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Assessing the reaction of the Baltic stock market to the spread of the COVID-19 pandemic

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Abstract: This research aims to assess the impact of the spread of the COVID-19 pandemic on the Baltic stock market. To reach this aim, the methods of bivariate (OLS) regression and VAR-based impulse response functions are employed. We use daily new cases of COVID-19 as well as the cumulative number of COVID-19 cases as independent and OMX Baltic Benchmark GI index as dependent variables for our research. The research period, covering data from 2020 March 1st to 2020 November 21st, is divided into three separate periods, reflecting the different phases of the spread of the COVID-19 pandemic. The results of the research revealed that the market reaction differs depending on the period; moreover, the Baltic stock market index was affected by new cases and total cases in a slightly different manner.

Keywords: COVID-19 pandemic; stock market; stock index; impulse response.

1. Introduction

The unexpected and rapid spread of the COVID-19 pandemic has inevitably affected different spheres of the economy, and financial markets were not excluded either. Starting with February or March of 2020, a significant decrease has been observed in almost all global, regional and national financial markets. As this market uncertainty has affected both investor decisions and the overall state of the financial system, a significant number of studies have been conducted to examine the impact of the spread of the COVID-19 pandemic on financial markets: the impact on global or regional markets was analysed by Albulescu, 2020; Gormsen & Koijen, 2020; Sansa & Hasan, 2020; Ftiti et al., 2021; Ciner, 2020; Shezhad et al., 2020; Izzeldin et al., 2020; Cheong, 2020; Ashraf, 2020; Zhang et al., 2020; Kanapickiene et al., 2020; Schoenfeld, 2020; Qing et al., 2020 and others. Moreover, there are also some researches examining the impact of the pandemic

on European financial markets (for example, Chikri et al. 2020; Borri, 2020; Enilov & Wang, 2020; Dias et al., 2020; O'Donnell et al., 2020) as well as researches examining the impact on the financial markets of Central and Eastern European countries (for example, Pardal et al., 2020, Tomal, 2021; Czech et al., 2020; Klose & Tillmann, 2020). However, specific researches assessing the impact of the pandemic on the Baltic stock market (Lithuania, Latvia, and Estonia) is still fragmentary. Taking this into account, the aim of this paper is to assess the impact of the spread of the COVID-19 pandemic on the Baltic stock market. To reach this aim, the methods of bivariate (OLS) regression and VAR-based impulse response functions are employed. Daily new cases of COVID-19, as well as the cumulative number of COVID-19 cases, was selected as independent and OMX Baltic Benchmark GI index as dependent variables for this research. The research period, covering data from 2020 March 1st to 2020 November 21st, is divided into three separate periods, reflecting the different phases of the spread of the COVID-19 pandemic. The results of the research revealed that the market reaction differs depending on the period; moreover, the Baltic stock market index was affected by new cases and total cases in a slightly different manner.

The rest of this paper is structured as following: in Section 2 the relevant scientific efforts in the field are analysed; in Section 3 the research design is described; in Section 4 the results of the assessment of the impact of the COVID-19 pandemic is discussed.

2. Literature review

Whereas the financial markets all over the world have demonstrated a response to the spread of the COVID-19 pandemic in one way or another, the researches in this area emerged. The impact of the spread of the COVID-19 pandemic on the global or regional financial markets has been analyzed by Albulescu, 2020; Gormsen & Kojen, 2020; Sansa & Hasan, 2020; Ftiti et al., 2021; Ciner, 2020; Shezhad et al., 2020; Izzeldin et al., 2020; Cheong, 2020; Ashraf, 2020; Zhang et al., 2020; Kanapickiene et al., 2020; Schoenfeld, 2020; Qing et al., 2020 and others. For example, Albulescu (2020) analyzed the effect of official announcements of new cases of COVID-19 and death ratio on the volatility of the financial market and confirmed that the spread of the COVID-19 pandemic has caused the increase in volatility in financial markets. The research of Sansa & Hasan (2020) using regression analysis has proven the short-time negative effect on Shanghai and New York stock markets caused by a rapid spread of the COVID-19 pandemic. Gormsen & Kojen (2020) emphasized the temporal nature of this effect and noted the signs of recovery on the market after the first wave of the pandemic. The research of Kanapickiene et al. (2020) has also confirmed the short-term negative effect of the COVID-19 pandemic on stock and derivatives markets.

