FORCE MAJEURE EVENTS AND STOCK MARKET REACTIONS IN UKRAINE

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This paper examines reactions in the Ukrainian stock market to force majeure events, which are divided into four groups: economic force majeure, social force majeure and terrorist acts, natural and technological disasters. More specifically, using daily data for the main Ukrainian stock market index (namely PFTS) over the period 01.01.1997-31.12.2018 this study investigates whether or not force majeure events create (temporary) inefficiencies and there exist profitable trading strategies based on exploiting them. For this purpose cumulative abnormal returns and trading simulation approaches are used in addition to Student's t-tests. The results suggest that the Ukrainian stock market absorbs new information rather fast. Negative returns in most cases are observed only on the day of the event. The only exception is technological disasters, the market needing up to ten days to react fully in this case. Despite the presence of

announcements through timeliness of reporting disclosure (Chambers and Penman, 1984).

Force majeure events are unexpected and therefore cannot be incorporated into asset prices in advance. As a result, they could create conditions for obtaining abnormal profits until the new information has been completely absorbed by market participants. In addition to the

Additional studies considered the impact of various force majeure events. Hanabusa (2010) showed that the 9/11 terrorist attacks had a significant effect on the stock prices of Japanese companies, whilst the Iraq War and Hurricane Katrina did not. Baker and Bloom (2013) used a panel including stock prices and volatilities for 60 countries over the period 1970-2012 to investigate the impact of natural disasters, terrorist attacks and unexpected political shocks on economic growth through stock market proxies. Tavor and Teitler-Regev (2019) examined 344 significant effects of natural disasters, artificial disasters and terrorism on the stock market using the Pessimism Index. Karolyi and Martell (2010) compared stock market reactions to 77 terrorist attacks with those to extreme events such as financial crashes (4) and natural catastrophes (19). Below we also consider a variety of unexpected force majeure events to assess their impact on the Ukrainian stock market in particular.

3. Data and Methodology

The Ukrainian stock market index, namely the PFTS, is used for the empirical analysis. The sample period goes from 01.01.1997 to 31.12.2018. The frequency is daily. As already mentioned, force majeure events are divided into four categories: economic, technological and natural disasters, terrorist acts in Ukraine during 1997-2018. A full list of force majeure events and their description is provided in Appendices A-D.

The following hypotheses are then tested:

- Hypothesis 1 (H1) – force majeure events create temporary inefficiencies in the Ukrainian stock market.
- Hypothesis 2 (H2) – trading strategies based on force majeure events can generate abnormal profits.

To test them we use the following methods:

A cumulative abnormal returns approach;

Student’s t-tests;

A trading simulation approach.

The cumulative abnormal returns approach is based on MacKinlay (1997) and is standard for event studies. Abnormal returns are defined as follows:

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These abnormal returns are cumulated over 1, 2,

sample consists of the trading results based on Hypothesis 2, and the second one of random trading results.

The null hypothesis (H0) is that the mean is the same in both samples, and the alternative (H1) that it is not. The computed values of the t-test are compared with the critical one at the 5% significance level. Failure to reject H0 implies that there are no advantages from exploiting the trading strategy being considered, whilst a rejection suggests that the adopted strategy can generate abnormal profits.

It should be mentioned that the trading simulation approach used in this paper does not incorporate transaction costs (spread, fees to the broker or bank, swaps etc.).

4. Empirical Results

Descriptive statistics for the PFST returns over the period of analysis are provided in Table 1. The series is rather volatile, as indicated by the size of standard deviation and minimum/maximum values; its mean return is consistent with random walk behaviour.

Table 1: Descriptive statistics for the PFST returns over the period 1997-2018

Number of observations	5226
Mean	0.000519
Median	0.000552
Sum	2.710888
Minimum	-0.159017
Maximum	0.276746
Variance	0.000385
Std.Dev.	0.019609
Standard Error	0.000271
Skewness	0.569882
Kurtosis	19.28168

First we calculate the cumulative abnormal returns in the case of economic force majeure events; the results are reported in Table 2.

Table 2: Cumulative abnormal returns for the PFST index over the period 1997-2018: economic force majeure events

Parameter/ Period α	1	2	3	5	10
Mean abnormal return across force majeure					

observations from	₀ to day	.			
Average cumulative abnormal return across event observations from	₀ to day	.	-0.59%	0.64%	

Table 4: Trading simulation results for the PFST returns over the period 1997-2018: economic force majeure events, α =1

Number of trades, units	Number of successful trades, unit	Number of successful trades, %	Profit, %	Profit % per trade
8	4	50.0%	4.3%	0.5%

As can be seen, the percentage of successful trades is 50% and profit per trade are close to the average return for the full sample, which suggests that these results do not differ from the random ones. As a further check a t-test is carried out (see Table 5), which again leads to the same conclusion. Therefore there is no evidence of abnormal profits based on exploiting the occurrence of economic force majeure events.

