IMPACT OF COVID-19 ON THE ROMANIAN CAPITAL MARKET: AN ASSESSMENT OF BET INDEX AND SHARES BRD, SNP, TLV, FP & SNP

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Abstract

This article studies the response of the Romanian stock market to the COVID-19 pandemic. The research approaches daily data on the number of new confirmed cases, respectively deaths caused by COVID-19 and the returns of the BET index and the share of BRD, FP, SNP and TLV, for the period 16 March 2020-30 September 2020. The empirical results confirm that the BET index and the shares listed on the Bucharest Stock Exchange responded negatively to the increase in the number of new cases, respectively COVID-19 deaths. Thus, the profitability decreased with the increase of the number of new cases, respectively deaths. Moreover, it is found that the Romanian capital market reacted more strongly to the increase in the number of deaths compared to the increase in the number of new cases. The study also suggests that the negative market reaction was strong in the first days of confirmed cases. The empirical results of the study indicate that stock market indices, respectively shares traded on the Bucharest Stock Exchange, respond quickly to COVID-19 and the reaction varies over time, depending on the stage of the pandemic.

Keywords: COVID-19, BVB, ARDL, Granger

JEL classification: C52, C61, G1, I10

Introduction

The analysis aims to establish links on the stock markets during the COVID-19 pandemic. To explore the relationships, daily data from March 16, 2020 to September 30, 2020 were used for the following markets: Italy, China, USA and Romania. The ARDL (Autoregressive Distributed Lag) model was approached, which allowed the study of cointegration between variables, the presence of short-term or long-term causal relationships.

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The empirical results of the ARDL model and the Granger causality test confirmed both the presence of a long-term and short-term relationship between the Romanian capital market and the COVID-19 variables.

The outbreak of coronavirus (COVID-19) occurred in December 2019 in China, in the city of Wuhan. According to the latest statistics, China is the second largest economy in the world in terms of nominal GDP, with an average growth rate of 6% in the last 30 years. In 2019, China's GDP was $ 14.3 trillion, representing over 20% of the world economy. China is classified as the largest producer and largest exporter of goods. It is also the fastest growing consumer market and the second largest importer of goods. China plays a prominent role in international trade and is involved in trade organizations and treaties.

Developments in capital markets are quite difficult to predict in the current context. Comparison with other financial crises in the past is not feasible, but it can work up to a point, very limited, if we refer only to the financial losses generated by the coronavirus. The only certainty at this moment, but also a priority, is the one related to prevention and protection against adverse developments. In times of uncertainty, the volatility of markets increases and at the same time the contagion between them, so that the correlation between markets is much closer.

Following the outbreak of COVID-19, there have been numerous disruptions to economic activity leading to declining production and consumption. Some economic sectors were more affected, such as tourism, industry and transport. According to Bloomberg, car sales fell in China by 20% in January 2020. China said it would take steps to stabilize the economy by controlling the virus and offering measures such as cuts in domestic taxes.

It is considered opportune to specify two economic phenomena, interest rates which are much lower than in the 2008 scenarios, the result being that of exaggerated stimulation of economic growth, globalization and integration of trade flows which is much higher now than 10-20 years ago. Any disruption can disrupt the global economy with a much greater impact.

Stock indices, both local and international, registered negative evolutions throughout 2020. The first quarter of 2020 was an extremely difficult period for investors, and stock indices representative for the countries studied in the analysis, China, Italy, USA and Romania marked the highest losses (Italy FTSE MIB: -27.7%, Romania BET: -23.6%, USA DJI: -23.2% and China HSI: -16.3%), compared to the third quarter 2020 where there is a recovery (FTSE MIB: -19%, BET: -9.7%, DJI: -2.7% and HSI: -16.8%).

This led to China's financial markets being closed until 9 February 2020. In the period since the beginning of February, Asian financial markets continued to decline, although they were no longer significant. US and European stock markets reacted less.

The negative impact of the COVID-19 virus on economic activities has led to a decrease in the price of oil, given that there is a higher supply than demand. Following the extraordinary meeting of OPEC members on 4-6 February 2020, it was decided to extend the voluntary production adjustments until the end of 2020 and to make an additional adjustment until the end of the second quarter of 2020.

The rest of the paper is organized as follows: section 1 presents the literature, section 2 presents the data used in the analysis and empirical methodology. Section 3 presents the empirical results. Finally, contain conclusions in section 4.

1. Literature review

Fallahgoul (2020) studies investors' beliefs, feelings and disagreements about stock market returns during the COVID-19 pandemic using a large number of investor messages - about 3.7 million messages - on a social media investment platform, Stock-Twits. It is found that the feeling/disagreement has a sudden decrease/increase in all investors with any investment experience between February 19, 2020 and March 23, 2020, where a market with a maximum history was followed by a record decline. Surprisingly, these measures have a sudden reversal towards the end of March. However, the performance of these measures in different sectors is heterogeneous. The financial and healthcare sectors are the most pessimistic and optimistic, respectively.

Albulescu (2020) tests the impact of official COVID-19 announcements and related figures on financial volatility, comparing the effect of data reported in China with that of COVID-19 data reported outside China. Empirical results show that only new cases reported outside China have a positive impact on the VIX index; the death rate has a significant and positive impact on the VIX index for all models tested, and the effect is stronger for the death rate outside China; the spread of coronavirus increases financial volatility. The persistence of COVID-19 could generate a new episode of international financial stress.

The rapid spread of the COVID-19 pandemic generates volatility in the financial and commodity markets, as well as in the real economy. The depth of the new economic crisis will depend on the policy response to the coronavirus crisis. Albulescu (2020) investigates how the official numbers COVID-19, new cases of infection and death rate, affect the UPR (Economic Policy Uncertainty), the uncertainty of economic policy in the US. Empirical results show that global COVID-19 numbers do not have a significant impact on US UPR. When assessing the situation outside China, a positive influence of COVID-19 variables on US UPR is identified.

The new coronavirus has generated significant volatility in financial markets, including the commodity market. Oil prices have fallen the most since 1991. Albulescu (2020) studies how the variables COVID-19, in terms of daily announcements of new cases of infection, have influenced international oil prices. The ARDL estimate showed a negative and significant impact of the coronavirus crisis, but relatively small compared to the effect of financial volatility and economic policy uncertainty on oil prices. The impact of COVID-19 on oil prices is indirect, primarily affecting financial market volatility.

Zhang et al. (2020) performs a statistical analysis of the impact of the COVID-19 pandemic on the risk of stock markets. The virus has killed thousands and brought significant challenges to countries around the world. The results show that the risks of the global financial market increase substantially in response to the pandemic. The individual reactions of the stock market are clearly related to the severity of the outbreak in each country. The high uncertainty of the pandemic and economic losses

has made markets extremely volatile and unpredictable. Political reactions are needed to fight the virus; however, unconventional policy interventions, such as QE (Quantitative Easing) in the US, create additional uncertainty and can cause long-term problems. In addition, countries do not work together to meet these challenges, as the markets of the group of countries studied here respond differently to national policies and the overall development of the pandemic. Finally, this tendency to disintegrate in the global community is more of a threat than a virus.