The effect of the COVID-19 pandemic on the European stock markets also becomes an object of scientific interest. Chikri et al. (2020) used a non-linear autoregressive distributed lag model to prove that financial markets are negatively impacted by the growth of the COVID-19 virus. Research chose to analyze indexes which also included the CAC40 index for France and Italy's FTSE MIB index. The results of this study confirmed that negative shocks in indexes were caused by the spread of the COVID-19 pandemic. Borri (2020) in research regarding the challenges of COVID-19 in Italy's financial markets stated that with the growth of the virus the health crisis in Italy deepened, even though implementations of strict lockdown had a success, the economic consequences are severe for the country. Even though the initial drop in the equity market in Italy and the rest of the Eurozone was similar in the first months of the COVID-19 pandemic, yet Italy's recovery has been weaker. According to Enilov & Wang (2020), the number of COVID-19 cases has a significant causal impact on stock market returns in such advanced economies as France,

Germany, and other G7 countries. Results show that the growth of the virus established a dominant short-term influence on the stock movements in the selected financial markets. Dias et al. (2020) analyzed the returns in eight European financial markets and indicated the relatively high dispersion around the average and existence of high volatility in February, March, and April 2020: the Greek market has the largest standard deviation and Italian market kurtosis and asymmetry has the highest levels; the results of this research have also revealed that the universal virus outbreak appeared to have a cointegration relation with the SSE, KOSPI and IBEZ 35 markets, however no relation with CAC40, DAX30, and FTSE MIB markets. O'Donnell et al. (2020) examined the response of the equity index to the ongoing COVID-19 pandemic and confirmed that changes in the index were significantly associated with the COVID-19 pandemic; the strongest effects were found in Italy and Spain.

Some researches analyze the impact of the COVID-19 pandemic on financial markets in Central and Eastern European countries. For example, the reaction of stock markets was investigated by Pardal et al. (2020), Tomal (2021), and others. Pardal et al. (2020), in their study of the integration of Central European capital markets in the context of the global COVID-19 pandemic, analyzed financial integration in the stock market indexes from such countries as Slovenia (SBITOP), Czech Republic (PX PRAGUE), Lithuania (OMX VILNIUS) and a couple of others in the Central Europe region. The results of this research indicated the instability experienced in the selected stock market indexes and especially in February and March 2020 months, when the first pandemic impact appeared. Moreover, the authors stated, with the assistance of econometric models, that the COVID-19 pandemic had an impact on the stock indexes of the capital markets of Central Europe; and the degree of financial integration in the chosen markets appeared to be significant, and thus negatively affects the efficiency of portfolio diversification strategies. Tomal (2021) in his research of real estate stock returns and their volatility with the assistance of the GJR-GARCHX model, found out that real estate stock returns in the Poland market were not affected by the first wave of the COVID-19 pandemic; and only afterwards in the second and third wave, the negative effects were visible.

There are also some efforts to estimate the effect on other financial markets in Central and Eastern European countries. For example, Czech et al. (2020) analyzed the impact of COVID-19 on the financial markets of Visegrad Group countries such as Czechia, Slovakia, Hungary, Poland, which were hit by the COVID-19 virus at the beginning of March 2020. The study stresses out that the COVID-19 pandemic had a negative impact on the Visegrad financial markets which in resulted Czech koruna, Polish zloty and Hungarian forint depreciation against the euro currency. The results have also confirmed a negative correlation between pandemic spread and the value of Visegrad Group member states' currencies which were mentioned above. The author's conclusion implies that during the "COVID-19 pandemic, when the Visegrad currencies weakened and stock indices plunged, the volatility was higher" (Czech et al., 2020). Moreover, Klose & Tillmann (2020) found that effects of policy on asset prices rely on the how much European country is exposed to COVID-19 pandemic. If the country is affected by a high growth rate of the virus, then it could also experience an increase in bond yields on days of a fiscal policy announcement.

Despite the increasing number of research in this area, the impact of the pandemic on the Baltic stock market (Lithuania, Latvia, and Estonia) has been examined in a very fragmented way, which confirms the necessity of such an analysis. Thus, further, the methods employed in this research are discussed.

3. Research design

To evaluate the impact of shock caused by the COVID-19 pandemic on the Baltic stock market (Lithuania, Latvia and Estonia), the methods of bivariate linear regression (OLS) and impulse response functions are being employed.

This research aims to assess the impact of the spread of the COVID-19 pandemic on the Baltic stock market during three separate periods: the first wave of the pandemic (1st of March 2020 – 31st of May 2020); the recovery period (1st of June 2020 – 31st of August 2020) and the onset of the second wave of the pandemic (1st of September 2020 – 30th of November 2020).

As significant number of researches in the area employs the simple linear regression models for evaluation of the impact of the COVID-19 pandemic (for example, Zhang et al., 2020; Sansa & Hasan, 2020; Kanapickiene et al., 2020; Ashraf, 2020 and others), to reach the aim of this research, in the first step, we also employ the regression technique, specifically bivariate (OLS) regression model:

$$Y_t = \alpha_0 + \beta_1 X_t + \varepsilon_t \quad (1)$$

where: Y_t is the dependent variable, X_t – independent variable, α - coefficient, t – time, and ε – error term.

