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CORONAVIRUS (COVID-19) AND STOCK MARKETS:

THE EFFECTS OF THE PANDEMIC ON THE GLOBAL ECONOMY

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ABSTRACT

The novel coronavirus (COVID-19) virus, which emerged in Wuhan City, Hubei Province of China, spread to other countries over time and was declared a global epidemic by the World Health Organization (WHO) on March 11, 2020. With the epidemic, curfews were imposed, workplaces closed, production decreased, shopping stopped, except for basic supplies. COVID-19 endangered human health as well as increased risk perception in financial markets. Large decreases occurred in stock markets in a short time, companies lost value, stock prices dropped. This study investigates the effect of COVID-19 outbreak on global markets between January 21, 2020 and April 7, 2020. Global markets are represented by Morgan Stanley Capital International (MSCI)' World, emerging market, European and G7 indices. Fourier Cointegration test detects that a long-term relationship between stock markets and COVID-19.

Keywords: Coronavirus, COVID-19, Stock Exchanges, MSCI, Fourier

Jel Codes: G10, G15, F37, F65

INTRODUCTION

On the 31st of December 2019, the World Health Organization (WHO) China Country Office announced that an unknown virus was seen in Wuhan City, Hubei Province of China. On 7 January 2020, Chinese officials announced that a new type of corona virus was seen in China. On 13 January 2020, the Ministry of Public Health, Thailand announced that a new type of virus has been detected from lab-confirmed novel coronavirus (COVID-19) in Wuhan. As of 20 January 2020, 282 confirmed cases of COVID-19 and six deaths have been reported from four countries including China, Thailand, Japan and the Republic of Korea (WHO, 2020).

COVID-19 cases exceeded 118,000 in 114 countries, 4,291 people died on March 11, 2020, WHO has made the assessment that COVID-19 can be characterized as a pandemic disease[3]. From March, the outbreak began to appear widely outside China, especially in Europe and the United States, and Europe became the center of the outbreak. As of April 14, 2020, the number of cases of COVID-19 worldwide is 1.844.863 and the number of deaths is 117.021.

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[3] https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on covid-19---11-march-2020 20.03.2020

The countries with the most common cases are USA 553.822, Spain 169.496, Italy 159.516, Germany 125.098, France 97.050 and The United Kingdom 88.625 respectively. The countries with the highest number of deaths from the COVID-19 outbreak are USA 21.972, Italy 20.465, Spain 17.489, France 14.946, The United Kingdom 11.329 and China 3,351[4].

Before the COVID-19 outbreak, outbreaks such as Ebola, Severe Acute Respiratory Syndrome (SARS), and Middle East Respiratory Syndrome (MERS) were also seen at the global level. However, none of these outbreaks have reached the round size of the COVID-19 outbreak. The first Ebola virus disease (EVD) happened in Central Africa. Ebola outbreak was discovered in 1976 and reached its highest level in the 2014-2016 period in West Africa[5]. Ebola has been mostly seen in Sub-Saharan West African countries (Guinea, Siera Leona, Liberia) and finally in Nigeria[6]. The Ebola virus disease, which was swallowed between 2013 and 2016, left after nearly 28.000 infections and 11.000 deaths in West Africa (Edu-Afful, 2018: 241). The SARS coronavirus virus was identified in 2003. SARS is thought to be an animal virus and the first infected people in southern China's Guangdong province in 2002. The SARS outbreak affected 26 countries and caused more than 8.000 cases in 2003[7]. From October March 5, 2012, the total number of laboratory-confirmed MERS infection cases was reported to the WHO, with 2.521 to 866 associated deaths worldwide. The majority of these cases were reported from Saudi Arabia. MERS globally reported cases from 27 countries[8].