Akhtaruzzaman et al. (2020) examines how the financial contagion occurs through financial and non-financial firms between China and the G7 countries. Empirical results show that the dynamic conditional correlations (DCC) between the profitability of Chinese financial stocks and the financial and non-financial G7 increased significantly during COVID-19. However, the extent of DCC growth has been greater for financial firms, implying that they play a more important role in transmitting the financial contagion than non-financial firms. The results show that China and Japan appear to be transmitters of the contagion during COVID - 19. Therefore, the role of Chinese and Japanese financial and non-financial firms in transmitting shocks to G7 markets may be of interest to decision makers, regulators, practitioners and other market participants. Optimal hedging ratios increased significantly in most cases during the COVID-19 period, implying higher hedging costs during the crisis.

Pavlyshenko (2020) studies different regression approaches for modeling the spread of COVID-19 and its impact on the stock market. The logistic curve model was used with Bayesian regression for predictive analysis of coronavirus spread. The impact of COVID-19 was studied using regressions compared to other crisis influences. Empirical results show that different crises with different motives have a distinct impact on the same actions.

Cardona-Arenas and Serna-Gómez (2020) study the effect of COVID-19 on the exchange rate in Colombia between February 16 and March 14, 2020, using a VAR model. The fact that the depreciation of the Colombian peso against the dollar is explained by a mixed effect between the effects generated by COVID-19 and the decrease in oil prices, with a greater explanatory influence coming from the variation of COVID-19 than oil prices.

Mzoughi et al (2020) examine the impact of the COVID-19 pandemic on oil prices, CO2 emissions and stock market volatility between 22 January 2020 and 30 March 2020, using a VAR. Empirical results show that although the growing number of COVID-19 infections is causing oil prices to fall, it is short-lived. The effects of COVID-19 also have a stronger impact on equity market volatility than on oil prices and CO2 emissions.

Topcua and Gulalb (2020) examine the impact of COVID-19 on emerging stock markets between March 10 and April 30, 2020. The study addresses a division of the period into three sub-periods: (i) March 10-31, (ii) March 10 - April 10 and (iii) March 10 - April 17, to understand the changing impact of the pandemic over time. Empirical results show that the negative impact of the outbreak on emerging stock markets gradually decreased and began to decline by mid-April. When countries are considered in terms of regions, Asian emerging markets are hardest hit, while in Europe the impact is modest. In addition, the impact of COVID-19 is found to be relatively

smaller in emerging markets, where governments have taken the necessary action in a timely manner and announced larger incentive packages.

He et al. (2020) studies the direct and indirect effects of COVID-19 on the stock markets of the People's Republic of China, Italy, South Korea, France, Spain, Germany, Japan and the USA and used conventional t and non-parametric Mann - Whitney tests. Empirical results show that COVID-19 has a negative but short-term impact on the stock markets of the affected countries and that the impact of COVID-19 on stock markets has two-way dispersal effects between Asian and European and American countries. However, there is no evidence that COVID-19 adversely affects the stock markets of these countries more than the global average.

Liu et al. (2020) assesses the short-term impact of the COVID-19 outbreak on 21 stock market indices in the main affected countries, including Japan, Korea, Singapore, USA, Germany, Italy, UK, etc. The consequences of infectious diseases are considerable and have directly affected stock markets around the world. The method of studying the events was approached, and the empirical results suggest that the COVID-19 outbreak has a significant negative effect on the profitability of the stock market in all affected countries and areas. Stock markets in Asian countries react more quickly to the outbreak, some of them recovering easily in the later stage of the pandemic. The cases confirmed by COVID-19 have significant adverse effects on the major performance of stock indices, with those in Asia suffering a greater decline in abnormal returns. The investor's feeling of fear turns out to be a transmission channel for the effect of the COVID-19 outbreak on the stock markets.

Eleftheriou and Patsoulis (2020) investigate the impact of government social distancing measures against the new disease, COVID-19, on 45 major stock market indices. The results indicate that stock market returns and the intensity of blocking measures are negatively linked. In particular, an increase in the intensity of COVID-19 non-pharmaceutical interventions in a given country leads to a decrease in the profitability of the stock market of the same country.

Ibrahim (2020) analyzes the impact of the new coronavirus (COVID-19) on stock market volatility for the main G7 stock market indices, using the GARCH (Generalized AutoRegressive Conditional Heteroskedasticity) and GJR-GARCH (Glosten-Jagannathan-Runkle GARCH) models. In addition, the results of the regression analysis show that the dummy variable COVID-19, the number of daily new cases and the growth rate of new daily cases have a significant positive impact on the volatility of the G7 stock market. Finally, the GARCH and GJR-GARCH models reveal that the COVID-19 coefficients have a significant positive impact on the conditional variance for all stock market indices studied, indicating that COVID-19 has led to increased market volatility.

2. Methodology and database

Data were used daily from March 16, 2020 to September 30, 2020 for the following markets: United States of America (USA), Italy (IT), China (CH) and Romania (RO). The selected variables are presented in Table no.1.

Table no. 1. Description of variables

Variables	Description	Source
Variables related to the COVID-19 pandemic outbreak		
CH_NEW_CASES	Number of new cases due to COVID-19 in China	Our World in Data
CH_NEW_DEATHS	Number of new deaths due to COVID-19 in China	Our World in Data
IT_NEW_CASES	Number of new cases due to COVID-19 in Italy	Our World in Data
IT_NEW_DEATHS	Number of new deaths due to COVID-19 in Italy	Our World in Data
US_NEW_CASES	Number of new cases due to COVID-19 in the USA	Our World in Data
US_NEW_DEATHS	Number of new deaths due to COVID-19 in the USA	Our World in Data
Variables on stock market returns		
BET	Daily percentage change - BET reference stock market index of BSE (Bucharest Stock Exchange)	www.investing.com
FP	Daily percentage change - FP (Fondul Proprietatea) share traded on BSE	www.investing.com
SNP	Daily percentage change - SNP (OMV Petrom) share traded on BSE	www.investing.com
BRD	Daily percentage change - BRD share (BRD Groupe Société Générale) traded on BSE	www.investing.com
TLV	Daily percentage change - TLV (Banca Transilvania) share traded on BSE	www.investing.com

Source: own calculations

A wide range of variables have been selected to achieve the goal, such as: stock market indices, the most traded shares on BVB, the new number of COVID-19 cases, the new number of COVID-19 deaths in China, USA and Italy.

