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THE EFFECTS OF COVID-19 ON THE ROMANIAN BANKING SECTOR

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Abstract:
Covid-19 impacted the economy livelihood and had a lot of negative effects on many economic sectors, including banking. We aim to measure some of these effects over the listed Romanian banks. Through the lockdown, the authorities tried to stop the spread of the virus, but regrettably a part of population lost their job permanently or temporarily, or their incomes were reduced alarmingly. Being faced with such a situation and considering that one also must cover the basic needs, if you, too, are in the position and you have one or more loans at the bank, the next question you ask yourself is how will I manage to pay the installment? Event studies use data from the financial market, which gives them a high degree of veracity. They use statistical methods using time as a dependent variable and then look for variables that explain the duration of an event (or time until an event). The research was done over several years, and the banks included in the research were: Transylvania Bank and BRD - Groupe Société Générale and BET is the stock index used. Regarding the main methods which were applied we mention: descriptive statistics, time series (e.g. Augmented Dickey Fuller test), least square method, t-statistic test. The test results were positive and consistent with reality. This paper evaluates the major impact of Covid-19 on Romanian banks and was able to give us answers and solutions to countless questions.

Keywords: *Covid-19, Event Study, Time Series, Stock Exchange*

JEL classification: *A10, C10, C22, G01, G21*

1. Introduction

Event study methodology is one of the most frequently used tools in financial research in recent years. An event study is a statistical method to assess the impact of an event on an outcome of interest. It can be used as a descriptive tool to describe the dynamic of the outcome of interest before and after the event or in combination regression discontinuity techniques around the time of the event to evaluate its impact. This method has been used mainly in finance to study the impact of specific events on firms' value, as it relies on having high frequency data. In other words, event studies explain how the prices of various stocks are formed in the capital market.

Recently, event study methodology has evolved to meet new research demands. Modifications such as removing general price variations from the stock market and extracting the effects of potentially confounding events are subsequent modifications to meet emerging research requirements.

Nonetheless, it is well known that it was the work of Eugene Fama and other collaborators that provided the main introduction to event study methodology mainly by analyzing how stock splits influence after removing confounding events. (Fama, Fisher, Jensen, & Roll, 1969)

In addition to stock market price reaction analysis, a large branch of literature has implemented event studies for impact assessments of macroeconomic phenomena or monetary policy decisions on bonds and exchange rates. (Ball & Brown, 1968)

2. Methodology

The structure of an event study is not unique, but there is always a general flow that is represented by several steps that appear in any type of analysis. Broadly, study events involve certain steps. The main research on the field of study events is the one of MacKinley, and he was the one that synthesized the study events steps as follow: (MacKinlay, 1997):

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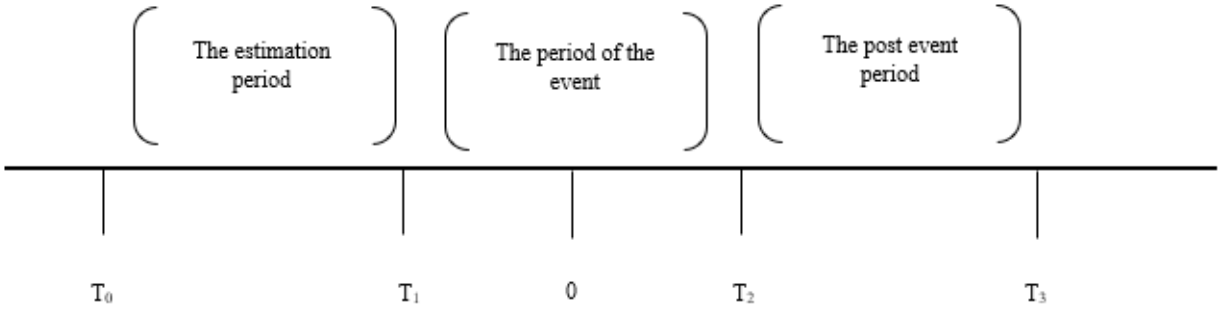
a) Select the event to be studied together with determining the analysis period;
b) Select the sample of companies that will enter the case study;
c) Selection of the estimation model of expected normal returns and their estimation;
d) Access excess returns;
e) Hypothesis tests.

2.1. The event and the chosen period

At this point, an event of interest was chosen to be studied along with its delimitation in time. In specialized literature, the event period is called the period selected to analyze the event.

Figure 1: Timeline for a general event study



Source: author's own processing

In which:
• T = 0 represents the time when the event occurs;
• The period (T_1,T_2) represents the period of the event;
• The period (T_0,T_1) represents the estimation period;
• The period (T_2,T_3) represents the post-event period

2.2. Selection of companies

At this step, the companies that were analyzed were chosen considering the following factors: the existence of data, whether the companies are listed or not, the field of interest, etc.

