Early Warning Signals From Global Financial Markets at the Beginning of Covid -19 Pandemic

Covid-19 Salgını Başlangıcında Küresel Finansal Piyasalardan Erken Uyarı Sinyalleri

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Abstract: The Covid-19 Pandemic pose health security risks all over the world and makes its effects felt in every field. The objective of this paper is to observe the response of the financial markets of countries with the highest global health security index (GHSI) when the pandemic cases started and to guide investors. The main areas of the index are prevention, detection, reporting, rapid response, health system, compliance with international norms and risk environment. Many indicators are monitored under these basic areas. The motivation point of the study is that comparing the financial markets of countries with the highest global health security index has never been investigated. The top 5 countries selected are as follows: The United States, The United Kingdom, The Netherlands, Australia and Canada. In the selection of the stock exchange, the most known indexes of the countries on a global scale and the highest trading volume are taken. The common transaction days are taken as a basis short period that starts on 28 February 2020 and ends on 15 May 2020. This study showing early warning signals from global financial markets will also be a guide for future studies and long-term analysis. Dumitrescu Hurlin Panel Causality Test applied to the data; the causality from death and case rates to stock market returns is investigated. Hidden causality is important in decision making. Investors should make international investments by thinking in detail about the assets in their portfolio. In the near future, the importance of hidden causality relations research and early warning signals that occur with the effect of financial contagion will increase.

Structured Abstract: This study is a multi-country analysis and observes the global contagion effect and hidden causality. Under the Covid-19 Pandemic, the financial markets are uncertain, and investors cannot predict their next steps. Today, technological developments and the momentum gained by communication networks have simplified the transfer of investment instruments. Countries are in financial competition with the development of their stock exchanges, although sometimes there are restrictions for countries, opening up capital markets and gaining an international identity has become a common goal. International portfolio investments are made by savers purchasing securities from international markets in order to get returns.

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Another feature of the international investments is that they provide investors with more alternative investment opportunities at different risk and return levels. Investors maintain balance by diversifying while creating their portfolios. Investing in one security or one sector or one country can be very risky, as different investment instruments increase in different sectors and different countries in the portfolio, success increases. It is important to distribute the risk and keep the balance. Portfolio integrity should be ensured without complicating management. Faced with the problem of uncertainty during the pandemic process, the investor does not have objective information about the possibilities of possible consequences. If international capital markets were fully integrated with each other, it would not be meaningful to pursue international portfolio diversification. The differences make international diversification attractive to investors. With diversification, the risk can be reduced, but the uncertainty problem cannot be completely eliminated, and the investors do not have an objective knowledge of the probabilities of possible outcomes.

The unknown timing of the pandemic and the inability to predict its future affect all areas of life, it is necessary to carry out studies in terms of health, but its contagiousness to all sectors, social factors, difficulties in economic and financial decisions are important. Other dimensions should not be overlooked while focusing on health.

The crisis in health sector is also a threat to financial markets and investors. Investment alternatives are compared to countries that are considered to be safe for the continuation of financial stability. It is important to show safe direction to investors in a crisis environment so that they can provide portfolio diversification. Reducing risks in an uncertain environment supports financial stability. This research article, which deals with the first period of the pandemic, examines the early reactions and signals in financial markets. This study is based on answers from following questions:

- Does the Pandemic death and case rates affect global financial market returns?

- Are market returns of countries with high score of health security index affected by the pandemic?

- Is financial markets returns volatility an early warning signal with the effect of global contagion?

The COVID-19 is confirmed as an ongoing pandemic according to WHO on the 11th March 2020 but situation reports of the Coronavirus disease can be accesible since late 2019 when first observed in Wuhan city, Hubei, China. Worldwide studies have been examined in detail. Studies in the literature are covered and compared in a comprehensive way.

The countries selected for this study are The United States, The United Kingdom, The Netherlands, Australia and Canada. For country selection, the 5 countries with the highest global health security index created by John Hopkins University are considered. This index is a tool developed to evaluate the global health security of a country. It is the first comprehensive health security index in which 195 countries are included in the calculations. The index average is 40.2 out of 100. For the index, it is seen that international preparations for epidemic and pandemic are very weak, even in high-income countries, the index average has increased to 51.9 level. The index evaluates the health security capabilities of countries with 6 categories and 34 indicators and 85 sub indicators, findings are obtained from open source answers from countries with 140 questions (GHSI, 2019).