Logarithmic profitability was used, the formula used:

$$R_t = \left(\frac{\ln(P_t)}{\ln(P_{t-1})}\right) \quad (1)$$

where P_t is the value of the stock market index at time t.

The Dickey-Fuller Unit Root Test (ADF) will be used to verify non-stationary variables. The null hypothesis assumes that the variable has a unitary root and is not stationary. The ADF test involves estimating the equation as:

$$\Delta a_t = \alpha + \beta t + q a_t + \sum_{j=1}^{k} \gamma_j \Delta a_{t-j} + \varepsilon_t, \text{ t=1,…,T}$$

(2)

where t represents the time trend, T = sample length and k is the length of the gap in the dependent variable.

Because both stationary and non-stationary variables are found in the study, the ARDL approach will help in the present research. Therefore, the autoregressive distributed lag model (ARDL) and the limit testing methodology are used by researchers due to its permissibility to use a mixture of variables I (0) and I (1). So an ARDL (p, q_1,…, q_k) is a regression that contains shifts of the dependent (p) and explanatory variables (q_1,…, q_k).

We have an ARDL model (p, q) that can be written as:

$$W_t = \mu + \beta_0 Z_t + \beta_1 Z_{t-1} + \cdots + \beta_{q0} Z_{t-q} + \delta_1 W_{t-1} + \cdots + \delta_p W_{t-p} + u_t$$

(3)

The Granger causality test can be applied to analyze causality between variables. The null hypothesis is that m does not cause Granger on n and that n does not cause Granger on m. The following bivariate regressions are given:

$$n_t = \alpha_0 + \alpha_1 n_{t-1} + \cdots + \alpha_p n_{t-p} + \beta_1 m_{t-1} + \cdots + \beta_p m_{-p} + \epsilon_t$$

(4)

$$m_t = \alpha_0 + \alpha_1 m_{t-1} + \cdots + \alpha_p m_{t-p} + \beta_1 n_{t-1} + \cdots + \beta_p n_{-p} + u_t$$

(5)

According to Granger CWJ (1969) a definition of Granger causality, in the case of two variables m and n: m causes Granger n if n can be better estimated using both the historical series of m and n than using the historical series of n.

In exploring stock market bonds during the COVID-19 pandemic outbreak, the autoregressive distributed lag model (ARDL) will be used, as well as the Granger causality test

3. Empirical results

The descriptive statistics of the variables are presented in table no.2. The role of the Skewness indicator is to measure the asymmetry of the density distribution function. A positive value of Skewness shows that the distribution has a long tail on the right side, respectively for a negative value it will be on the left side. The positive values of the Skewness indicator are recorded by the variables COVID-19, and the BET index and the shares traded on BVB indicate a distribution with asymmetry to the right.

The most interesting feature is kurtosis, which measures the size of the extremes. A kurtosis greater than 3 suggests that the returns of the indices show "heavy tails" than the normal distribution. That is, the probability of extreme returns is higher than the probability that they are below the normal distribution. This feature is called leptokurtic or simply "heavy tails". A positive skewness indicates an asymmetric distribution on the right and a negative skewness on the left. For series with a normal

distribution, kurtosis takes the value 3, for a value less than 3 the distribution is flatter than the normal one (platikurtic) and for k greater than 3 the distribution is leptokurtic. In the present case, all the variables studied (except US_NEW_CASES) record values of kurtosis greater than 3, have a leptokurtic distribution, with several values centered on the tail "heavy tails", which means high probabilities for extreme values.

Table no. 2. Descriptive statistics of variables

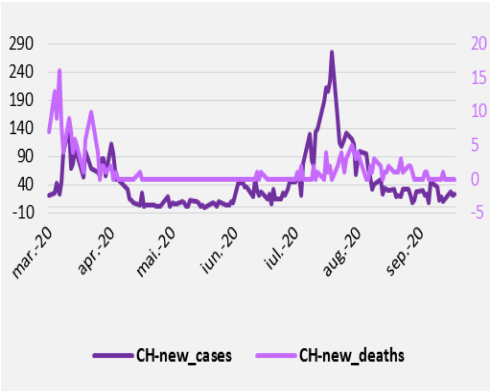
	Mean	**Std. Dev.**	**Skewness**	**Kurtosis**	**Jarque-Bera**	**Probability**
BET	0.001	0.017	-1.289	13.007	609.607	0
BRD	0	0.022	-0.669	5.493	45.692	0
CH_NEW_CASES	47.073	50.868	1.88	6.961	170.279	0
CH_NEW_DEATHS	1.401	2.625	2.874	12.705	726.235	0
IT_NEW_CASES	1354.642	1453.655	1.473	4.269	58.739	0
IT_NEW_DEATHS	155.161	224.532	1.475	3.877	54.067	0
SNP	0.001	0.021	-0.757	6.465	81.605	0
TLV	0.001	0.025	-0.755	4.984	35.498	0
US_NEW_CASES	35515.82	17267.22	0.153	2.495	1.988	0.37
US_NEW_DEATHS	1007.08	646.875	1.087	5.233	55.432	0
FP	0	0.029	-0.184	20.296	1708.368	0

Source:own calculations

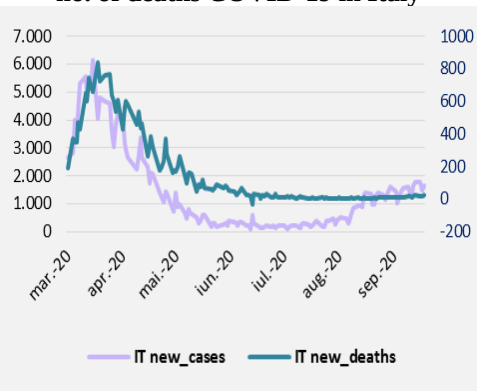
The Jarque-Bera test provides information about the normal distribution of variables. Table 2 also shows the results of the Jarque-Bera test, which indicates that the distribution of variables is not normally distributed, because the probability associated with it is 0, except for the US_NEW_CASES data series which has a normal distribution.

Figure no. 1 shows the evolution of the number of new cases due to COVID-19, as well as the progress of the number of new deaths due to COVID-19. It is observed that the USA records the highest figures both in terms of new cases and the number of new deaths reported. Italy ranks second, with the number of new deaths being slightly lower than in the US. Although the epicenter of the COVID-19 pandemic began in China, it is observed that the number of sick and dead is significantly lower than in the USA and Italy.