The impact of the outbreak on global markets began to increase rapidly as the COVID-19 outbreak was not began to prevent it from spreading despite strict quarantine measures in China and the outbreak began to appear in other countries, particularly in European countries, other than China. The stock markets have suffered sharp declines since the last week of February 2020. Between 01st of January 2020 and 4st of April 2020, stock market indices were in the historical low state Dow Jones -26%, S&P500 -24%, FTSI100 -29%, DAX -29%, NIKKEI225 -23%, Nasdaq -18% and Shanghai -10% fell down. In the same time, crude oil price fell by -53%. The COVID-19 epidemic has affected global markets, economies, asset prices, businesses and employees as well as human health. For these reasons, the impact of the COVID-19 global outbreak on world stock markets has been investigated at a global level.

COVID-19 AND STOCK MARKETS

The COVID-19 outbreak caused a decline in financial markets in January 2020, but that decline didn't last long and losses were quickly compensated. January's and February's decline was generally in Asian markets, especially in China. In China despite the strict measures taken in to account, it was impossible to prevent the spread of virus to other countries, so the global stock markets collapsed. The declines in the stock markets were further increased when the WHO announced COVID-19 as a global pandemic on March 11, 2020. 1 January 2020 – 1 April 2020, MSCI World Index -25%, MSCI Emerging Markets Index -26%, MSCI Europe Index -27% and G7 Index -25% depreciated (Figure 1).

[4] https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports/ 15.04.2020
[5] https://www.who.int/health-topics/ebola#tab=tab_1 26.03.22020
[6] https://www.who.int/health-topics/ebola#tab=tab_1 26.03.22020
[7] https://www.who.int/ith/diseases/sars/en/ 24.03.2020
[8] https://www.who.int/emergencies/mers-cov/en/ 26.03.2020

According to the IMF, there was $83 billion capital outflows from emerging market exchanges in the period 21 January 2020 and March 21, 2020[9].

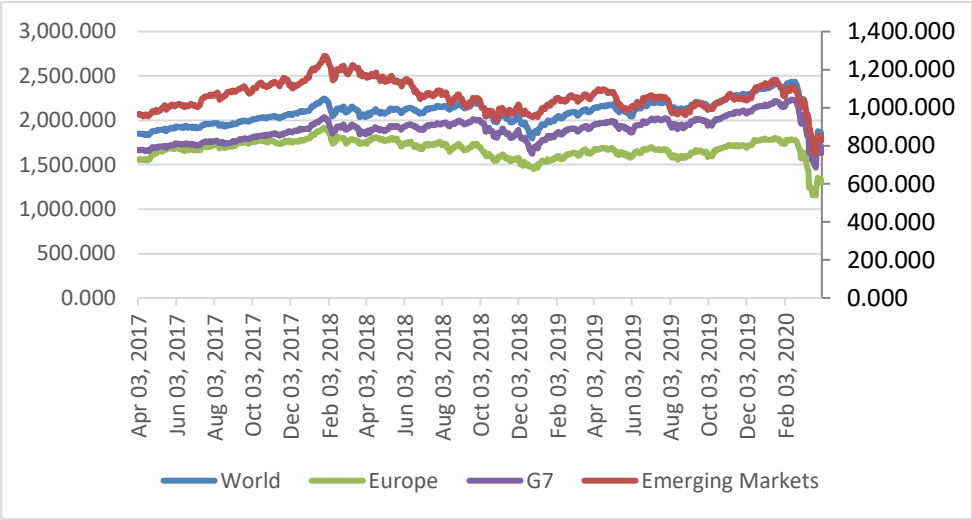

Figure 1: Stock Markets (MSCI Indices)

January 2, 2020 – March 27, 2020, there were significant changes in market yields in general, but the reflection of these changes on the sectors showed differences (Figure 2). Some sectors have significant declines, while increases occurred in some sectors. The sector where the decline occurred most is airlines. Apart from this sector, there have also been declines in consumer services, precious metals and minerals, insurance, capital markets, utilities, transportation non airlines, real estate, integrated oil and gas, gold and banks. However, there have been increases in the biotechnology, food and staples retailing, telecominication services, healty care equipment and suppliers sectors. According to United Nations Conference on Trade and Development (UNCTAD) data, growth rate over previous year as of 25 March 2020, world primary commodity prices overall declined by 37.3%. Looking at sectoral distributions, energy decreased by 55%, industrial metals by 18%, agriculture by 7% and livestock by 15%, while precious metals prices increased by 5% (UNCTADa, 2020: 8).