The daily and cumulative (total) numbers of confirmed cases of COVID-19 infection in the Baltics (Lithuania, Latvia, and Estonia) were selected as independent, while the OMX Baltic Benchmark GI index was selected as a dependent variable.

In the second step, the impulse response functions based on two-variable VAR models for each pair of the dependent and independent variables are used to determine the response of the Baltic stock market to the shock of the COVID-19 pandemic. To determine the suitable lag selection, Aikake information criteria were used. Impulse response functions and accumulated impulse response functions are analyzed.

The daily data is used. The data of COVID-19 cases in the Baltic States (Lithuania, Latvia, and Estonia) is retrieved from the Our World in Data Coronavirus Pandemic (COVID-19) database and the data of selected stock OMX Baltic Benchmark GI index is retrieved from the Nasdaq Baltic database. Data is analyzed using the Eviews11 software package.

Further, the main results of our research are presented.

4. Results and discussion

In this section, the impact of the spread of the COVID-19 pandemic on the Baltic stock market is being assessed and the reaction of the Baltic stock market to the shock caused by the pandemic is being analysed.

Figure 1 represents the dynamics of the daily and total numbers of confirmed COVID-19 cases in Baltic states (Lithuania, Latvia, and Estonia) during the whole period analysed.

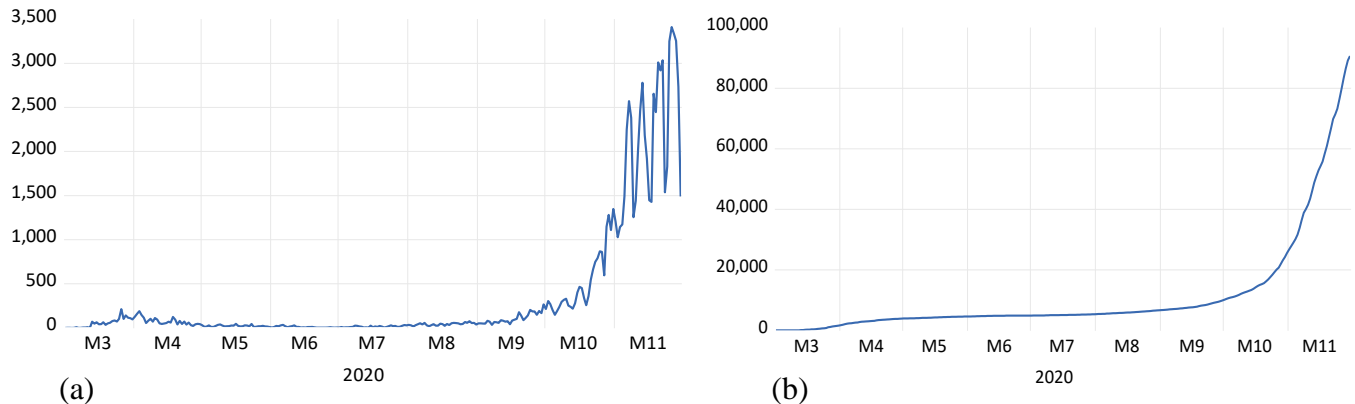


Figure 1. Number of daily confirmed COVID-19 cases Baltic states: daily (Panel a) and total (Panel b), 2020

Source: compiled by the authors on the basis of Our World in Data Coronavirus Pandemic (COVID-19) database

Note: M3 = March; M4 = April; M5 = May; M6 = June; M7 = July; M8 = August; M9 = September; M10 = October; M11 = November.

Figure 2 represents the dynamics of the OMX Baltic Benchmark GI index during the whole period analysed. As this figure confirms, the most severe shock in the Baltic stock market was experienced at the beginning of March 2020, while in later periods, the market began to show strong signs of recovery, i.e. after a significant negative shift in March, the Baltic stock market regained its upward trend and at the end of November 2020 even reached new highs.

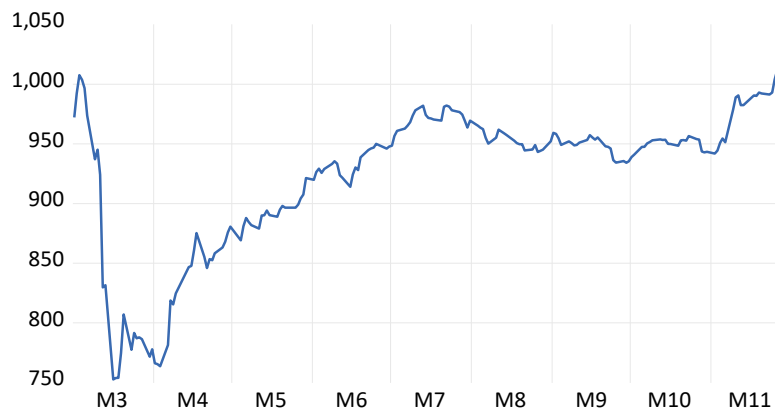


Figure 2. Dynamics of OMX Baltic Benchmark GI index, 01/03/2020 – 30/11/2020

Source: compiled by the authors on the basis of Nasdaq Baltic database data.