Evolutions no. of new cases of COVID-19 vs. no. of COVID-19 deaths in China



Evolutions no. of new cases COVID-19 vs no. of deaths COVID-19 in Italy



Evolutions no. of new cases COVID-19 vs no. of deaths COVID-19 in US

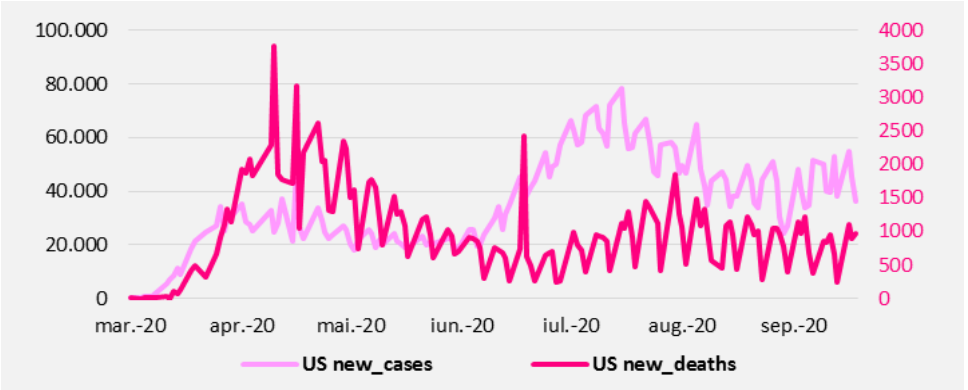


Figure no. 1 Evolutions no. new cases COVID-19 vs no. COVID-19 deaths
Source: Our World in Data, own processing

Figure no. 2 shows the evolution of the BET index, as well as of the most traded shares from BVB in the period explored. Significant volatility is consolidating, especially for Fondul Proprietatea during March 2020. International stock markets reacted violently, with the highest volatility being observed in March, when all the world's economies began to impose restrictions on the spread of the virus, these negatively impacting the evolutions of the stock market indices from global level, being also influenced by the feeling of fear of the investors.

In the first part of 2020, the Bucharest Stock Exchange, represented by the BET index (-13.21%) registered among the lowest decreases compared to other emerging markets in the area (eg Poland WIG: -14.25 %, Hungary BUX: -22.27% and Greece ASE: -30.30%) and even with some developed markets (France CAC40: -17.43%, United Kingdom FTSE100: -18.20% and USA DJIA: -9.55%).

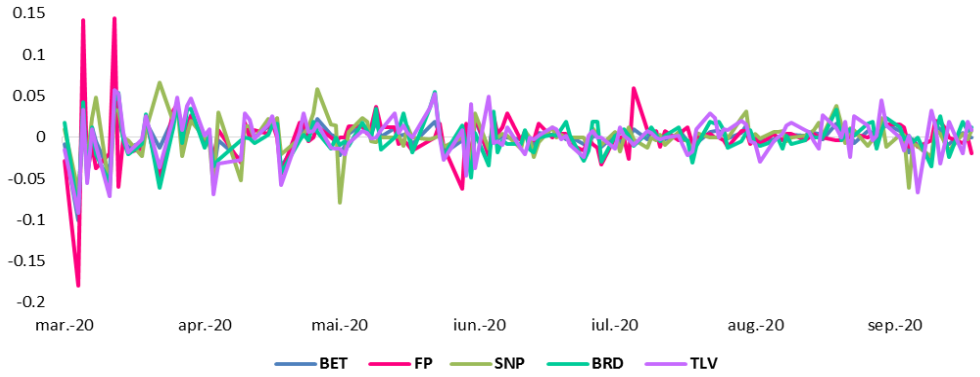


Figure no.2. Evolution of the profitability of BSE indices
Source: Investing, own processing

Table no.3 reveals the correlations between the variables. There are high negative correlations between the number of new cases and new deaths due to COVID-19 and the BET index, respectively the four selected shares. In the case of the BET stock index, it has strong negative correlations with the number of COVID-19 deaths in China and with the number of new cases and deaths due to COVID-19 in Italy. FP and TLV shares are strongly positively correlated with the number of new COVID-19 cases and deaths in Italy, and the SNP is strongly correlated with the number of COVID-19 deaths in Italy and China. Of the four shares, BRD has significantly lower correlations with COVID-19 specific variables.

Table no. 3. Correlation matrix.

		1	2	3	4	5	6	7	8	9	10	11
1	**BET**	1	0.67	0.87	0.82	0.93	-0.19	-0.58	-0.69	-0.81	0.47	0.03
2	**BRD**	0.67	1	0.57	0.45	0.72	-0.17	-0.22	-0.18	-0.37	0.09	-0.13
3	**FP**	0.87	0.57	1	0.57	0.77	-0.05	-0.47	-0.62	-0.76	0.49	-0.05
4	**SNP**	0.82	0.45	0.57	1	0.73	-0.42	-0.57	-0.47	-0.53	0.17	0.2
5	**TLV**	0.93	0.72	0.77	0.73	1	-0.16	-0.43	-0.52	-0.73	0.46	-0.03
6	**CH_NEW_CASES**	-0.19	-0.17	-0.05	**-0.42**	-0.16	1	0.25	0.07	0.05	0.45	-0.14
7	**CH_NEW_DEATHS**	**-0.58**	-0.22	**-0.47**	**-0.57**	**-0.43**	0.25	1	0.54	0.4	-0.33	-0.4
8	**IT_NEW_CASES**	**-0.69**	-0.18	**-0.62**	**-0.47**	**-0.52**	0.07	0.54	1	0.88	-0.54	-0.15
9	**IT_NEW_DEATHS**	**-0.81**	-0.37	**-0.76**	**-0.53**	**-0.73**	0.05	0.4	0.88	1	-0.55	0.05
10	**US_NEW_CASES**	0.47	0.09	0.49	0.17	0.46	0.45	-0.33	-0.54	-0.55	1	0.1
11	**US_NEW_DEATHS**	0.03	-0.13	-0.05	0.2	-0.03	-0.14	-0.4	-0.15	0.05	0.1	1

Source: own calculations

Non-stationary variables lead to inadequate results, which mean insignificant results. The verification of the stationarity of the selected data is performed by the ADF stationarity test. This test is most commonly used to confirm the stationarity of a data series.

Table no. 4 shows the results of the ADF test at the level and in the first difference, as well as the level of integration of the data series.

Table no. 4. Dickey-Fuller test results

Variabile	Level	1st difference	Integration order
	Prob.*	Prob.*	
BET	0	0	I(0)
FP	0.0006	0	I(0)
SNP	0	0	I(0)
BRD	0	0	I(0)
TLV	0	0	I(0)
CH_NEW_CASES	0.3275	0	I(1)
CH_NEW_DEATHS	0	0	I(0)
IT_NEW_CASES	0.5543	0	I(1)
IT_NEW_DEATHS	0.7408	0	I(1)
US_NEW_CASES	0.1658	0.0126	I(1)
US_NEW_DEATHS	0.2656	0	I(1)

Notes: Null hypothesis: has a unitary root.
Source: own calculations

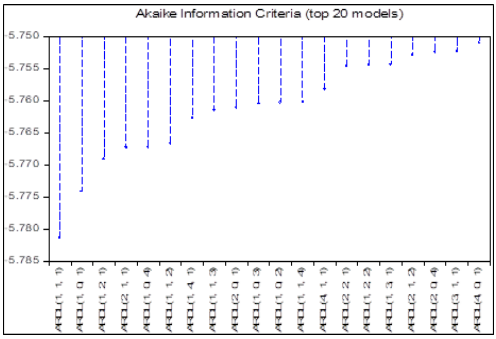
The variables used as a proxy for the Bucharest Stock Exchange are stationary at the first difference and have an integration order of I (1), so in this case the null hypothesis is rejected and it is concluded that the series is stationary and that the average and variation of the series are constant in time.