[9]https://www.paraanaliz.com/2020/ekonomi/fed/piyasa-analiz-fedin-verdigini-kongre-caldi-44950/ 23.03.2020

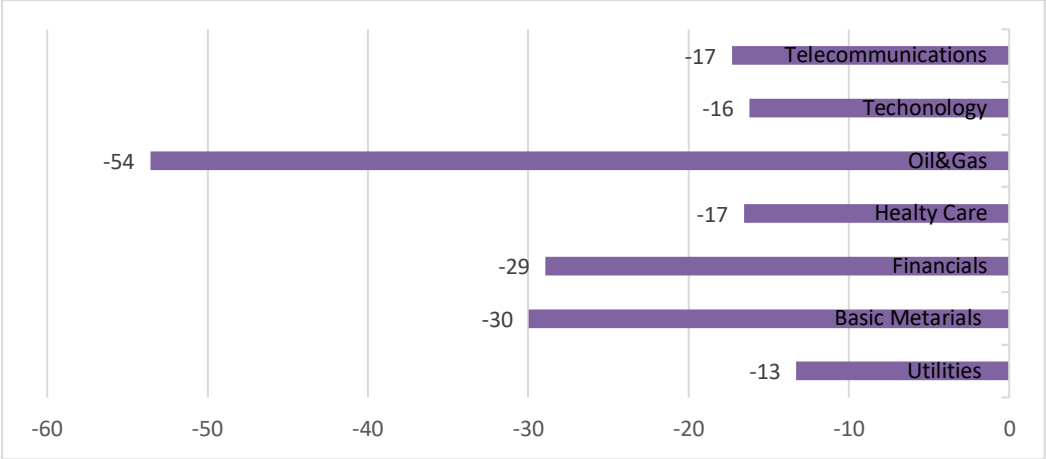

Figure 2: Cumulative Return (%), Jan 2 through Mar 27, 2020, Dow Jones

During this period, some stock markets have had big declines, while some stock markets increased. The stock markets in which the value decreases are Belguim, Netherlands, Sweden, United States, Germany, Portugal and Switzerland respectively. The stock markets in which the value increases are Taiwan, Hong Kong, Singapore, Israel, China, South Korea (Wang et al, 2020)[10].

Significant increases occured in volatility index (VIX), showing global risk appetite (Table 1). Compared to past high-risk events, COVID-19 coronavirus is understood to pose a significant risk to the markets.

Table 1: Previous High Volatility Events (VIX)

Crisis Event	Event Date	VIX at Event date
Covid-19 Coronavirus	3/18/2020	84,57
US/China trade war	12/24/2018	36,07
Chine Currency	8/24/2015	40,74
US Debt	8/8/2011	48,00
European Debt	5/7/2010	40,95
Global Financial Crisis	9/29/2008	46,72
9/11	9/17/2001	41,76

Source: https://www.msci.com/www/blog-posts/the-coronavirus-market-impact/01732620365

What the impact of the outbreak will be on the global financial system and the global economy depends on some circumstances. The first and most important of these is the extent to which the outbreak will continue. The number of cases and deaths from the outbreak is steadily increasing. This indicates that the COVID-19 outbreak will continue. Second, it depends on the measures that the country's economies will take against the effects of the outbreak.

In times of financial crisis, people's financial needs are increasing more. Without financial markets, this need cannot be met. It is difficult to take advantage of markets during periods of increasing uncertainty. Policymakers, central banks and market participants need accurate and reliable information in managing crisis conditions.