All of the stock returns data are obtained in the period beginning from February 28, 2020 to May 15, 2020, considering the days when all stock markets are open. The reason why the panel causality test, which is used as a research method, is preferred is due to the non-linear properties of the financial data. Nonlinear structures of financial data should be captured and observed clearly before and after the pandemic. One-way panel causality test is applied following the assumption that international investors invest in these 5 countries which affect one another.

This study provides panel causality analysis of the impact of the COVID-19 pandemic on financial markets. The great uncertainty of the pandemic and its associated economic losses has caused financial markets to become highly volatile and unpredictable. Global stock markets linkages display clear different patterns before and after the pandemic announcement. Financial markets give early warning signals. General results are:

- Positive shocks in the rate of COVID-19 cases bring about negative shocks in stock market indexes.

- Negative shocks in the rate of COVID-19 cases bring about positive shocks in stock market indexes.

As a result of the study, it can be suggested that researchers should conduct longer-term research, examine different investment instruments, consider the transaction volumes of investors, observe more countries, examine the behavioral finance dimension, and compare with previous health crises.

Keywords: Finance**,** Covid-19 Pandemic, Global Health Security Index, Financial Markets, Dumitrescu Hurlin Panel Causality Test.

JEL Codes: C58, G10, I15

Öz: Covid-19 Pandemisi tüm Dünyada sağlık güvenliği riski oluşturmakta ve her alanda etkilerini hissettirmektedir. Bu çalışmanın amacı, Covid-19 pandemisi vakaları başladığında en yüksek küresel sağlık güvenlik endeksine (GHSI) sahip ülkelerin finansal piyasalarının tepkisini gözlemlemek ve yatırımcılara rehberlik etmektir. Endeksin temel alanları önleme, tespit, raporlama, hızlı karşılık verme, sağlık sistemi, uluslararası normlara uygunluk ve risk ortamıdır. Bu temel alanlar altında birçok gösterge izlenmektedir. Çalışmanın motivasyon noktası, en yüksek küresel sağlık güvenliği endeksine sahip ülkelerin finansal piyasaları karşılaştırmasının hiçbir zaman araştırılmamış olmasıdır. Seçilen ilk 5 ülke şu şekildedir: Amerika Birleşik Devletleri, Birleşik Krallık, Hollanda, Avustralya ve Kanada. Borsa seçiminde ise ülkelerin küresel ölçekte en bilinen ve işlem hacimleri en yüksek endeksleri alınmaktadır. Ülkeler için vaka başlangıçlarına göre ortak işlem günleri alınmakta olup 28 Şubat 2020'de başlayan ve 15 Mayıs 2020'de sona eren kısa vade ele alınır. Küresel finansal piyasalardan erken uyarı sinyallerini gösteren bu çalışma diğer yandan gelecekteki çalışmalar ve uzun vadeli analizler için bir rehber olacaktır. Dumitrescu Hurlin Panel Nedensellik Testi uygulanan verilerde; ölüm ve vaka oranlarından borsa getirilerine doğru nedensellik araştırılmaktadır. Salgının yatırım davranışlarını değiştireceği beklenmektedir. Saklı kalmış nedensellikler karar vermede önemlidir. Yatırımcılar portföylerindeki varlıklar üzerinde detaylı düşünerek uluslararası yatırım yapmalıdır. Yakın gelecekte ise finansal bulaşma etkisiyle meydana gelen saklı nedensellik ilişkileri araştırmaları ve erken uyarı sinyallerinin önemi artacaktır.

Anahtar Kelimeler: Finans, Covid-19 Pandemisi, Küresel Sağlık Güvenliği Endeksi, Finansal Piyasalar, Dumitrescu Hurlin Panel Nedensellik Testi.

1. Introduction

The Covid-19 Pandemic threatens health security worldwide. The Global Health Security Index[1] (GHSI, 2019) also questions whether countries are ready for a pandemic while calculating their scores based on many criteria. By the end of the year 2019, the first Covid-19 case was detected in the Wuhan City in the Hubei province of China. Due to the high mobility in the world, the Coronavirus spread in a very short time, and the process continued with the pandemic announcement of the World Health Organization on 11 March 2020 (WHO, 2020).