It is noted that the indicators related to the evolution of COVID-19 for the most affected regions, China, USA and Italy, show a mixed integration order (I (0) and I (1)).

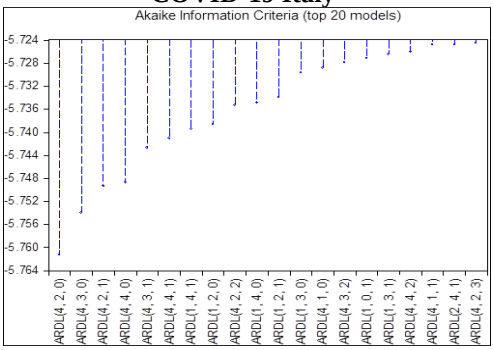
After studying the stationarity of the data series and due to the mixed results, it is concluded that the ARDL model is the most appropriate in studying the relationships between variables, namely how the specific index of the Romanian capital market reacts against the uncertainty created by the COVID-19 pandemic. In addition, the study also introduces a number of four companies traded on the BSE to capture how they react to news of the new number of cases and deaths due to COVID-19.

The ARDL (An Autoregressive Distributed Lag) model is used especially when the studied indicators are integrated I (0) and I (1). For the correct choice of the ARDL model that allows the research of the relationships that are established between variables, it is imperative to choose the correct number of lags. Therefore, the Akaike information criteria (AIC) will be analyzed to select the optimal lags for the variables included in the ARDL model.

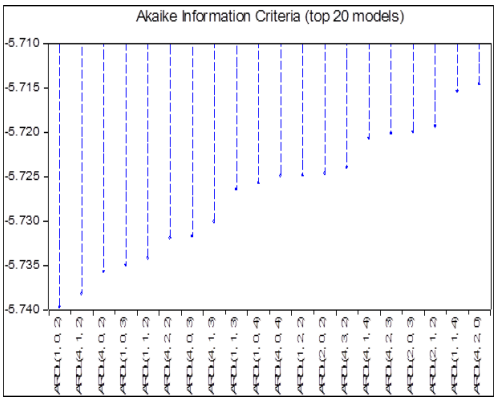
Optimal lags for the BET model - COVID-19 CHINA



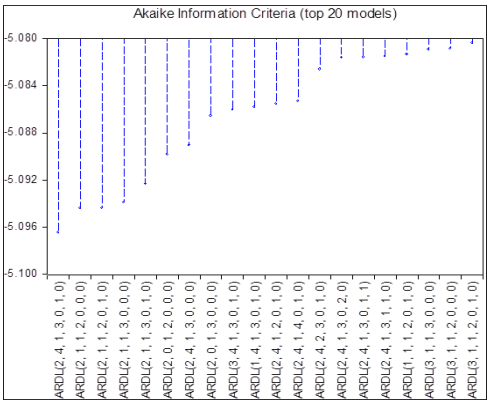
Optimal lags for the BET model - COVID-19 Italy



Optimal lags for the BET model - COVID-19 USA

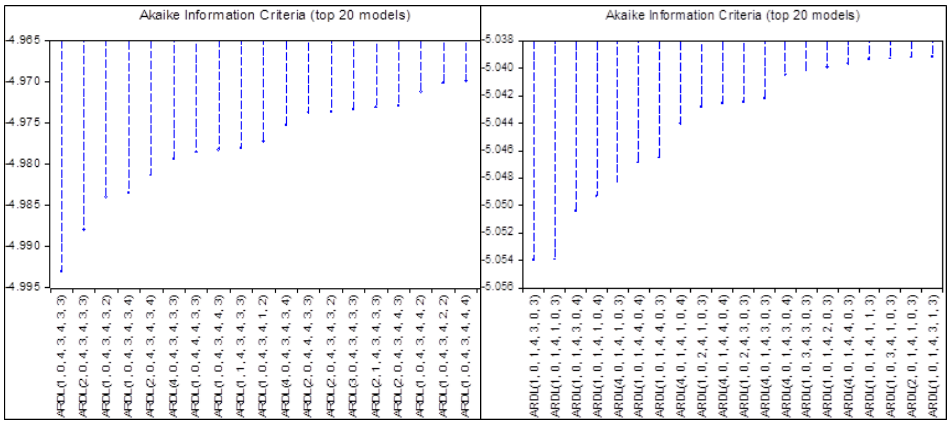


Optimal lags for the BRD –COVID-19 model



Optimal lags for the FP model - COVID-19

Optimal lags for the SNP – COVID-19 model



Optimal lags for the TLV-COVID-19 model

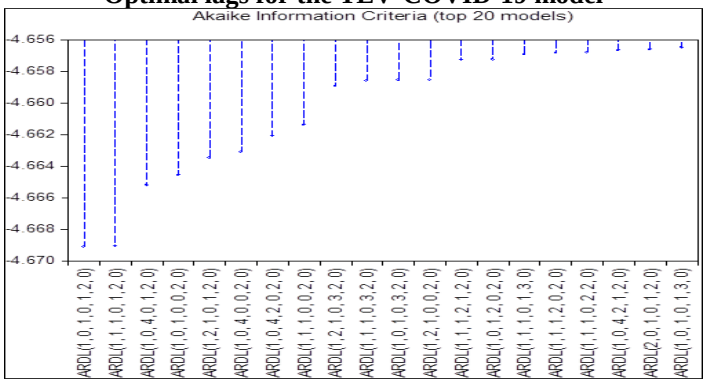


Figure no 3. Optimal lags for estimated models

Source: own calculations

The criteria graph will be applied, which will indicate the correct lags for the ARDL model and the lowest value is preferred. The horizontal axis of the graph represents the estimated ARDL models and the vertical axis shows the AIC value of the models. According to the results, a total of 62500 specifications of the ARDL model were considered for each of the four cases, with information on COVID-19 in China, USA and Italy. The first 20 results are presented in the criteria chart.

In addition, Table 5 summarizes the selected lags for the BET, BRD, FP, SNP, TLV & COVID-19 models (China, USA and Italy), according to the graphical criteria.