2.3. Model selection and profitability estimation

The model used to estimate the expected normal returns of the shares is implemented, and the expected normal returns are estimated for the period of time the event takes place. Here we can mention that the expected normal return of a stock *i*, further denoted by R_{it} is the expected return on the chosen market during the period in which the event occurs. It is calculated for the parameters that are estimated using the model chosen for the period (T_0,T_1), i.e. the estimation period. According to the methodology, the announcements regarding the quarterly results can be grouped by the net profit that is announced, and a comparison is made with the average of the estimates made by the analysts.

2.4. Establishing excess returns

Excess returns are also known as abnormal returns and noted by *ARn*. They can be excessive or weak. Abnormal returns are calculated as the difference between the actual realized return and the expected normal return of a stock *i*.

$$AR_n = R_{mt} - R_{it} \quad (1)$$

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The profitability realized is the one that is recorded on the market during the analysis period of the event. This is calculated as the daily percentage change in the closing share prices of the case study companies.

2.5. Hypothesis testing

The hypothesis that the excess return is statistically different to zero was verified and tested using the statistical test t.

Two classes of models can be used to estimate the expected normal returns of a stock *i*, namely: statistical models and economic models.

Since the market method was used for the case study, this method will be presented below. The estimation period of *N* days was established by the one who carries out the study, and the method itself aims to obtain the parameters of the model ($\alpha i, \beta i$) which has the following equation:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (2)$$

After applying this model for the companies chosen in the analysis, we concluded that α_i is not statistically significantly different from zero, therefore the model has the following form:

$$R_{it} = \beta_i R_{mt} + \varepsilon_{it} \quad (3)$$

To solve the market model, the "Ordinary Least Squares - OLS" method is used to determine the parameters.

3. Empirical results

Our aim is to measure these effects on two Romanian banks: Transylvania Bank and BRD - Groupe Société Générale. The date 12 December 2019 is taken as t_0 because it is the very day on which the first case of infection was presented in Wuhan, China. The period chosen, according to the specialized literature, was 499 days. The stock market index considered in the analysis is BET.

The case study started with the preliminary analysis of the data in which the descriptive statistics, histograms, boxplots, the asymmetry index, the flattening index, and the correlation matrix can be found.

Table 1: Descriptive statistics original data

Variables	TB	BRD	BET
Minimum value	11.98	9.9	6934
First quartile	15.86	11.8	8272
Median	16.95	12.7	8774
Mean	17.55	12.96	8766
Third quartile	19.59	13.74	9321
Maximum value	21.78	16.4	10220

Source: author's own processing

In the descriptive statistics, which can be viewed in the previous figure, the minimum value, the maximum value, the average, the first quartile, the median or the second quartile and the third quartile can be found for each company, as well as for the stock index. Furthermore, each company was taken and analyzed one by one, so that later various comparisons can be made.

3.1. Transylvania Bank

The bank was founded in 1993, in Cluj-Napoca, by a group of local businessmen, with 79% Romanian and 21% foreign capital.

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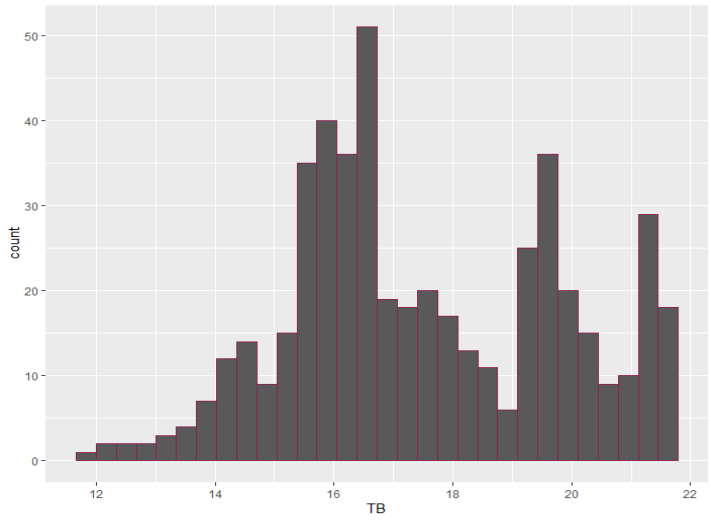
From the analysis of the share price of this bank, we concluded that it is almost symmetrical and platykurtic.

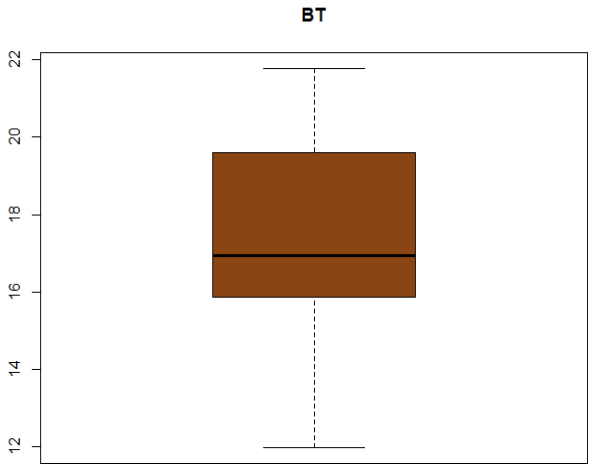
Figure 2: Transylvania bank share price



Source: author's own processing

Following the construction of the boxplot related to this bank, the distribution is not symmetrical and there are no outliers.