As the number of cases increased, countries introduced tighter quarantine precautions. The global financial markets and the world economy experience one of the largest negative information shocks. Sectoral restrictions have also been a sign of great economic uncertainty and unpredictability. The extent of the pandemic process and its negative effects on the economy will cover the coming years, and it may change behavioral finance trends and increase fears in the stock market (Naidenova et al., 2020). In order to avoid economic losses, investors started to look for secured areas and alternative investment instruments from the first days.

This study looks for an answer to the question of how financial markets reacted to the Covid-19 pandemic spread effect. Figure 1 illustrates ratios from daily confirmed cases for the selected countries (Appendix A-1). Figure 2 illustrates the stock markets indexes for the selected countries (Appendix A-2). The paper is organized as follows. The introduction section provides general information about the pandemic, GHSI and stock markets. The data and methodology section gives the properties and source of the sample. The empirical results/findings section focuses on uncovering

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[1] GHSI is the abbreviation of The Global Health Security Index.

the nonlinear structure in the financial markets and observing movements in hidden structure by Panel Causality Analysis. Empirical results are explained step by step. The conclusion section discusses and interprets the results and makes recommendations for future studies. All proofs are in the Appendix.

2. Literature Review

The unknown timing and unpredictable future of the pandemic affects all areas of life. It is undoubtedly the health sector that comes to mind first, and research is increasing day by day. While focusing on healthy individuals in a human-centered approach, it is important not to overlook other dimensions, especially economic and financial ones.

When the literature is analyzed from a conceptual perspective, the effects of the pandemic are based on economic indicators and commercial dimensions (Cardona-Arenas & Serna-Gómez 2020; Ayittey et al., 2020; Baker et al., 2020; Ma et al., 2020; Mzoughi et al., 2020), especially the responses of the aviation sector (Lau et al., 2020) and tourism sector (Acar 2020; Günay et al., 2020), the volatility of stock index returns (Ahmar & Del Val 2020; Al-Awadhi et al., 2020; Alber 2020; Ceylan 2020; Eloriaga 2020; Estrada et al., 2020; Günay 2020; İzzeldin 2020; Kanno 2020; Liu 2020; Naidenova et al., 2020; Onali 2020; Pata 2020; Sansa 2020; Yılmazkuday 2020; Wang & Enilov 2020; Zeren & Hızarcı 2020), investors' portfolio preferences, recommendations of alternative investment instruments and discussions on transition to digital life (Corbet et al., 2020a; Kakushadze & Liew 2020; Yarovaya et al., 2020), investor sentiment by fears and biases (Albulescu 2020; Bansal 2020), scenarios and policies for a new normal (Chohan 2020; McKibin & Fernando 2020; Meier & Smith 2020; Elenev et al., 2020), sustainability-based corporate resilience (Albuquerque 2020; Cheema-Fox et al., 2020; Ding et al., 2020) and also comparing the process to previous crises (Alfaro et al., 2020; Arner et al., 2020; Goodell 2020).

Different situations stand out in studies related to the effects of the Covid-19 Pandemic on stock index returns in the financial markets. Country selection is carried out through similar criteria, which have a high spread of outbreak or poor number of confirmed cases (Alber 2020; Zeren & Hızarcı 2020). The Chinese stock markets are the most preferred by authors to investigate pandemic effects on return volatility over the world (Al-Awadhi et al., 2020; Alber 2020; Estrada et al., 2020; Gunay 2020; Liu 2020; Naidenova et al., 2020; Sansa 2020; Zeren & Hızarcı 2020). The Chinese financial markets are monitored in almost every study, especially since being the starting point of the outbreak and having a high share of the global supply chain. There are also studies dealing with the economies of the most developed countries (G7) (İzzeldin 2020; Pata 2020; Wang & Enilov 2020). According to authors who select stock market index from sectors and customize their results, the general finding is that the pandemic affects sector index returns (Kanno 2020; Liu 2020). The health and services sectors are the most affected sectors, and the telecommunication and technology sectors are the least affected sectors by the pandemic (İzzeldin 2020). This situation may be explained by individuals in quarantine maintaining communication, technological tool requirements in remote working methods and alternative hobby searching. Finally, some studies focus on stock market returns by addressing a single country (Ahmar & Del Val 2020; Eloriaga 2020; Onali 2020; Yılmazkuday 2020), but other ones question whether there are contagious effects considering links among many countries (Corbet et al., 2020b; Estrada et al., 2020; Gunay 2020; Yarovaya et al., 2020).