[10] https://www.msci.com/www/blog-posts/the-coronavirus-market-impact/01732620365 20.03.2020

Stock markets try to maintain sustainable, reliable and flexible in these processes. Stock markets enable businesses to fund, investors to price assets and manage risk appropriately, and central banks and policy makers to promote financial stability; they should be allowed to do so with appropriate support from policymakers (Sukumar, 2020)[11].

Bans and restrictions were enforced on short-selling transactions in order to prevent sharp declines in the stock market. According to The World Federation of Exchanges (WFE) CEO Nandini Sukumar (2020)[12], banning short-selling markets are preventing price formation and increasing uncertainty. This can increase volatility and create an effect on the contrary, hampering stock markets' ability to serve the real economy.

While global markets have experienced sharp declines from COVID-19 pandemics, countries, international economic and financial institutions have announced economic and financial measures, aid and protection packages to combat COVID-19.

The U.S. Senato passes $2.2 trillion aid package to fight COVID-19 to meet the liquidity needs of the credit market and to support markets[13]. Of this amount, $532 billion consists of financial support to large corporations and local governments, bond purchases, $290 billion is direct aid to families, $290 billion is tax deductions, $377 billion is aid and loan support to small businesses, $260 billion is unemployment payments, $126 billion is support to hospitals and health care systems, and the rest is other support. The U.K. announces that 80% of the salaries of those unable to go to businesses due to COVID-19 will be covered by the government by up to £2,500 at month. Value Added Tax (VAT) payments were deferred for 3 months to help businesses pay their employees and keep things going. £30 billion in cash is provided to businesses through tax deferral, which accounts for 1.5% of GDP[14]. Germany has generated a €500 billion loan package to support companies affected by the outbreak. The scope of export credit and guarantee letters has been extended, tax payments deferred. A program has been prepared for salary support for those who cannot go to work due to the outbreak and are on leave[15]. €25 billion emergency package was announced in Italy. Employees will be paid €500 for one time. Loan and mortgage payments will be postponed. €100 billion loan guarantee fund has been created to meet the liquidity needs of companies in Spain[16]. The Australian Government has announced a $ 200 billion economic and financial support package[17]. On March 18, 2020, Turkey announced an economic package of 100 billion Turkish liras ($15 billion) and an 18-point economic package in terms of tackling COVID-19.

[11]Sukumar, N. (CEO) https://www.world-exchanges.org/news/articles/world-federation-exchanges-issues-statement-covid-19-and-market-volatility 30.03.2020
[12]https://www.world-exchanges.org/news/articles/world-federation-exchanges-warns-against-short-selling-bans 30.03.2020
[13]https://www.independent.ie/videos/us-senate-passes-22-trillion-dollar-aid-package-to-fight-coronavirus-39077709.html 27.03.2020
[14]https://www.hurriyet.com.tr/galeri-son-dakika-corona-virus-haberi-salgin-ne-zaman-bitecek-uzmanlar-tarih-verdi-41474088 21.03.2020
[15]https://tr.euronews.com/2020/03/19/turkiye-100-milyar-liralik-onlem-paketi-acikladi-diger-avrupa-ulkeleri-ne-yapti-covid-19 22.03.2020
[16]https://tr.euronews.com/2020/03/19/turkiye-100-milyar-liralik-onlem-paketi-acikladi-diger-avrupa-ulkeleri-ne-yapti-covid-19 22.03.2020
[17] https://www.bloomberght.com/avustralya-200-milyar-dolarlik-rekor-tesvik-acikladi-2251557 30.03.2020

The European Union (EU) has created a €37 billion budget to support health care systems and businesses in member states[18]. The EU has launched the process of enforcing a retract clause in Stability and Growth Pact, which limits public spending. The Stability and Growth Pact includes strict rules limiting public spending and budget deficits of EU member states. The EU's decision will release the restriction on public spending of member states during times of crisis. Under EU rules, the budget deficits of member states are limited to 3% of GDP and public debt is limited to 60% of GDP[19].