Note: M1 = January; M2 = February; M3 = March; M4 = April; M5 = May; M6 = June; M7 = July; M8 = August; M9 = September; M10 = October; M11 = November.

The temporary nature of the market decline seen in Figure 2 raises the necessity of further analysis. The descriptive statistics of selected dependent and independent variables are provided in Table 1.

Table 1. Descriptive statistics of dependent and independent variables

	OMX Baltic Benchmark GI	New Cases in Baltics	Total Cases in Baltics
Mean	925.992	329.789	11268.470
Median	947.670	47.000	5092.000
Maximum	1042.960	3411.000	90694.000
Minimum	752.640	0.000	2.000
Std. Dev.	60.881	716.276	17260.890
Skweness	-1.282	2.773	2.884
Kurtosis	4.027	9.909	10.939
Jarque-Bera	61.052	89.268	1103.593
Probability	0.000	0.000	0.000
Sum	177790.6	90692.00	3098829.0
Sum Sq. Dev.	707945.4	1.41E+08	8.16E+10
Observations	192	275	275

Source: compiled by the authors.

Note: Std. Dev. – Standard Deviation.

Further, the impact of the spread of the COVID-19 pandemic on the Baltic stock market is assessed. As a starting point, we have attempted to assess the impact of the spread of the COVID-19 pandemic on Baltic stock markets using the whole period (03/01/2020 – 11/30/2020) data. The results of this assessment are provided in Table 2.

Table 2. Bivariate regression models for OMX Baltic Benchmark GI (whole period – 03/01/2020 – 11/30/2020)

	Coefficient	Std. Error	t-Value	p-Stat	R sq.	Observ.
New Cases in Baltics						
C	916.398	4.556	201.129	0.000**	0.118	192
NC	0.031	0.006	5.032	0.000**		
Total Cases in Baltics						
C	908.008	4.724	192.202	0.000**	0.200	192
TC	0.002	0.0002	6.898	0.000**		

Source: compiled by the authors.

**99% c.l.

Note: Std. Error – Standard Error; p-Stat = p-Statistics; R sq. = R squared; Observ. = Observations; NC= New cases in Baltics; TC= Total cases in Baltics.

The results in Table 2 allow us to state that the impact of the spread of the COVID-19 pandemic (both in terms of new and total cases) appeared to be statistically significant and positive. This result does not allow to differentiate the market reaction during different phases of the COVID-19

pandemic, as from graphical analysis (Figure 2) initial negative shift as well as subsequent recovery and growth of OMX Baltic Benchmark GI index can be indicated.