The similarity of this study is using the "Dumitrescu - Hurlin (2012)" method for causality (Wang & Enilov 2020). The difference of this study is the criterion of country selection by the highest GHSI scores.

3. Data and Methodology

The countries selected for this study are The United States, The United Kingdom, The Netherlands, Australia and Canada. The selection criteria were based on the GHSI. GHSI was created to evaluate health security and related skills in 195 countries that were party to international health regulations. It is a project of Nuclear Threat Initiative (NTI) and Johns Hopkins Center for Health Security (JHCHS), developed by the Economist Intelligence Unit (EIU). The calculation of the index is an elaborate and comprehensive work based on 140 questions in 6 categories, 34 indicators, and 85 sub-indicators. The purpose of calculating the GHSI is to encourage countries to improve national health security and to reduce the risk of infectious outbreaks that could lead to pandemics. Countries with higher scores on the GHSI have better health security than others. In the study, the top 5 countries in the GHSI according to 2019 data, namely the USA, UK, Netherlands, Australia and Canada were selected as target countries. Table 1 shows the GHSI Scores for the selected countries (Appendix A-3). The most recognized stock market indexes of the most important stock exchanges in these 5 countries were taken as the first data set. Information about the stock indexes of the selected countries within the scope of the study is given respectively. The Standard and Poor's 500 Index (SPX) consists of 500 stocks weighted by their capital. The index is designed to measure the performance of the local economy through the collective market value of 500 shares representing all major industries. The UK Financial Times Exchange 100, commonly known as FTSE 100 or 'Footsie', is the stock price index of the 100 largest companies listed on the London Stock Exchange (LSE). FTSE 100 represents approximately 81% of the entire market size of LSE and is considered the best indicator of UK shares, although it does not cover the entire market. S&P ASX 200 is Australia's primary stock market index. The index comprises the 200 largest ASX-listed stocks and acts as the benchmark for Australian equity performance. S&P TSX Composite Index has provided investors with a primary indicator of market activity for the Canadian equity markets since it launched in 1977. With approximately 95% coverage of the Canadian equities market, it is the primary gauge for Canadian-based, Toronto Stock Exchange listed companies (Bloomberg, 2020). AEX is a free float market capitalization weighted index that reflects the performance of the 25 largest and most actively traded shares listed on the Euronext Amsterdam, and it is the most widely used indicator of the Dutch stock market. The index serves as an indicator for structured products, funds, exchange traded funds, options and futures (Euronext, 2020). The second data set comprised of the daily rates of COVID-19 cases in these 5 countries. All data were obtained in the period beginning from February 28, 2020 to May 15, 2020, considering the days when all stock markets were open.

The aim of the study was to seek an answer for the following question: does the COVID-19 pandemic affect the stock markets in the 5 countries which are the most secure (on account of the presence of international financial investors) according to the GHSI during the COVID-19 pandemic? For this purpose, one-way panel causality test was applied following the assumption that international investors invest in these 5 countries which affect one another. The reason that the causality test was performed in one-way from the rate of COVID-19 cases to stock market indexes was because a relation in the reverse direction, *i.e.* stock market indexes affecting COVID-19 cases was not likely.