Table 5: t-test for evaluating the success of the trading strategy: PFST returns over the period 1997-2018, economic force majeure, α =1

Parameter	Value
Number of the trades	8
Total profit	4.32%
Average profit per trade	0.54%
Standard deviation	1.25%
t-test	1.22
t critical (0,95)	1.78
Null hypothesis	not rejected

The results of the cumulative abnormal returns approach for the case of social force majeure and terrorist acts in Ukraine during 1991-2018 are presented in Table 6.

Table 6: Cumulative abnormal returns for the PFST returns over the period 1991-2018: social force majeure and terrorist acts

Parameter/ Period α	1	2	3	5	10
Mean abnormal return across force majeure event on day vent o					

The results are very similar to those for the economic force majeure events: negative returns are observed only on the day of event (not for any other time horizon). The t-test results are presented in Table 7.

Table 7: t-test for the PFST returns over the period 1991-2018: social force majeure and terrorist acts

Parameter/Period α	1	2	3	5	10
Mean return across force majeure event on day α	-0.73%	0.05%	0.83%	0.71%	0.59%
Standard deviation of returns across force majeure event on day α	1.99%	2.49%	3.49%	3.04%	2.93%
Mean return for the whole data set	0.05%	0.05%	0.05%	0.05%	0.05%
Standard deviation of returns for the whole data set	1.96%	1.96%	1.96%	1.96%	1.96%

The size of the data set across
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Table 9: t-test for evaluating the success of the trading strategy: PFST returns over the period 1991-2018, social force majeure and terrorist acts, period $\alpha = 1$

Table 17: t-

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Appendix A

Table A.1: The main economic force majeure

Appendix B

Table B.1: The main social, military and political force majeure events and terrorist acts in Ukraine during 1991-2018

Force majeure	Description	Date
"Orange Revolution", Kyiv, etc. regional centers	Because of numerous falsifications in the second round of elections, an all-Ukrainian protest rally began, which resulted in a significant change in the political vector in the country.	22.11.2004
"Revolution of dignity", Kyiv, etc. regional centers	As a result of the failure of signing the Association Agreement with the EU, the rejection of the policy of the government began mass protests	21.11.2013
Power breaking of EuroMaydan, Kyiv	Because of illegal actions of power units, in particular, "Berkut" on cleaning the Independence Square from protesters, 79 people were injured.	30.11.2013
"Bloody Thursday", Kyiv	As a result of the confrontation of power units and protesters, 105 people were killed (as of April 10, 2014), 1,500 people were injured, hundreds were declared as missing	20.02.2014
Crimean annexation	Because	

Appendix C

Table C.1: The main natural disasters in Ukraine during 1991-2018

Force majeure	Description	Date
Flood in Transcarpathian region in 1998	Due to the heavy rains of the Tisza, Borzhava, Latoritsa and others, rivers came out of the coast and flooded 120 settlements. 350 thousand people were recognized as flood victims, 17 people died, 20 thousand people were resettled, 40793 were flooded, the amount of losses exceeded 820 million UAH. On November 7, 1998 the territory of the oblast was declared a zone of emergency ecological situation	3-5.11.1998
Flood in the Precarpathians, Carpathians, Transcarpathia	Due to heavy rains on July 31, 2008, territories of 6 western regions were declared as zones of emergency ecological situation, rivers Prut, Dniester and others. left the banks. 30 people died, 40,601 dwelling houses flooded, the amount of losses is more than 4 billion UAH.	28.07.2008
Flood in Transcarpathian region in 2017	Due to heavy rains and snow, the level of water on the rivers of Transcarpathia exceeded the level during the 1998 flood, 1023 households were flooded, 1 person died, 146 people evacuated	13-18.12.2017
Anomalous heat in Ukraine	As a result of the action of the anticyclone, the climatic indicators of a number of areas in the number of days with a maximum temperature of 0.48 82.8	

Appendix D

Table D.1: The main technological disasters in Ukraine during 1991-2018

	23 people were killed, 20 were injured	
Accident at the mine named after Zasyadko, Donetsk	As a result of the explosion of air-methane mixture on the horizon of 1078, 100 people died	18.11.2007
Explosions of shells in the warehouses of the military part of 0829, 61st Arsenal of the Southern Operational Command of the Army, and fire at the gas distribution station of Lozova, Kharkiv region.	Because of explosions evacuated people in	