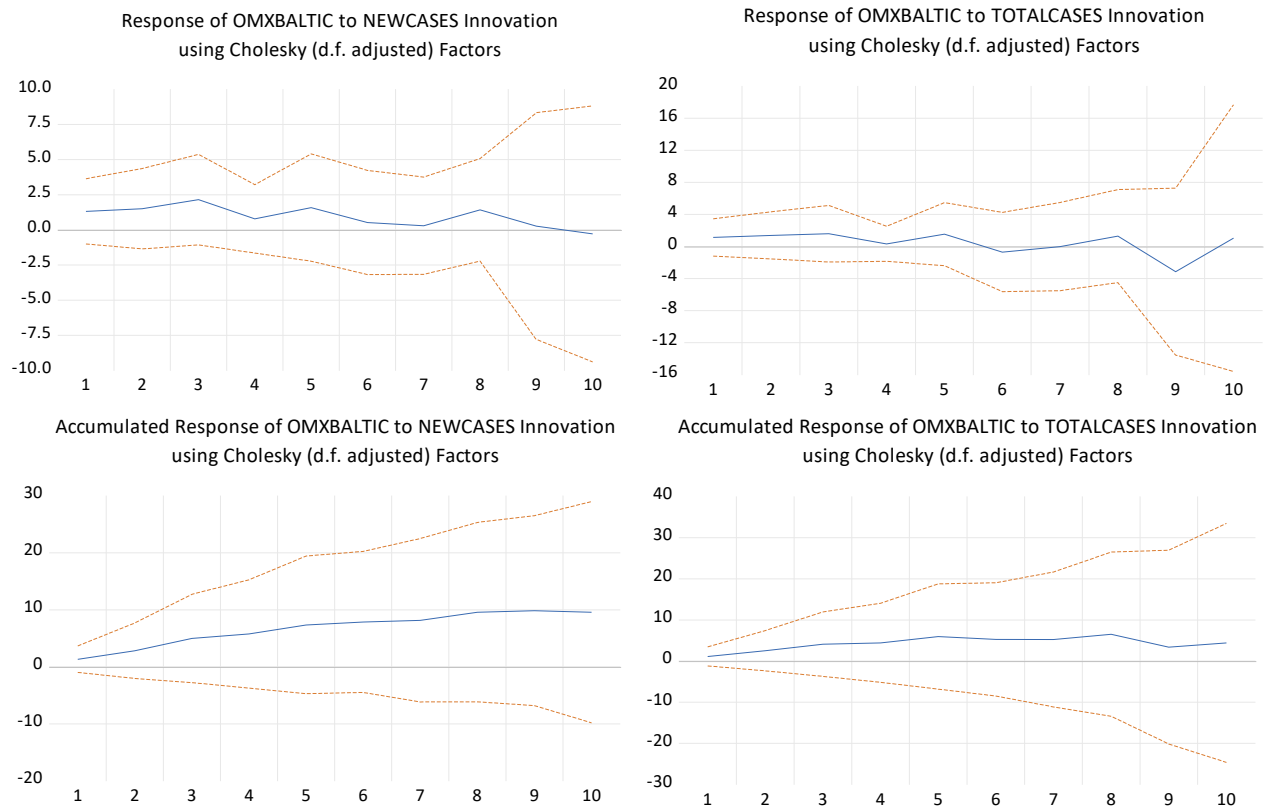


Figure 3. Response OMX Baltic Benchmark GI to the spread of the COVID-19 pandemic in the Baltic states (whole period – 03/01/2020 – 11/30/2020)

Source: compiled by the authors.

Seeking to better assess the primary response of the Baltic stock market index the impulse response functions are constructed. Figure 3 reveals the dynamic effects of COVID-19 daily new cases and total cases on the value of OMX Baltic Benchmark GI index during the whole period. As is can be seen from the figure, the impulse response functions show the initial positive response of value of OMX Baltic Benchmark GI index to the increase of daily and total cases reported in Baltic states; this response appears to be inconstant and turn to negative on day 10 (new cases) and 9 (total cases). The accumulated response appeared to be a positive one. To sum up, the analysis of the whole period does not allow to make unambiguous conclusions about the nature of the reaction of the Baltic stock market to the spread of the COVID-19 pandemic, thus the analysis of market reactions in separate periods is necessary.

Firstly, the impact of COVID-19 on the OMX Baltic Benchmark GI index is analyzed using the data of Period 1 (03/01/2020 – 5/31/2020). The bivariate regression models for the COVID-19 effect in Period 1 are provided in Table 3.

Table 3. Bivariate regression models for OMX Baltic Benchmark GI (Period 1 – 03/01/2020 – 05/31/2020)

	Coefficient	Std. Error	t-Value	p-Stat	R sq.	Observ.
New Cases in Baltics						
C	912.259	8.589	106.215	0.000**	0.524	62
NC	-1.073	0.132	-8.128	0.000**		
Total Cases in Baltics						
C	851.968	14.837	57.421	0.000**	0.010	62
TC	0.004	0.005	0.779	0.439		

Source: compiled by the authors.

**99% c.l.

Note: Std. Error – Standard Error; p-Stat = p-Statistics; R sq. = R squared; Observ. = Observations; NC= New cases in Baltics; TC= Total cases in Baltics.

The results in Table 3 allows to state the following: (i) the impact of the increase of new cases appeared to be statistically significant and negative, i.e. during the first wave of the pandemic, the Baltic stock market was affected negatively, which is also confirmed by the results of graphical analysis (Figure 2); (ii) the impact of the increase of the total cases appeared to be statistically insignificant.