First of all, panel unit root tests were performed on the series. The tests applied were the panel unit root test of Levin, Lin & Chu (LLC), Breitung's (2000) panel unit root test, the panel unit root test by Im, Pesaran, & Shin (2003), and the Fisher-type unit root test. Panel unit root degrees of the series were found as a result of these tests. One of the first panel unit root tests, the Levin, Lin & Chu (LLC) was first proposed by Levin and Lin in 1992, generalized for autocorrelation and heteroscedasticity analysis in 1993, and finally published in 2002 with primary study findings. Breitung's (2000) panel unit root test is quite similar to LLC panel unit root test. Its main difference is the use of ordered versions of series as opposed to the LLC test where the series themselves are used. Im, Pesaran & Shin (2003) developed the LLC test under the alternative hypothesis to allow

heterogeneity for the value of p and proposed a simple test procedure based on the average of individual unit root test statistics. Furthermore, Maddala & Wu (1999) and Choi (2001) developed a nonparametric test that combined the p-values of test statistics obtained from individual unit root tests. The basic and alternative hypotheses of these two unit root tests are the same as the IPS panel unit root test. Maddala & Wu (1999), arguing that calculating the mean value of ADF test statistics was not the most effective way to evaluate stationarity, suggested to use Fisher test statistics, which led to the development of Fisher-type panel unit root tests (Liew *et al.,* 2009:5).

As for an inter-series causality test, Dumitrescu and Hurlin's (2012) panel causality test was used. Dumitrescu and Hurlin (2012) argue that the causality relation that applies to a particular economic event is likely to be valid also for other countries. For this reason, they proposed a panel causality test, suitable for a greater number of observations. The test they developed was a Granger-causality test developed as a panel.

In the Dumitrescu-Hurlin panel Granger-causality test, where X and Y represent two stationary processes observed for N units during the period T, the following linear pattern for the heterogeneous model is taken into account for each unit (i) at the time t:

$$y_{i,t} = \propto_i + \sum_{k=1}^{K} \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^{K} \beta_i^{(k)} x_{i,t-k} + \varepsilon_{i,t} \qquad \text{(Equation1.)}$$

Here, it is assumed that individual effects ($\propto_i$) are constant and the lag length K is the same in horizontal sections. The basic and alternative hypotheses tested with this model are as follows:

$$H_0 = \beta_i = 0 \qquad \forall i = 1, \dots, N$$
$$H_1 = \beta_i = 0 \qquad \forall i = 1, \dots, N_1$$
$$H_1 = \beta_i \neq 0 \qquad \forall i = N_1 + 1, \dots, N$$

The basic hypothesis entails that there is no Granger-causality relation between variables, whereas in the alternative hypothesis there is a Granger-causality relation between variables at least in one unit. Even though a heterogeneous model was used, the expected result was homogeneous for the basic hypothesis and a heterogeneous one for the alternative hypothesis. The basic hypothesis was tested with the simple average of individually calculated Wald statistics.

4. Empirical Results

First of all, the panel unit root tests of the series were tested. Table 2 below summarizes the unit root test results:

Table 2: Panel Unit Root Test Results

Stock Market Indices						
TEST	**On Level**			**1st Difference**		
	Model*	**Statistic**	**Prob.**	**Model***	**Statistic**	**Prob.**
Levin, Lin & Chu t	C + T	-1.44242	0.0746**	C + T	-7.49916	0.0000**
Breitung t-stat	C + T	0.37421	0.6459	C + T	-8.57121	0.0000**
Im, Pesaran and Shin W-stat	C + T	-0.11868	0.4528	C + T	-8.28803	0.0000**
ADF - Fisher Chi-square	C + T	7.67731	0.6603	C + T	75.8176	0.0000**
PP - Fisher Chi-square	C + T	6.16902	0.8009	C + T	183.152	0.0000**
COVID-19 Case Rates						

TEST	On Level			1st Difference		
	Model*	Statistic	Prob.	Model	Statistic	Prob.
Levin, Lin & Chu t	C + T	-1.62970	0.0516**	---------------	---------------	---------------
Breitung t-stat	C + T	-2.98947	0.0014**	---------------	---------------	---------------
Im, Pesaran and Shin W-stat	C + T	-5.21270	0.0000**	---------------	---------------	---------------
ADF - Fisher Chi-square	C + T	48.1547	0.0000**	---------------	---------------	---------------
PP - Fisher Chi-square	C + T	124.089	0.0000**	---------------	---------------	---------------

*Model: constant and trend.
**Significant

According to the results summarized in Table 2, stock market data of 5 countries is stationary in the 1st difference in the fixed and trending model as a panel. As for the rate of COVID-19 cases in these 5 countries, it is stable as a panel at the level of fixed and trending model.