Figure 3: Transylvania bank share price boxplot



Source: author's own processing

3.2. BRD - Groupe Société Générale

It was founded in 1923 and is currently the third largest bank by assets (about 10.9 bn €) in Romania. From the analysis of the share price of this bank, we concluded that it is asymmetrical on the left and platykurtic.

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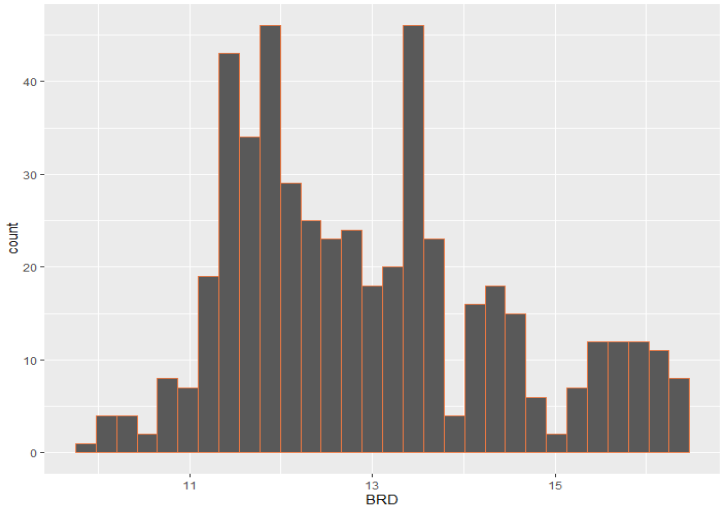
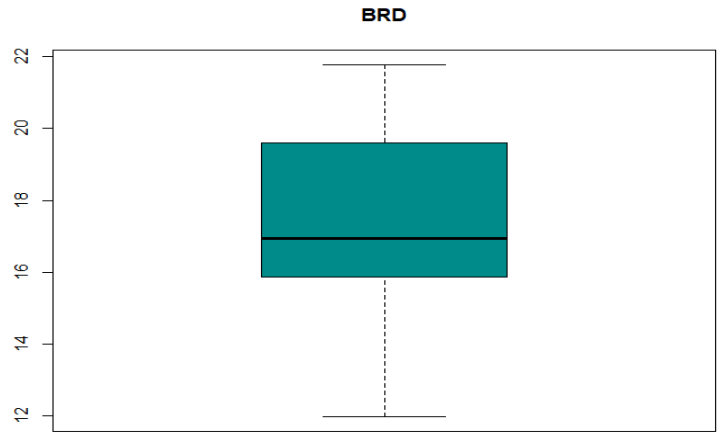
Figure 4: BRD bank share price



Source: author's own processing

The boxplot showed us that the distribution is not symmetrical and that there are no outliers.

Figure 5: BRD bank share price boxplot



Source: author's own processing

3.3.BET

The BET (Bucharest Exchange Trading) index is the BSE's first official index launched on 19 September 1997. This index showed an asymmetry to the right and a platycurtic distribution.

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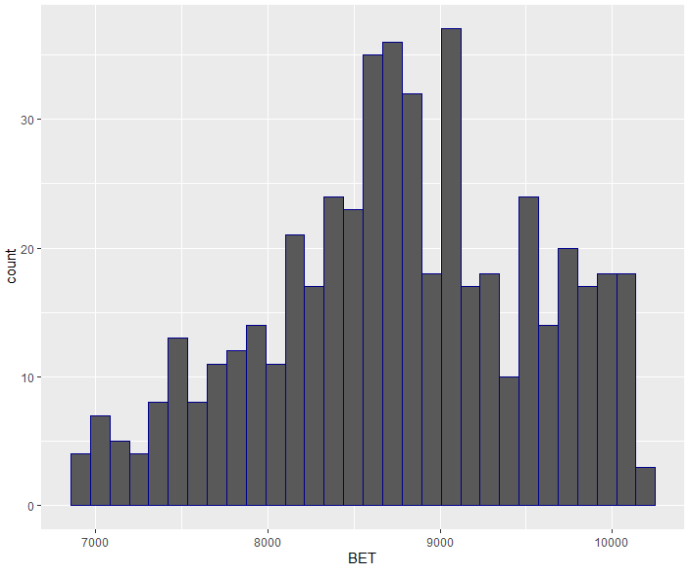
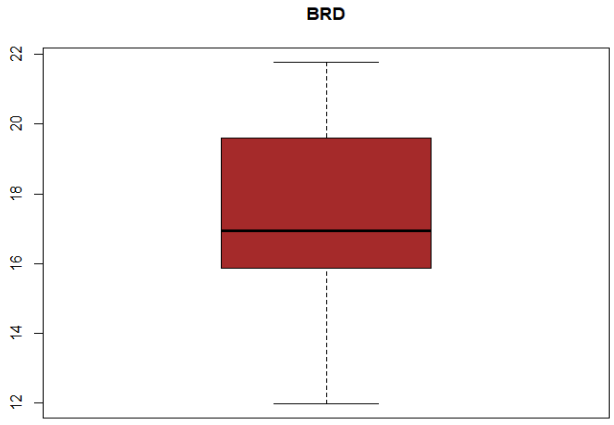
Figure 6: BET share price