Table no. 5. Results of ARDL lags

ARDL- BET- COVID-19 China
ARDL(1,1,1)
ARDL- BET- COVID-19 Italy
ARDL(4, 2, 0)
ARDL- BET- COVID-19 USA
ARDL(1, 0, 2)
ARDL- BRD- COVID-19
ARDL(2, 4, 1, 3, 0, 1, 0)
ARDL- FP- COVID-19
ARDL(1, 0, 4, 3, 4, 3, 3)
ARDL- SNP- COVID-19
ARDL(1, 0, 1, 4, 3, 0, 3)
ARDL- TLV- COVID-19
ARDL(1, 0, 1, 0, 1, 2, 0)

Source: own calculations

The results reported below represent the ARDL test related to cointegration. Pesaran has two critical values for the cointegration test: the lower critical link assumes that all variables are I (0), which means that there is no cointegration, and the upper limit assumes that all variables are I (1), which means that there is cointegration between variables. If the value of F-Statistic is higher than the critical limit values, it indicates a long-term relationship between the projected variables, namely cointegration.

Table no. 6. ARDL test results for BVB & COVID-19

Null hypothesis: There are no long-term relationships	**F-statistic**	
BET - COVID-19 China	61.02475	
BET - COVID-19 Italy	20.52066	
BET - COVID-19 USA	105.4772	
Critical Value Bounds		
Significance	**I0 Bound**	**I1 Bound**
10%	2.12	3.23
5%	2.45	3.61
2.50%	2.75	3.99
1%	3.15	4.43
Null hypothesis: There are no long-term relationships	**F-statistic**	
BRD- COVID-19	10.03921	
FP-COVID-19	24.61719	
SNP-COVID-19	23.07108	
TLV-COVID-19	18.7289	
Critical Value Bounds		
Significance	**I0 Bound**	**I1 Bound**
10%	2.12	3.23

5%	2.45	3.61
2.50%	2.75	3.99
1%	3.15	4.43

Source: own calculations

In all seven cases (new number of COVID-19, new number of deaths due to COIV-19 in China, USA and Italy) the value of the F-statistical test is higher than the limits of 1%, which suggests that there is a relationship on long term between variables, then the null hypothesis is rejected, which means that the variables in all the studied models are cointegrated. Next, the results of the long-term and short-term relationship between the mentioned variables for the selected cases will be analyzed.

Table no. 7 summarizes the results of the long-term and short-term relationship between the BET stock market index and COVID-19 (China, Italy, USA) - new cases / deaths.

Table no. 7. Form of ARDL cointegration and long-term and short-term coefficients for BVB & COVID-19

BET - COVID-19 China				
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CH_NEW_CASES	0.000004	0.000025	0.140547	0.8884
CH_NEW_DEATHS	-0.000445	0.000516	-0.862984	0.3897
C	0.00125	0.001702	0.734679	0.4639
Short Term Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CH_NEW_CASES)	-0.000081	0.000058	-1.401171	0.1635
D(CH_NEW_DEATHS)	-0.003989	0.000801	-4.980944	0
CointEq(-1)	**-1.106792**	0.081882	-13.516941	**0**
BET - COVID-19 Italy				
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
IT_NEW_CASES	0.000001	0.000002	0.714099	0.4765
IT_NEW_DEATHS	-0.000002	0.00001	-0.254968	0.7992
C	0.000213	0.001233	0.173114	0.8628
Short Term Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(BET(-2))	0.257662	0.112673	2.286812	0.0239
D(BET(-3))	0.215818	0.073334	2.942947	0.0039
D(IT_NEW_CASES)	**-0.000007**	0.000003	-2.130693	**0.0351**
D(IT_NEW_CASES(-1))	-0.000008	0.000003	-2.456926	0.0154

D(IT_NEW_DEATHS)	-0.000003	0.000013	-0.255513	0.7988
CointEq(-1)	**-1.32203**	0.169126	-7.816849	**0**
BET - COVID-19 USA				
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
US_NEW_CASES	0	0	-0.764734	0.4458
US_NEW_DEATHS	-0.000001	0.000002	-0.301831	0.7633
C	0.003689	0.002956	1.248156	0.2142
Short Term Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(US_NEW_CASES)	0	0	-0.766605	0.4447
D(US_NEW_DEATHS)	0.000003	0.000003	1.045408	0.2978
D(US_NEW_DEATHS(-1))	**0.000006**	0.000002	2.573781	**0.0112**
CointEq(-1)	**-1.244915**	0.070765	-17.592169	**0**

Source: own calculations

The coefficient of error correction in all three cases (China, Italy and the USA) is significant at the significance level of 5%. Consequently, the negative and significant error correction term, which indicates the conversion speed, will show that the next day, the dependent variable, in our case, the BET index of the Romanian stock market will reach equilibrium with a speed of 110.6% (China), 132.2% (Italy) and 124.4% (USA).

The first model, which includes the number of new cases and deaths of COVID-19 in China, did not identify any effect from COVID-19 on the evolution of the BET index in both the long and short term. Instead, the model that incorporates the variables COVID-19 in Italy, it was found that the impact of the number of new cases of COVID-19 is stronger in this case, establishing in the short term, a negative impact of the new cases COVID-19 in Italy on the stock market. Thus, an increase in the number of new COVID-19 cases in Italy will negatively impact the daily evolution of the profitability of the BET index.

In the latest model, it is found that the number of deaths recorded in the US due to COVID-19 has a positive impact on the Romanian stock market in the short term, but the value of the coefficient is very close to zero, which can be interpreted as a very small effect, which is transmitted to the BET index.

Table no. 8. Form of ARDL cointegration and long and short term coefficients for BRD & COVID-19

BRD - COVID-19				
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CH_NEW_CASES	-3.3E-05	0.000049	-0.67359	0.5019
CH_NEW_DEATHS	-0.00033	0.001313	-0.25045	0.8027
IT_NEW_CASES	0.000002	0.000003	0.639527	0.5238
IT_NEW_DEATHS	-1.1E-05	0.000021	-0.52016	0.6039

US_NEW_CASES	0	0	0.698432	0.4863
US_NEW_DEATHS	0.000001	0.000003	0.293184	0.7699
C	-0.00358	0.006608	-0.54242	0.5886
Short Term Coefficients				
D(BRD(-1))	0.138296	0.079954	1.729681	0.0864
D(CH_NEW_CASES)	**-0.00022**	0.000077	-2.88948	**0.0046**
D(CH_NEW_CASES(-1))	0.000082	0.000092	0.889326	0.3757
D(CH_NEW_CASES(-2))	-0.00021	0.000094	-2.20853	0.0292
D(CH_NEW_CASES(-3))	0.000158	0.000073	2.169956	0.0321
D(CH_NEW_DEATHS)	**-0.0033**	0.001336	-2.4705	**0.015**
D(IT_NEW_CASES)	0.000005	0.000005	0.97587	0.3312
D(IT_NEW_CASES(-1))	**-2.4E-05**	0.000006	-4.22138	**0**
D(IT_NEW_CASES(-2))	0.000009	0.000005	1.73992	0.0845
D(IT_NEW_DEATHS)	-1.1E-05	0.000021	-0.51927	0.6046
D(US_NEW_CASES)	**0**	0	2.099407	**0.038**
D(US_NEW_DEATHS)	0.000001	0.000003	0.294278	0.7691
CointEq(-1)	**-1.01206**	0.122852	-8.23806	**0**