The Dumitrescu and Hurlin (2012) test was applied to the series for causality calculation based on the rate of COVID-19 cases to stock market indexes, with stock market data $I(1)$ and COVID-19 cases $I(0)$. Table 3 below summarizes the test results:

Table 3: Dumitrescu and Hurlin (2012) Panel Causality Test Results

Causality Status	Lags	W-Stat.	Zbar-Stat.	Prob.
Causality From COVID-19 Case Rate To Stock Market Index	1	4.66724	5.30254	1.E-07
Causality From COVID-19 Case Rate To Stock Market Index	2	9.43122	7.46472	8.E-14
Causality From COVID-19 Case Rate To Stock Market Index	3	11.1067	6.48167	9.E-11

According to the results summarized in Table 3, there is no causality between stock exchange indexes and COVID-19 cases of the 5 countries from the rate of cases towards the stock market indexes. Nonetheless, it should be noted that in a short-term analysis like this hidden causations might exist between positive/negative components of series. In consideration of this, at this stage of the study the series were divided into positive/negative components and unit root tests, as well as the Dumitrescu and Hurlin (2012) test were performed again. Table 4 summarizes the unit root test results of the series components:

Table 4: Panel Unit root Test Results of Positive and Negative Components

Stock Market Indices (positive component)						
TEST	On Level			1st Difference		
	Model*	Statistic	Prob.	Model*	Statistic	Prob.
Levin, Lin & Chu t	C + T	2.49836	0.9938	C + T	-6.56864	0.0000**
Breitung t-stat	C + T	-0.98826	0.1615	C + T	-8.71641	0.0000**
Im, Pesaran and Shin W-stat	C + T	3.50620	0.9998	C + T	-8.05098	0.0000**

	Model*	Statistic	Prob.	Model	Statistic	Prob.
ADF - Fisher Chi-square	C + T	1.43801	0.9991	C + T	73.3286	0.0000**
PP - Fisher Chi-square	C + T	1.86285	0.9973	C + T	161.135	0.0000**

COVID-19 Case Rates (positive component)						
TEST	**On Level**			**1st Difference**		
	Model*	**Statistic**	**Prob.**	**Model**	**Statistic**	**Prob.**
Levin, Lin & Chu t	C + T	-4.81604	0.0000**	C + T	--------------	--------------
Breitung t-stat	C + T	-6.20401	0.0000**	C + T	--------------	--------------
Im, Pesaran and Shin W-stat	C + T	-7.48669	0.0000**	C + T	--------------	--------------
ADF - Fisher Chi-square	C + T	66.9962	0.0000**	C + T	--------------	--------------
PP - Fisher Chi-square	C + T	192.867	0.0000**	C + T	--------------	--------------

Stock Market Indices (positive component)						
TEST	**On Level**			**1st Difference**		
	Model*	**Statistic**	**Prob.**	**Model***	**Statistic**	**Prob.**
Levin, Lin & Chu t	C + T	-8.23792	0.0000**	C + T	-1.48138	0.0693**
Breitung t-stat	C + T	--------------	--------------	C + T	3.31815	0.9995
Im, Pesaran and Shin W-stat	C + T	-4.87639	0.0000**	C + T	1.24720	0.8938
ADF - Fisher Chi-square	C + T	44.6696	0.0000**	C + T	3.63385	0.9624
PP - Fisher Chi-square	C + T	28.4662	0.0015**	C + T	2.00594	0.9963

COVID-19 Case Rates (negative component)						
TEST	**On Level**			**1st Difference**		
	Model*	**Statistic**	**Prob.**	**Model**	**Statistic**	**Prob.**
Levin, Lin & Chu t	C + T	-8.46125	0.0000**	C + T	-1.70759	0.0439**
Breitung t-stat	C + T	--------------	--------------	C + T	2.37719	0.9913
Im, Pesaran and Shin W-stat	C + T	-6.15577	0.0000**	C + T	0.35347	0.6381
ADF - Fisher Chi-square	C + T	61.2625	0.0000**	C + T	18.9265	0.0412**
PP - Fisher Chi-square	C + T	102.580	0.0000**	C + T	45.9727	0.0000**

According to the results summarized in Table 4, the positive component of the stock market data is stationary in the 1st difference in the stationary and trending model as a panel and the negative component is stationary at the degree of stationary and trending model as a panel. Both positive and

negative components of the data on the rate of COVID-19 cases are stationary at the degree of the stationary and trending model as panel.