Source: author's own processing

The Bet boxplot is asymmetric and does not display outliers.

Figure 7: BET share price boxplot



Source: author's own processing

The table below shows the values of skewness and kurtosis coefficients:

Table 2: Skewness and kurtosis for the original data

Coefficient	Transylvania Bank	BRD - Groupe Société Générale	BET
Skewness	0.1529	0.5514	-0.2203
Kurtosis	-0.8786	-0.4891	-0.5877

Source: author's own processing

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The correlation matrix for the original data can be seen below:

Table 3: The correlation matrix for the original data

Correlation Matrix	TB	BRD	BET
TB	1	0.9072	0.9263
BRD	0.9072	1	0.8601
BET	0.9263	0.8601	1

Source: author's own processing

We concluded that there are strong positive correlations between the share prices of Transylvania Bank and BRD (0.9072), BRD and BET (0.8601), BET and Transylvania Bank (0.9263).

Since it was an analysis based on time series, we also built similar types of graphs for both shares and the BET index.

Figure 8: BT time series graph

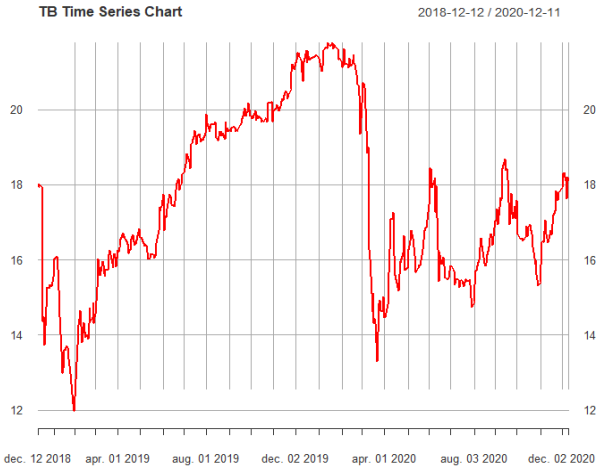
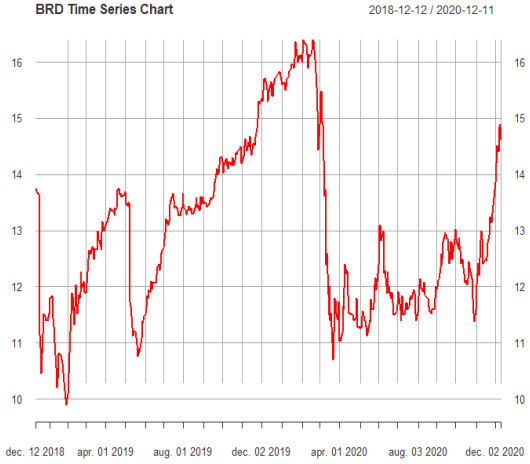
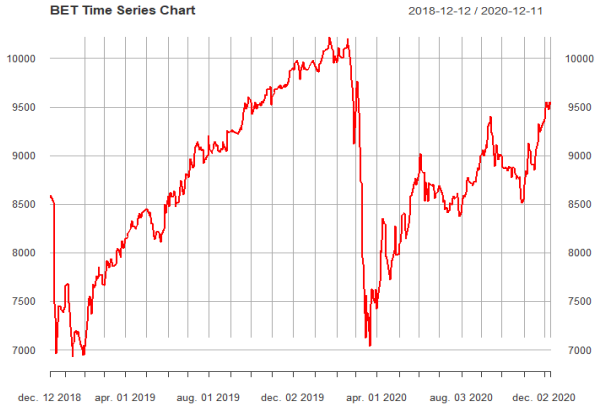