Source: own calculations

Table no. 8 shows the results of the long-term and short-term link between the BRD share and COVID-19 (China, Italy and the USA). BRD - Groupe Société, one of the largest banks in Romania, is 58.32% owned by the French financial group Société Générale, and offers complete financial services for individuals and companies. In the long run, no impact of COVID-19 variables on the evolution of the daily return of BRD share was identified. However, in the short term, negative relations are established from China to BRD, so an increase in the number of new COVID-19 cases, respectively deaths, will determine in the short term a negative evolution of BRD and the number of new COVID-19 cases reported in Italy will negatively impact the profitability of BRD's share in the short term. There is a positive impact of the number of new cases in the US on the bank in the short term.

Table no. 9. Form of ARDL cointegration and long and short term coefficients for FP & COVID-19

FP - COVID-19				
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CH_NEW_CASES	0	0.000044	-0.00774	0.9938
CH_NEW_DEATHS	0.001276	0.001427	0.894056	0.3733
IT_NEW_CASES	-1E-06	0.000003	-0.22106	0.8255
IT_NEW_DEATHS	-8E-06	0.000021	-0.37388	0.7092
US_NEW_CASES	0	0	-0.43461	0.6647
US_NEW_DEATHS	-2E-06	0.000004	-0.3686	0.7132
C	0.004761	0.00691	0.688988	0.4923
Short term				
Variable	Coefficient	Std. Error	t-Statistic	Prob.

D(CH_NEW_CASES)	0	0.000051	-0.00774	0.9938
D(CH_NEW_DEATHS)	-0.00055	0.001534	-0.36068	0.719
D(CH_NEW_DEATHS(-1))	0.003849	0.001224	3.144087	0.0022
D(CH_NEW_DEATHS(-2))	-0.00032	0.001269	-0.25527	0.799
D(CH_NEW_DEATHS(-3))	**-0.00303**	0.001139	-2.66121	**0.009**
D(IT_NEW_CASES)	**-0.00002**	0.000006	-3.56545	**0.0005**
D(IT_NEW_CASES(-1))	-1.4E-05	0.000006	-2.23127	0.0277
D(IT_NEW_CASES(-2))	0.000012	0.000006	2.259158	0.0259
D(IT_NEW_DEATHS)	**-7.6E-05**	0.000038	-1.9947	**0.0486**
D(IT_NEW_DEATHS(-1))	0.000143	0.000045	3.182431	0.0019
D(IT_NEW_DEATHS(-2))	0.000017	0.000042	0.390382	0.697
D(IT_NEW_DEATHS(-3))	-0.00011	0.000039	-2.96137	0.0038
D(US_NEW_CASES)	0	0	1.024717	0.3078
D(US_NEW_CASES(-1))	0.000001	0	2.206057	0.0295
D(US_NEW_CASES(-2))	**-1E-06**	0	-2.21718	**0.0287**
D(US_NEW_DEATHS)	0.000003	0.000005	0.560062	0.5766
D(US_NEW_DEATHS(-1))	0.000006	0.000004	1.417072	0.1593
D(US_NEW_DEATHS(-2))	0.000007	0.000004	1.620319	0.1081
CointEq(-1)	**-1.1601**	0.090472	-12.8228	**0**

Source: own calculations

Table no. 9 shows the results of FP and COVID-19. Fondul Proprietatea was set up by the Romanian Government in December 2005, to compensate people whose assets were abusively expropriated by the communist regime (especially in cases where restitution in kind was not possible), by granting actions to Fondul Proprietatea, depending on the losses suffered.

In the case of the model that includes Fondul Proprietatea, the number of new deaths in China due to COVID-19 will cause a price decrease in the short term. Also, the effects of COVID-19 in Italy will adversely affect the evolution of FP in the short term. Fondul Proprietatea is negatively influenced by the increase in the number of COVID-19 cases in the USA.

Table no. 10. Form of ARDL cointegration and long and short term coefficients for SNP & COVID-19

SNP - COVID-19				
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CH_NEW_CASES	**-0.00011**	0.000045	-2.34565	**0.0207**
CH_NEW_DEATHS	**0.003842**	0.001305	2.944789	**0.0039**
IT_NEW_CASES	-5E-06	0.000004	-1.55451	0.1228
IT_NEW_DEATHS	0.000043	0.000025	1.749113	0.083
US_NEW_CASES	**0**	0	2.010663	**0.0467**
US_NEW_DEATHS	0.000004	0.000004	0.981682	0.3283
C	-0.01259	0.007435	-1.69316	0.0932
Short term				
Variable	Coefficient	Std. Error	t-Statistic	Prob.

D(CH_NEW_CASES)	**-0.00011**	0.000045	-2.38132	**0.0189**
D(CH_NEW_DEATHS)	-0.00045	0.001337	-0.33299	0.7398
D(IT_NEW_CASES)	0.000005	0.000006	0.88156	0.3799
D(IT_NEW_CASES(-1))	0.000008	0.000006	1.393893	0.1661
D(IT_NEW_CASES(-2))	**-1.7E-05**	0.000006	-2.96957	**0.0036**
D(IT_NEW_CASES(-3))	0.000013	0.000005	2.427077	0.0168
D(IT_NEW_DEATHS)	-3.3E-05	0.000037	-0.89674	0.3717
D(IT_NEW_DEATHS(-1))	-4.4E-05	0.00004	-1.09472	0.2759
D(IT_NEW_DEATHS(-2))	0.000066	0.000036	1.833906	0.0693
D(US_NEW_CASES)	**0**	0	2.032761	**0.0444**
D(US_NEW_DEATHS)	-2E-06	0.000004	-0.55049	0.5831
D(US_NEW_DEATHS(-1))	0.000007	0.000004	1.965121	0.0518
D(US_NEW_DEATHS(-2))	**-8E-06**	0.000004	-2.1815	**0.0312**
CointEq(-1)	**-1.01788**	0.081204	-12.5348	**0**

Source: own calculations

Table no. 10 contains the results between SNP and COVID-19. OMV Petrom is the largest Romanian oil and gas company, with activities in the exploration and production, refining and marketing, natural gas and energy sectors. This company is the only one with long-term effects from the number of new COVID-19 cases in China, so the long-term evolution of the SNP will be negatively impacted with the increase in the number of cases of disease in China. In addition, a long-term positive link is established between the number of deaths in Italy and the number of new cases in the USA, but their value is very close to zero.

