interest rates, supply chain issues, energy challenges and this happens after the extraordinary long bull market, high market values of securities and multi-year monetary expansion and state interventionism. Overall, we are in an extremely turbulent and unpredictable period, both for economies, as well as listed companies traded on the stock exchanges.

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