The Dumitrescu and Hurlin (2012) test was performed again on the series for causality calculation based from the rate of COVID-19 cases to stock market indexes with the stock market data positive component I(1), negative component I(0), and the rate of COVID-19 cases positive and negative components I(0). Table 5 below summarizes the test results:

Table 5: Dumitrescu and Hurlin (2012) Panel Causality Test Results (Separated into Series Components)

Causality Status	Lags	W-Stat.	Zbar-Stat.	Prob.
Causality From COVID-19 Case Rate[+] To Stock Market Index[+]	1	0.69591	-0.51014	0.6100
	2	3.22967	1.15434	0.2484
	3	7.70120	4.28239	4.E-07
Causality From COVID-19 Case Rate[+] To Stock Market Index[-]	1	4.10608	4.49009	7.E-06
	2	7.60653	5.62243	2.E-08
	3	6.25195	2.53520	0.0112
Causality From COVID-19 Case Rate- To Stock Market Index[-]	1	10.7489	14.2292	0.0000
	2	5.96669	3.95020	8.E-05
	3	5.92666	2.26934	0.0232
Causality From COVID-19 Case Rate- To Stock Market Index[+]	1	0.81503	-0.33579	0.7370
	2	7.07120	5.06329	4.E-07
	3	8.70928	4.52777	6.E-06

According to the results summarized in Table 5, two causations were identified:
- Positive shocks in the rate of COVID-19 cases bring about negative shocks in stock market indexes.
- Negative shocks in the rate of COVID-19 cases bring about positive shocks in stock market indexes.

5. Conclusion

Global health security may not be sufficient even for a country in the high-income group. This situation contains threats and indicates that they are not prepared for epidemic and pandemic. It is stated that health security is a very comprehensive process, and the scoring and weighting system for the index should be reconsidered (Razavi et al., 2020). According to the GHSI of 195 countries with an average score of 40.2 out of 100, it causes bio-security, laboratory systems, trade restrictions, recovery plans, investor sentiment and portfolio diversification and financing problems and many more. The health security capacity in every country should be transparent and regularly measured, and the results should be published.

In this study, in which the financial markets were observed, we could state that investors who love risk have turned into investors who avoid risk with the Covid-19 pandemic. Volatilities in the stock markets increased. While evaluating investment alternatives from different countries, one may see that investors shape their portfolios according based on the case rates. Research findings support investors and decision-makers for next steps.

In the study by Wang and Enilov (2020) who examined the effects of the epidemic process on stock market index returns by considering G7 Economies, for Canada and USA Stock Exchanges,

causality from cases to stock market returns was determined by the same method. Estrada et al. (2020) determined that USA S&P 500 Index was affected by the outbreak process, but this market reaction tendency had a short period. Onali (2020) also stated that USA S&P 500 Index was mostly affected by China's case reports.

For further studies, it may be recommended to update the analysis with current data and reach new results. Additionally, analysis may be carried out by considering the ranking of countries according to different income groups or different geographical regions based on GHSI sub-filters.