Figure 9: BRD time series graph



Source: author's own processing

Figure 10: BET time series graph



Source: author's own processing

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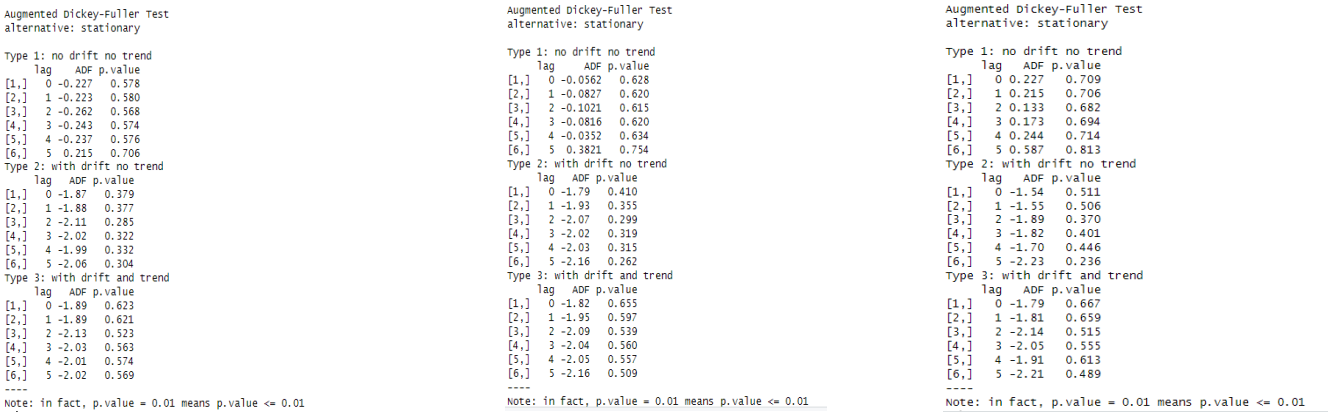
Since in the analysis we used time series, we tested their stationarity for each individual share, as well as for the BET index. To test the stationarity of the series, we chose to use the Augmented Dickey-Fuller (ADF) test.

Figure 11: ADF test



```
Augmented Dickey-Fuller Test
alternative: stationary

Type 1: no drift no trend
     lag    ADF p.value
[1,]   0 -0.227   0.578
[2,]   1 -0.223   0.580
[3,]   2 -0.262   0.568
[4,]   3 -0.243   0.574
[5,]   4 -0.237   0.576
[6,]   5  0.215   0.706
Type 2: with drift no trend
     lag   ADF p.value
[1,]   0 -1.87   0.379
[2,]   1 -1.88   0.377
[3,]   2 -2.11   0.285
[4,]   3 -2.02   0.322
[5,]   4 -1.99   0.332
[6,]   5 -2.06   0.304
Type 3: with drift and trend
     lag   ADF p.value
[1,]   0 -1.89   0.623
[2,]   1 -1.89   0.621
[3,]   2 -2.13   0.523
[4,]   3 -2.03   0.563
[5,]   4 -2.01   0.574
[6,]   5 -2.02   0.569
----
Note: in fact, p.value = 0.01 means p.value <= 0.01
```

```
Augmented Dickey-Fuller Test
alternative: stationary

Type 1: no drift no trend
     lag     ADF p.value
[1,]   0 -0.0562   0.628
[2,]   1 -0.0827   0.620
[3,]   2 -0.1021   0.615
[4,]   3 -0.0816   0.620
[5,]   4 -0.0352   0.634
[6,]   5  0.3821   0.754
Type 2: with drift no trend
     lag   ADF p.value
[1,]   0 -1.79   0.410
[2,]   1 -1.93   0.355
[3,]   2 -2.07   0.299
[4,]   3 -2.02   0.319
[5,]   4 -2.03   0.315
[6,]   5 -2.16   0.262
Type 3: with drift and trend
     lag   ADF p.value
[1,]   0 -1.82   0.655
[2,]   1 -1.95   0.597
[3,]   2 -2.09   0.539
[4,]   3 -2.04   0.560
[5,]   4 -2.05   0.557
[6,]   5 -2.16   0.509
----
Note: in fact, p.value = 0.01 means p.value <= 0.01
```