The International Monetary Fund (IMF) has decided to provide the Rapid Credit Facility (RCF) about US$ 165.99 million to cash support countries to meet the urgent balance of payment needs from the outbreak of the COVID-19[20]. The World Bank (WB) and International Finance Corparation (IFC) will do $14 billion package of financing to support companies and countries in their efforts to prevent to the rapid spread of COVID-19[21]. WB also expects to deploy up to $160 billion to help countries protect the poor and support businesses, and economic recovery[22]. The Federal Reserve Bank (FED) would lend to eligible borrowers, taking as collateral certain types of assets purchased by the borrower from Funds. The Department of Treasury would provide $10 billion as credit protection to the Reserve Bank. Swap agreements have been made between the FED and the central bank of many countries in order to meet the need for cash and liquidity [23].

The COVID-19 emerged from Wuhan city of China and spread worldwide. The COVID-19 outbreak, especially the quarantine imposed in Wuhan, has affected China economically and the world economy based on China. Wuhan is one of the important trading centers of China. There are more than 300 factories in the city. These factories include 500 of the world's largest companies, including SAP, PSA and Microsoft, China contributes 16.3% to world GDP and is the main provider of worldwide growth (Ayittey et. al., 2020: 473). China will suffer an output loss from 3,9% to 4,6%, and the global impact of this output loss will be around 1%. It is also worth noting that about 40% of the impact comes indirectly from network production structure inside China and the global trade network (Luo and Tsang, 2020: 8).

The world economy has shown slow recovery and low growth following the 2008 global financial crisis and the subsequent European debt crisis. COVID-19 has significantly affected economic activities at the global level. In many countries, factories closed, production decelerated, sales of businesses fell, employment declined. Due to the decrease in production and sales that will occur with the COVID-19 effect, the world economy may grow below expectations in 2020.

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[18] https://www.bloomberght.com/ab-kovid-19-tedbirlerini-onayladi-2251618 30.03.2020

[19] https://www.hurriyet.com.tr/galeri-son-dakika-corona-virus-haberi-salgin-ne-zaman-bitecek-uzmanlar-tarih-verdi-41474088 21.03.2020

[20] https://www.imf.org/en/News/Articles/2020/04/03/pr20133-madagascar-imf-executive-board-approves-disbursement-to-address-the-covid-19-pandemic 04.04.2020

[21] https://www.ifc.org/wps/wcm/connect/news_ext_content/ifc_external_corporate_site/news+and+events/news/covid-19-response 20.03.2020

[22] https://www.worldbank.org/en/news/feature/2020/04/02/the-world-bank-group-moves-quickly-to-help-countries-respond-to-covid-19 04.04.2020

[23] https://www.federalreserve.gov/newsevents/pressreleases/monetary20200320a.htm 21.03.2020

IMF's Managing Director Kristalina Georgieva for 2020 said that it is negative a recession at least as bad as during the global financial crisis. Likewise, OECD warned that the shock from the virus is already bigger than the 2007-2009 global financial crisis, UNCTAD announced that by 2020, growth in the world economy would fall below 2% and the value of the world economy loss would be $1 trillion[24] (Figure 3).