Also, in the short term, negative relations are confirmed from the three sources of transmission of the contagion, thus determining a negative evolution of the SNP share. This share has the most links to COVID-19 variables in China, Italy and the USA, both in the short and long term.

Table no. 11. Form of ARDL cointegration and long and short term coefficients for TLV & COVID-19

TLV - COVID-19				
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CH_NEW_CASES	-7E-06	0.000057	-0.11538	0.9083
CH_NEW_DEATHS	-5E-06	0.001344	-0.00386	0.9969
IT_NEW_CASES	0	0.000004	0.131192	0.8958
IT_NEW_DEATHS	-2E-06	0.000023	-0.09849	0.9217
US_NEW_CASES	0	0	0.049676	0.9605
US_NEW_DEATHS	0.000002	0.000004	0.431605	0.6668
C	-0.00063	0.008604	-0.0729	0.942
Short term				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CH_NEW_CASES)	-6E-06	0.000054	-0.11537	0.9083

D(CH_NEW_DEATHS)	**-0.00425**	0.001325	-3.20839	**0.0017**
D(IT_NEW_CASES)	0	0.000003	0.131055	0.8959
D(IT_NEW_DEATHS)	-5.9E-05	0.000038	-1.55161	0.1233
D(US_NEW_CASES)	0	0	-0.19908	0.8425
D(US_NEW_CASES(-1))	**0.000001**	0	2.244109	**0.0266**
D(US_NEW_DEATHS)	0.000002	0.000004	0.432331	0.6663
CointEq(-1)	-0.94809	0.08437	-11.2372	0

Source: own calculations

The results of the long-term and short-term link between TLV and COVID-19 can be found in table no.11. Banca Transilvania is currently the largest bank in Romania and was established in 1993, in Cluj-Napoca.

According to the results, TLV marked the least relationships with COVID-19 variables. Thus, according to the estimates identified from these ARDL models, in the short term, the results show a negative impact of COVID-19 deaths in China and a positive effect of the new US COVID-19 cases on TLV share.

To explore causality between variables, the Granger causality test is used, and the data series must be stationary and therefore transformed into stationary series. Table no. 12 shows the results after the Granger causality test for the BET, BRD, FP, SNP, TLV and COVID-19 index.

Table no. 12. Results of the Granger causality test for the capital market and COVID-19 variables

Pairwise Granger Causality Tests	
Null Hypothesis:	**Prob.**
CH_NEW_DEATHS does not Granger Cause BET	0.0372
DIT_NEW_CASES does not Granger Cause BET	0.0306
DUS_NEW_DEATHS does not Granger Cause BET	0.0219
CH_NEW_DEATHS does not Granger Cause FP	0.0455
DIT_NEW_CASES does not Granger Cause FP	0.0326
DIT_NEW_DEATHS does not Granger Cause FP	0.039
CH_NEW_DEATHS does not Granger Cause SNP	0.014
DUS_NEW_DEATHS does not Granger Cause SNP	0.0508

Source: own calculations

Between the variables COVID-19 (China, Italy and the USA) and the BET stock index, unidirectional causal relations are established: from the number of COVID-19 deaths to BET, from the number of new cases in Italy to BET and from the number of deaths in the USA to BET.

The results of the Granger test, in the case of Fondul Proprietatea, indicate the presence of the same types of unidirectional causal relationships that were identified at the level of the BET stock index.

OMV Petrom presents Granger-type causal relationships only with COVID-19 variables from China and the USA. Namely, both the number of COVID-19 deaths in China and the USA cause Granger the SNP share.

No variables representing the evolution of the COVID-19 epidemic in China, Italy and the USA cause any causation on BRD and TLV.

Conclusions

COVID-19 is changing the paradigm in global and local financial markets, quickly turning into a new risk, generating feverish behavior among investors and posing unprecedented challenges for policy makers. The study provides evidence of significant negative effects on the Romanian capital market caused by COVID-19 between March 16, 2020 and September 30, 2020.

Investors are no longer so interested in potential returns, but in the lower risk of some asset classes, such as low-risk government bonds. Even in the case of government bonds, there is a selection and a preference for countries with the best possible rating, even if the returns may be negative in some cases.

Given the evolution of assets since the beginning of the pandemic, primarily the fall in prices for the riskiest asset classes, it is important to know and not lose sight of long-term goals. Long-term diversification is important in order to limit risks, while protecting the asset portfolio. However, the evolution in recent months has highlighted the close correlations between some asset classes, which have evolved with a similar pattern.

The research looked at whether the Romanian stock market is affected by the COVID-19 pandemic outbreak. To explore the links, daily data were used between March 16, 2020 - September 30, 2020 for the following markets: USA, Italy, China and Romania. A wide range of variables was selected to achieve the target, such as stock market indices, the new number of cases of disease, the new number of deaths in China, the USA and Italy. So far, the number of researches is low, this being among the first analyzes that address the impact of COVID-19 in China, USA and Italy on the Romanian capital market.

Empirical results from ARDL models confirmed both short-term (in the vast majority of models studied) and long-term negative relationships (only in the case of SNP were long-term negative relationships identified from the number of new cases in China on the evolution of the share). Thus, the study suggests that the negative reaction of the Romanian capital market was strong in the first days of confirmed cases / declared deaths due to COVID-19.

Between the variables COVID-19 (China, Italy and USA) and the stock market index BET and FP are established unidirectional causal relations: from the number of deaths COVID-19 to BET / FP, from the number of new cases from Italy to BET / FP and from the number of deaths in the US to BET / FP. OMV Petrom presents Granger-type causal relationships only with COVID-19 variables from China and the USA. Namely, both the number of COVID-19 deaths in China and the USA cause Granger to evolve SNP share. No variables representing the evolution of the COVID-19 epidemic in China, Italy and the USA cause any causation on BRD and TLV.

Therefore, the empirical findings of the ARDL model and the Granger causality test confirmed both the presence of a long-term and short-term relationship between the Romanian capital market and the COVID-19 variables.

The results of the research offer many suggestions to investors in optimizing their portfolios and provide guidance for decision makers and regulators. In this phase of COVID-19, not only the international stock markets, but also the foreign exchange markets recorded extremely volatile days. With the exception of periods of high volatility, average stock market liquidity is declining in the second half of the year, with the first affected markets being border or emerging markets, which include the local capital market, with investors preferring developed markets or less assets, such as government securities or gold.

These developments are forcing market participants (especially banks) to reduce their risk-taking capacity and slow down growth in both financial markets and global economies. To prevent these actions, policymakers should continue to provide liquidity to international markets, as illustrated by recent Federal Reserve swap operations.

Research on the effects of COVID-19 is still in its infancy. Future research is warranted on this topic, in particular with the availability of longer periods under COVID - 19.

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