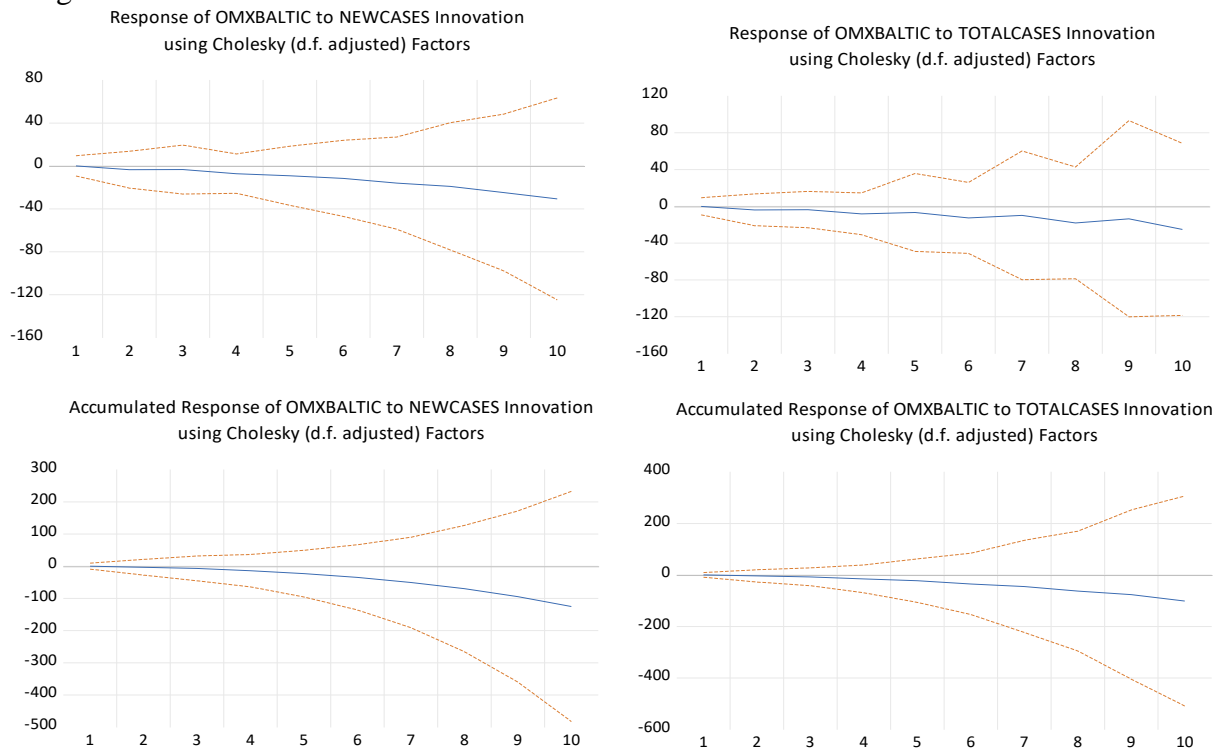


Figure 4. Response OMX Baltic Benchmark GI to the spread of the COVID-19 pandemic in the Baltic states (Period 1 – 03/01/2020 – 05/31/2020)

Source: compiled by the authors.

Figure 4 reveals the dynamic effects of COVID-19 daily new cases and total cases on the value of OMX Baltic Benchmark GI index during Period 1. As is can be seen from Figure 4, the impulse response functions show the initial negative response of value of OMX Baltic Benchmark GI index to the increase of daily and total cases reported in Baltic states; this response appears to become stronger during the next several days. The accumulated response appeared to be negative as well.

Secondly, the impact of COVID-19 on the OMX Baltic Benchmark GI index is analyzed using the data of Period 2 (06/01/2020 – 08/31/2020). The bivariate regression models for the COVID-19 effect in Period 2 are provided in Table 4.

Table 4. Bivariate regression models for OMX Baltic Benchmark GI (Period 2 – 06/01/2020 – 08/31/2020)

	Coefficient	Std. Error	t-Value	p-Stat	R sq.	Observ.
New Cases in Baltics						
C	953.157	3.600	264.759	0.000**	0.001	65
NC	-0.011	0.129	-0.082	0.935		
Total Cases in Baltics						
C	919.366	21.739	42.292	0.000**	0.037	65
TC	0.006	0.004	1.552	0.126		

Source: compiled by the authors.

**99% c.l.

Note: Std. Error – Standard Error; p-Stat = p-Statistics; R sq. = R squared; Observ. = Observations; NC= New cases in Baltics; TC= Total cases in Baltics.

The results in Table 4 allows to state that the impact of the increase of both new and total cases of COVID-19 appeared to be statistically insignificant, i.e. during the recovery period of the pandemic, the Baltic stock market has not been affected by the COVID-19 pandemic statistically significantly, which is also confirmed by the results of graphical analysis (Figure 2).

Figure 5 reveals the dynamic effects of COVID-19 daily new cases and total cases on the value of OMX Baltic Benchmark GI index during Period 2. As is can be seen from Figure 5, slightly different conclusions can be made here since the impulse response functions show the initial negative response of value of OMX Baltic Benchmark GI index to the increase of daily and total cases reported in Baltic states; accumulated response appeared to be negative as well.