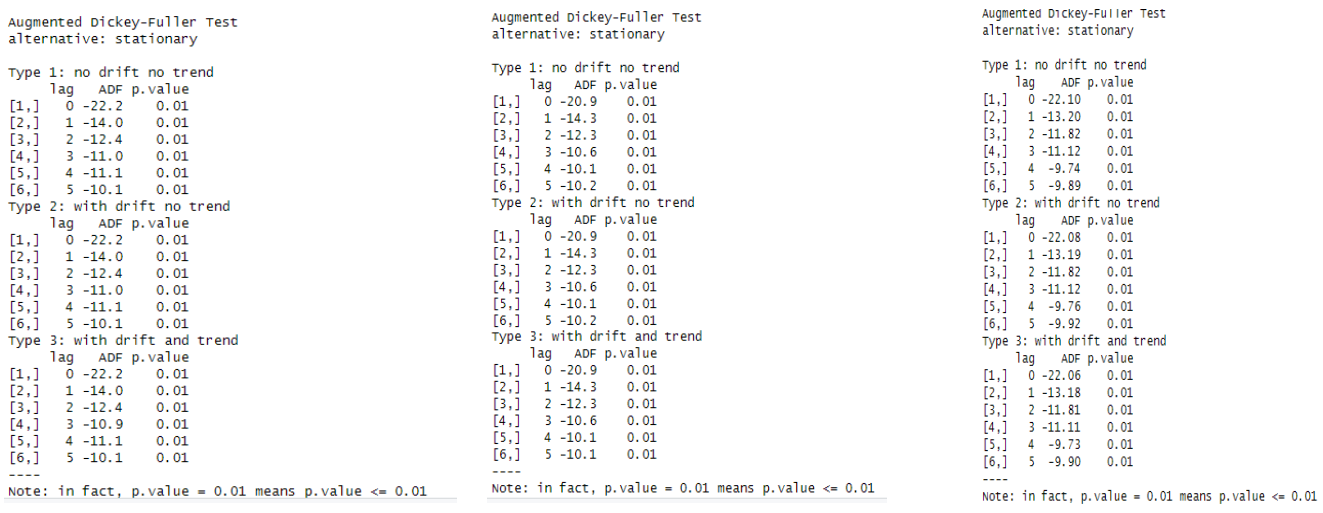
```
Augmented Dickey-Fuller Test
alternative: stationary

Type 1: no drift no trend
     lag   ADF p.value
[1,]   0 0.227   0.709
[2,]   1 0.215   0.706
[3,]   2 0.133   0.682
[4,]   3 0.173   0.694
[5,]   4 0.244   0.714
[6,]   5 0.587   0.813
Type 2: with drift no trend
     lag   ADF p.value
[1,]   0 -1.54   0.511
[2,]   1 -1.55   0.506
[3,]   2 -1.89   0.370
[4,]   3 -1.82   0.401
[5,]   4 -1.70   0.446
[6,]   5 -2.23   0.236
Type 3: with drift and trend
     lag   ADF p.value
[1,]   0 -1.79   0.667
[2,]   1 -1.81   0.659
[3,]   2 -2.14   0.515
[4,]   3 -2.05   0.555
[5,]   4 -1.91   0.613
[6,]   5 -2.21   0.489
----
Note: in fact, p.value = 0.01 means p.value <= 0.01
```

Source: author's own processing

Since the p-value in all three cases was not less than 0.05, the conclusion was that the series is not stationary, it has a unit root, and the null hypothesis was not rejected.

Afterwards, we performed the first difference to stationary the time series.

Figure 12: ADF first difference test



```
Augmented Dickey-Fuller Test
alternative: stationary

Type 1: no drift no trend
     lag   ADF p.value
[1,]   0 -22.2    0.01
[2,]   1 -14.0    0.01
[3,]   2 -12.4    0.01
[4,]   3 -11.0    0.01
[5,]   4 -11.1    0.01
[6,]   5 -10.1    0.01
Type 2: with drift no trend
     lag   ADF p.value
[1,]   0 -22.2    0.01
[2,]   1 -14.0    0.01
[3,]   2 -12.4    0.01
[4,]   3 -11.0    0.01
[5,]   4 -11.1    0.01
[6,]   5 -10.1    0.01
Type 3: with drift and trend
     lag   ADF p.value
[1,]   0 -22.2    0.01
[2,]   1 -14.0    0.01
[3,]   2 -12.4    0.01
[4,]   3 -10.9    0.01
[5,]   4 -11.1    0.01
[6,]   5 -10.1    0.01
----
Note: in fact, p.value = 0.01 means p.value <= 0.01
```

```
Augmented Dickey-Fuller Test
alternative: stationary

Type 1: no drift no trend
     lag   ADF p.value
[1,]   0 -20.9    0.01
[2,]   1 -14.3    0.01
[3,]   2 -12.3    0.01
[4,]   3 -10.6    0.01
[5,]   4 -10.1    0.01
[6,]   5 -10.2    0.01
Type 2: with drift no trend
     lag   ADF p.value
[1,]   0 -20.9    0.01
[2,]   1 -14.3    0.01
[3,]   2 -12.3    0.01
[4,]   3 -10.6    0.01
[5,]   4 -10.1    0.01
[6,]   5 -10.2    0.01
Type 3: with drift and trend
     lag   ADF p.value
[1,]   0 -20.9    0.01
[2,]   1 -14.3    0.01
[3,]   2 -12.3    0.01
[4,]   3 -10.6    0.01
[5,]   4 -10.1    0.01
[6,]   5 -10.1    0.01
----
Note: in fact, p.value = 0.01 means p.value <= 0.01
```

```
Augmented Dickey-Fuller Test
alternative: stationary

Type 1: no drift no trend
     lag    ADF p.value
[1,]   0 -22.10    0.01
[2,]   1 -13.20    0.01
[3,]   2 -11.82    0.01
[4,]   3 -11.12    0.01
[5,]   4  -9.74    0.01
[6,]   5  -9.89    0.01
Type 2: with drift no trend
     lag    ADF p.value
[1,]   0 -22.08    0.01
[2,]   1 -13.19    0.01
[3,]   2 -11.82    0.01
[4,]   3 -11.12    0.01
[5,]   4  -9.76    0.01
[6,]   5  -9.92    0.01
Type 3: with drift and trend
     lag    ADF p.value
[1,]   0 -22.06    0.01
[2,]   1 -13.18    0.01
[3,]   2 -11.81    0.01
[4,]   3 -11.11    0.01
[5,]   4  -9.73    0.01
[6,]   5  -9.90    0.01
----
Note: in fact, p.value = 0.01 means p.value <= 0.01
```