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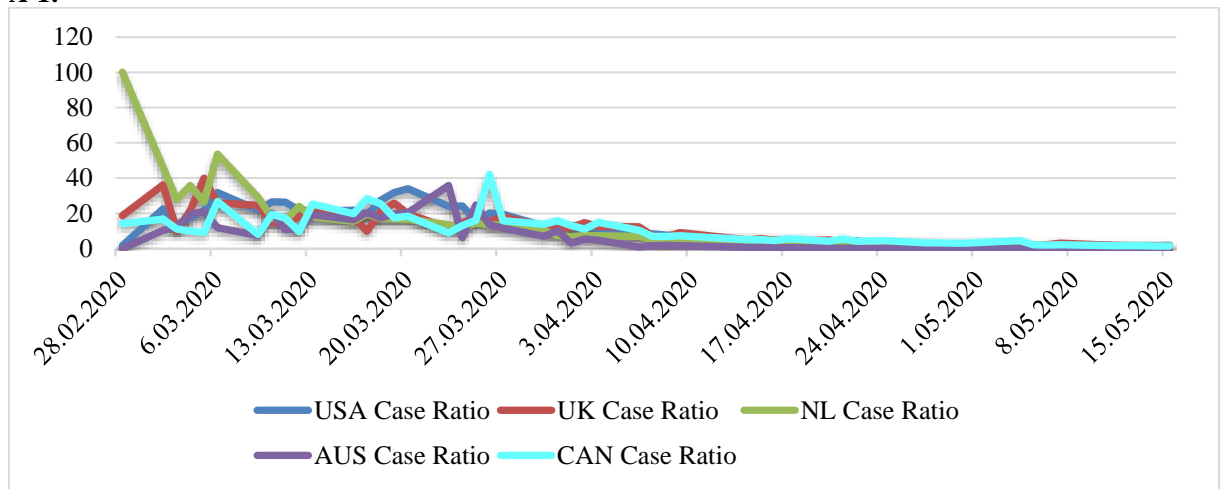
Appendix A

A-1:

Fig. 1: Covid-19 Pandemic Daily Case Ratios From Selected Countries
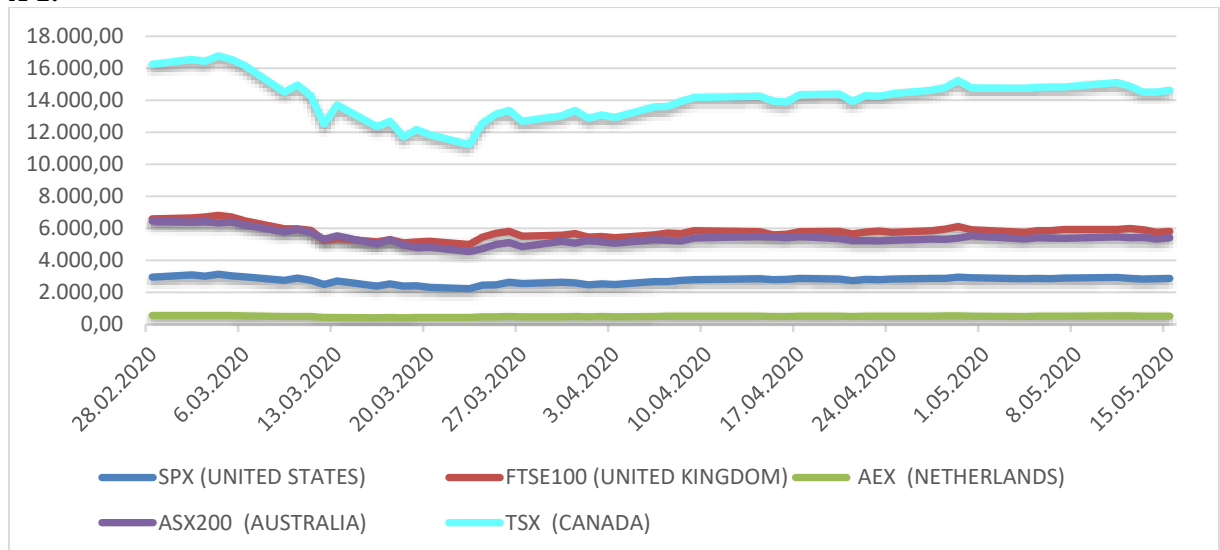
A-2:

Fig. 2: Stock Markets Indexes From Selected Countries

A-3:

Table 1: Global Health Security Index Scores

GLOBAL HEALTH SECURITY INDEX SCORES*					
Rank	Country	Index Score	Region	Population	Income
1	United States (USA)	83.5	Northern America	100m+	High income
2	United Kingdom (UK)	77.9	Europe	50-100m	High income
3	Netherlands (NL)	75.6	Europe	10-50m	High income
4	Australia (AUS)	75.5	Oceania	10-50m	High income
5	Canada (CAN)	75.3	Northern America	10-50m	High income

*https://www.ghsindex.org/