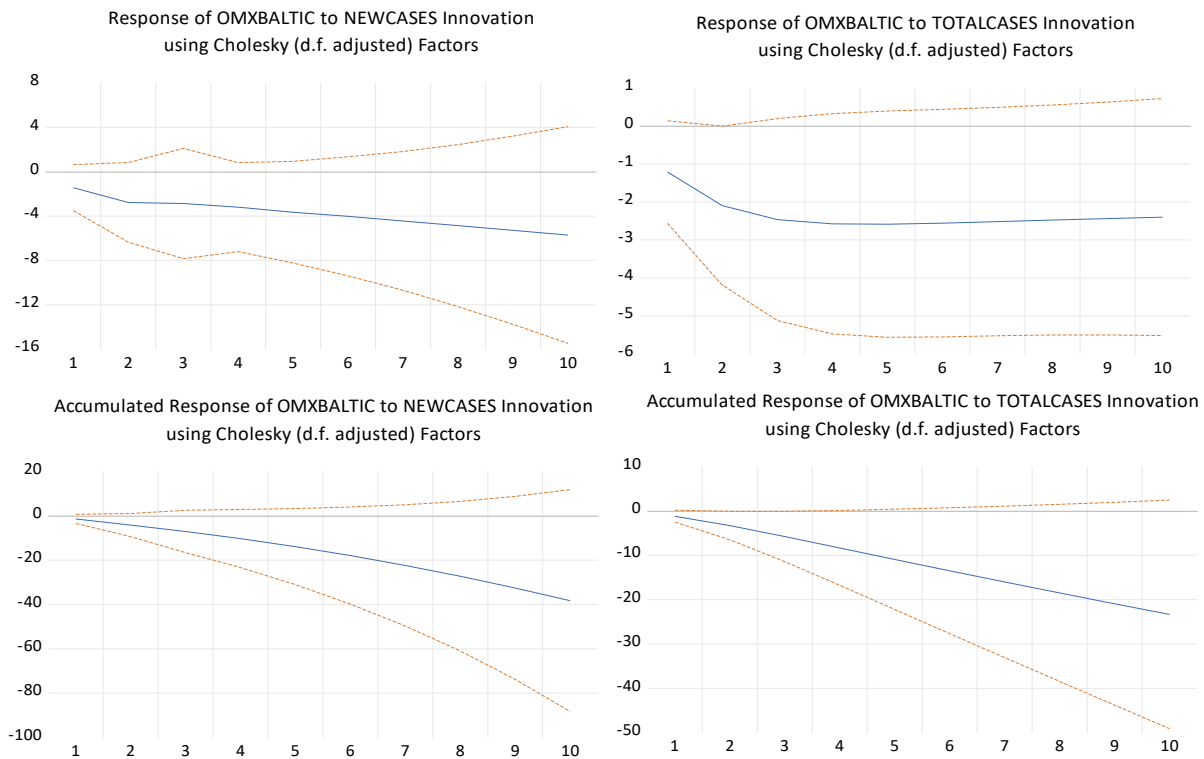


Figure 5. Response OMX Baltic Benchmark GI to the spread of the COVID-19 pandemic in the Baltic states (Period 2 – 06/01/2020 – 08/31/2020)

Source: compiled by the authors.

Finally, the impact of COVID-19 on the OMX Baltic Benchmark GI index is analyzed using the data of Period 3 (09/01/2020 – 11/30/2020). The bivariate regression models for the COVID-19 effect in Period 3 are provided in Table 5.

Table 5. Linear regression models for OMX Baltic Benchmark GI (Period 3 – 09/01/2020 – 11/30/2020)

	Coefficient	Std. Error	t-Value	p-Stat	R sq.	Observ.
New Cases in Baltics						
C	945.162	2.462	383.944	0.000**	0.583	65
NC	0.018	0.002	9.396	0.000**		
Total Cases in Baltics						
C	937.979	1.737	540.060	0.000**	0.831	65
TC	0.001	5.06E-05	17.598	0.000**		

Source: compiled by the authors.

**99% c.l.

Note: Std. Error – Standard Error; p-Stat = p-Statistics; R sq. = R squared; Observ. = Observations; NC= New cases in Baltics; TC= Total cases in Baltics.

The results in Table 5 allows us to state that the impact of the increase of both new and total cases of COVID-19 appeared to be statistically significant and positive, i.e. during the onset of the second wave of the pandemic, the Baltic stock market has been affected positively, i.e. index values increased, which is also confirmed by the results of graphical analysis (Figure 2).

Figure 6 reveals the dynamic effects of COVID-19 daily new cases and total cases on the value of OMX Baltic Benchmark GI index during Period 3.