Source: author's own processing

We can notice the series are now stationary, the p-value was 0.01 which was less than 0.05, so we rejected the null hypothesis and accepted the alternative hypothesis that there was no unit root. This was demonstrated by the graphs below.

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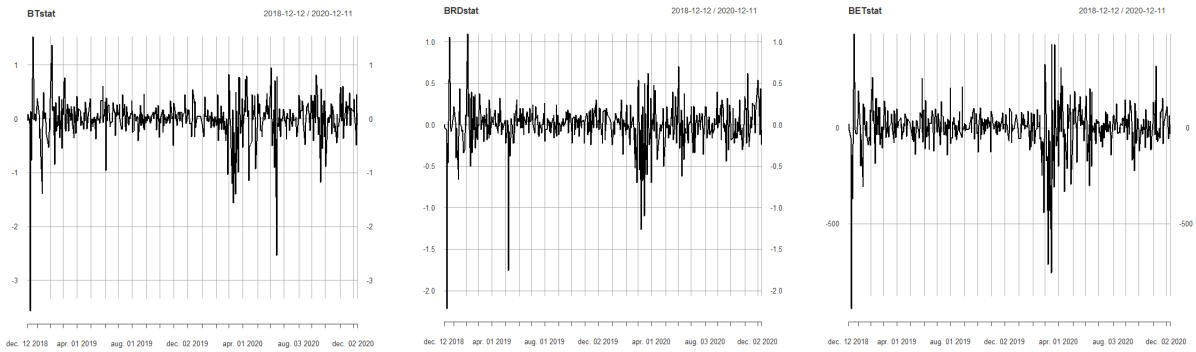
Figure 13: Stationary time series graphs



Source: author's own processing

Since the analysis was done at the level of prices on the capital market, at this step we calculated the returns of the 2 shares as well as the market index. Their graphs can be seen below:

Figure 14: TB profitability graph

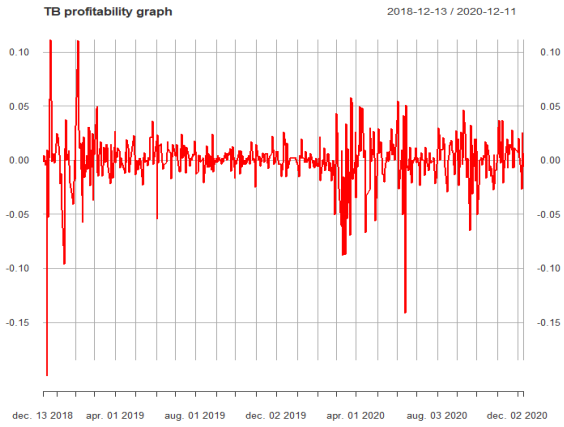
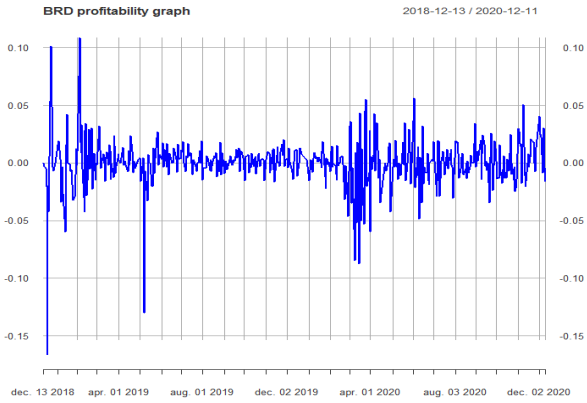
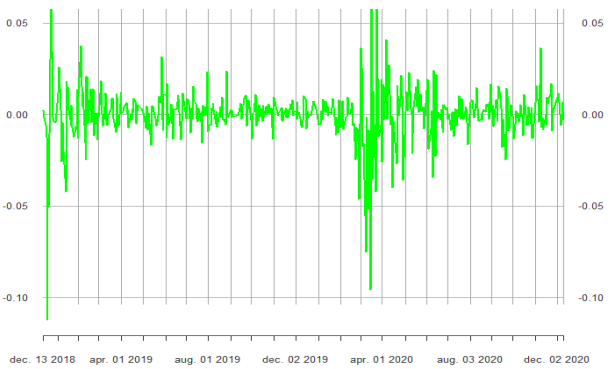