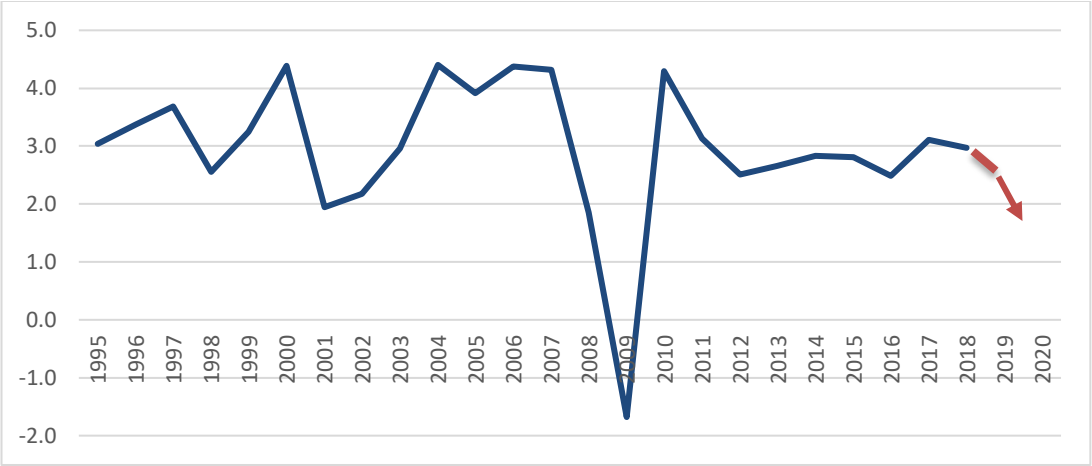

Figure 3: World GDP Growth (Annual%)

According to UNCTADb (2020) global foreign direct investment (FDI) flows will decrease by 5% -10%. If COVID-19 is brought under control, this decrease will remain at 5%, if COVID-19 is not brought under control, FDI investments will decrease by 15%.

The impact of the COVID-19 financial crisis depends on several factors: The first is the speed at which the virus spreads. The second is when to find vaccines and drugs. The last one is the health, economic and financial measures to be taken by governments (UNCTADc, 2020).

There are two possibilities regarding the economic consequences of COVID 19. The first is the short-lived of the outbreak and a V-shaped recovery through economic and financial measures. The other one is the long-term epidemic of COVID-19, its economic and financial results are large and recovery is U-shaped (UNCTADc, 2020). Despite these two situations, the effects of the outbreak in the services sector may be in the form of L (Mann, 2020:82). In sectors such as tourism and transportation, the impact of the epidemic could be much greater, and it could take many years for service sectors to recover.

Seven different scenarios have been made in relation to the COVID-19 outbreak by McKibbin and Fernando (2020). Scenario 1-3 the epidemic is a reflection of the economic and financial impact of the situation in China on other countries due to the isolation of the epidemic in China. Scenario 4-6 is that shocks associated with the epidemic occur at different degrees in all countries. Scenario 7 is a recurrence of a mild outbreak for an indefinite time each year.

[24]https://www.weforum.org/agenda/2020/02/coronavirus-economic-effects-global-economy-trade-travel 04.04.2020

Table 2: GDP Loss in 2020 (% Deviation from baseline)

Country/Region	S04	S05	S06	S07
Australia	-2,1	-4,6	-7,9	-2,0
Brazil	-2,1	-4,7	-8,0	-1,9
China	-1,6	-3,6	-6,2	-2,2
India	-1,4	-3,1	-5,3	-1,3
Rest of Euro Area	-2,1	-4,8	-8,4	-1,9
France	-2,0	-4,6	-8,0	-1,5
Germany	-2,2	-4,6	-7,0	-1,7
South Africa	-1,8	-4,0	-7,0	-1,5
Italy	-2,1	-4,8	-8,3	-2,2
Japan	-2,5	-5,7	-9,9	-2,0
United Kingdom	-1,5	-3,5	-5,9	-1,5
Rest of World	-1,5	-3,5	-5,9	-1,5
Mexico	-0,9	-2,2	-3,8	-0,9
Canada	-1,8	-4,1	-7,1	-1,6
Rest of OECD	-2,0	-4,4	-7,7	-1,8
Rest of Oil-Producing Countries	-1,4	-3,2	-5,5	-1,3
Argentina	-1,6	-3,5	-6,0	-1,2
Russia	-2,0	-4,6	-8,0	-1,9
Saudi Arabia	-0,7	-1,4	-2,4	-1,3
Turkey	-1,4	-3,2	-5,5	-1,2
United States	-2,0	-4,8	-8,4	-1,5
Other Asia	-1,6	-3,6	-6,3	-1,5
Indonesia	-1,3	-2,8	-4,7	-1,3
Republic of Korea	-1,4	-3,3	-5,8	-1,3

Source: McKibbin and Fernando, 2020: 21

Scenario 4-6 shows that the outbreak is spreading in all countries on a global scale. Scenarios 4, 5 and 6 represent low, medium and high levels, respectively. It shows that the COVID-19 epidemic will be in accordance with scenario 6 as of early April. According to this scenario, by 2020, developed economies will decrease by between 7% and 9%, emerging countries by 5-8% and rest of the world by 5.9%. According to McKibbin and Fernando, in 2020, GDP is expected to decrease by $9.170 billion in total (Table 2).