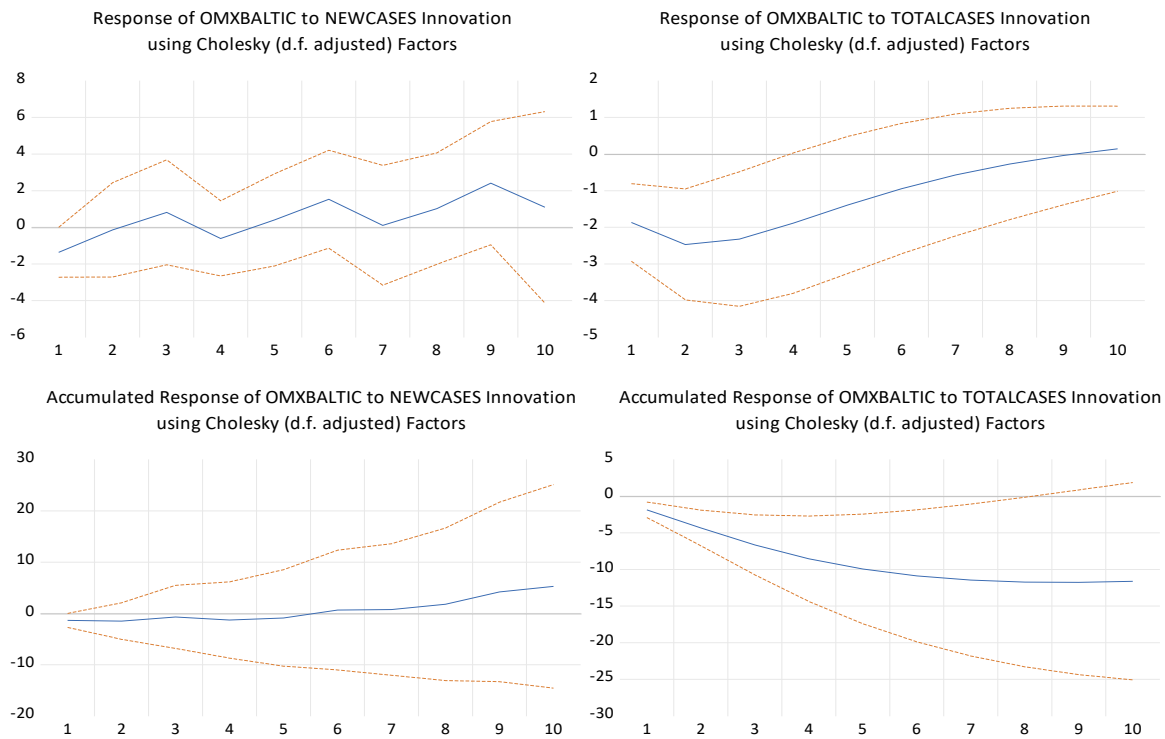


Figure 6. Response OMX Baltic Benchmark GI to the spread of the COVID-19 pandemic in the Baltic states (Period 3 – 09/01/2020 – 11/30/2020)

Source: compiled by the authors.

As is can be seen from Figure 6, although the initial response of value of OMX Baltic Benchmark GI index to the increase of daily and total cases reported in Baltic states appeared to be negative, it seems to turn to positive on days 4 and 6 respectively. Interestingly, the accumulated response to the increase of total cases appeared to be negative, while the initial accumulated response to the increase of new cases was negative but turned to be positive later on in Period 3.

Taking into account the results of three different periods, it can be concluded that the reaction of the Baltic stock market to the spread of the COVID-19 pandemic differs depending on the period investigated: the negative reaction was observed during the first wave of the pandemic, almost no reaction appeared to be seen during the recovery period in summer, while on the onset of the second wave of the pandemic the stock market increased, i.e. has not demonstrated negative reaction. The results of our research are consistent with the results of Sansa & Hasan (2020),

Gormsen & Koijen (2020) and Kanapickiene et al. (2020) as they emphasize the temporary negative reaction of stock markets at the beginning of the COVID-19 pandemic.

Conclusions

Analysis of OMX Baltic Benchmark GI index dynamic revealed that the most severe shock in the Baltic stock market was experienced at the beginning of March 2020; however, after a significant negative shift in March, the Baltic stock market regained its upward trend and at the end of November 2020 even reached new highs.

The analysis of a longer period (comprising several different by nature stages of the pandemic) does not allow to differentiate the market reaction during different phases of the COVID-19 pandemic, which is why the estimation based on a shorter period data is necessary.

The research revealed that the reaction of the Baltic stock market to the spread of the COVID-19 pandemic differs depending on the period investigated: the negative reaction was observed during the first wave of the pandemic, almost no reaction appeared to be seen during the recovery period in summer, while on the onset of the second wave of the pandemic the stock market increased, i.e. has not demonstrated negative reaction.

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