Figure 15: BRD profitability graph



Source: author's own processing

Figure 16: BET profitability graph



Source: author's own processing

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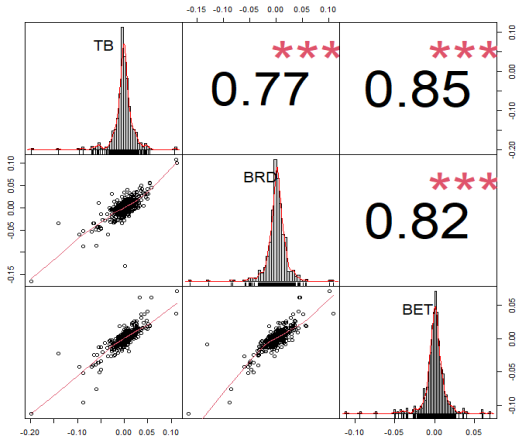
We have also constructed the correlation matrix for the stocks and the market index. The graphical form of the correlation matrix is given below:

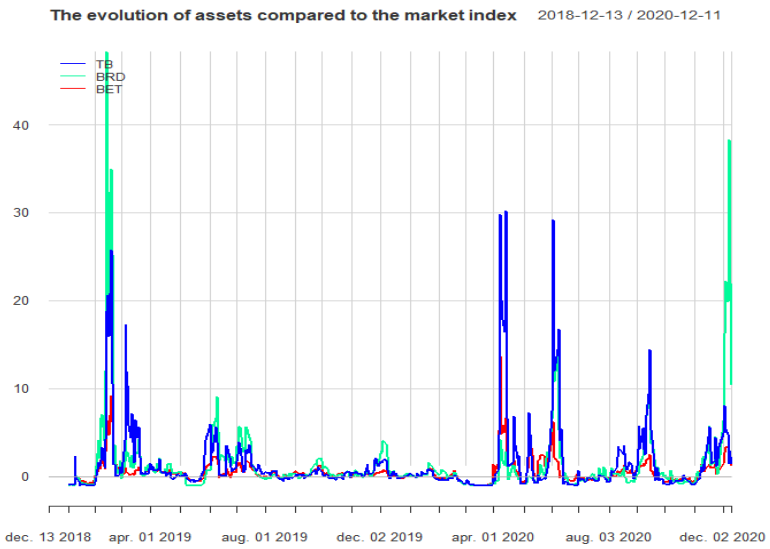
Figure 17: Correlation matrix for returns



Source: author's own processing

We could state the fact that there are close and positive correlations between these variables. The evolution of assets compared to the market index can be seen below:

Figure 18: The evolution of assets compared to the market index



Source: author's own processing

We could notice the shares of the 2 banks followed the trend of the market index for most of the time considered in the analysis.

The last step was the analysis and evaluation of the conclusion from the statistical t - student test. The hypothesis that excess (abnormal) returns are statistically different from zero was tested. For this, the statistical test t was used for each of the days corresponding to the event period. The value of t_{stat} was calculated to be able to compare it with t_{critic} for a confidence coefficient of 95%. The calculated one had the value of 12.70, while the tabular one is ±1.96. In conclusion, the null hypothesis of no statistical

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differences was rejected, and the alternative hypothesis was accepted. Additionally, the t-test was performed for each action.

Figure 19: T-test

```
        One Sample t-test

data:  ARBT
t = -0.46656, df = 12, p-value = 0.6492
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 -0.04761380  0.03081856
sample estimates:
   mean of x
-0.008397624
```

```
        One Sample t-test

data:  ARBRD
t = -0.18538, df = 12, p-value = 0.856
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 -0.007022433  0.005921141
sample estimates:
    mean of x
-0.0005506463
```

Source: author's own processing

4. Conclusion

The paper analyzed the study of the newly encountered event, namely Covid-19, on the results of the values of companies on the banking market in Romania. This case study aimed to demonstrate the fact that the previously mentioned event has an influence on the financial results of Transylvania and BRD banks which can be seen in their capital market returns.

In general, in the medium term, this event study can also show us the behavior of investors that can be buying shares or selling them. Investor interest and behavior is highly influenced by announcements made by analysts, other investors, holding companies or others. Investors' perception of the news, their risk appetite and ultimately the decision they make must also be considered.

In conclusion, the event study chosen and presented showed the influence of Covid-19 on Romanian banks. In the end, we were able to affirm the fact that this phenomenon also led to anomalies for this sector of activity.

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