LITERATURE REVIEW

The literature explores the economic and financial results of diseases and epidemics such as Ebola, AIDS, H7N9, especially SARS. Especially, researches examining the effects of SARS disease are outnumbered more than others. On the other hand, although it has been a short time since the appearance of the COVID-19 epidemic, it has attracted attention in studies investigating the effects of COVID-19.

Nippani and Washer (2004) look for the effect of SARS on the stock markets of China, Canada, Indonesia, Hong Kong, Singapore, Philippines, Vietnam and Thailand. SARS had no negative effect on the affected countries' stock markets with the exception of Vietnam and China. Loh (2006) examines that the effect of SARS on the performance of airline stocks listed at the stock markets of Canada, China, Thailand, Hong Kong and Singapore during 1 December 2002-5 July 2003.

In the study, it is seen that SARS has a negative effect on the return of airline stocks, and SARS a negligible effect on the volatility of market returns, except in Singapore where volatility was significantly increased. Chen et al (2009) analyze the impact of the SARS outbreak on the Taiwan's stock market during September 25, 2002 to May 21, 2003. Results show that the SARS crisis did bring negative effect on retail and the wholesale and tourism sectors. However, the biotechnology sector has shown positive effect.

Qui et al (2018) investigates the impacts of SARS and Influenza A Virus Subtype (H7N9) in 2003 in China. In the study, both H7N9 and outbreaks of SARS have had an impact on China, causing significant negative impacts the economy, the economic impact of H7N9 was seen to be less than SARS. Chen et al (2018) analyze the effect of SARS epidemic on the long-term relationship between four Asian stock markets (Japan, Taiwan, Hong Kong and Singapore) and China in the period 1998-2008 with weekly data. In the study, it has been observed that SARS epidemic weakens the long-term relationship between the four markets and China.

Some researches has been seen on the Ebola outbreak, which is seen at the global level. Giudice and Paltrinieri (2017) in African countries in 2006-2015, with monthly data on 78 mutual fund samples, investigate the impact of the capital flow of the Ebola virus. In the study they find that the Ebola outbreak had a negative and statistically significant impact on the flow of capital to mutual funds, attracting investors to their savings from the funds. Ichev and Marinc (2018) in the period from January 2014 to June 2016, the Ebola outbreak has investigated the effect on companies' stock returns. The study show that the Ebola outbreak has an effect on the stocks of companies of their operations to the West African countries (WAC) and the U.S. and that volatility increases after the Ebola outbreak.

Some researches has been carried out on the COVID-19 outbreak, which has been seen around the world for several months and has not yet been discontinued. Luo and Tsang (2020) analyze economic impact of the COVID-19 on Chine and global economy. In the study, it is seen that will 4% loss of output from labor loss, and global output drops by 1% also the impact of indirect about 40% global economy through the supply chain in the Chinese economy. Estrade et al (2020) examines the economic impact of the coronovirus on China's economic performance. They indicate that the growth of the Chinese economy will grow 4,3% in 2020, hence the Chinese economy can lose a margin between 1,9% to 2% its growth. Zeren and Hizarci (2020) investigate the impact of COVID-19 in the period 23 January 2020-13 March 2020. The study results has shown that there is a cointegration relationship between COVID-19 deaths and stock markets, and that COVID-19 epidemic cases have cointegration with the SSE, KOSPI and IBEX35 indices, whereas there is no cointegration relationship with the FTSE MIB, CAC40 and DAX30 indices.

As distinct from the outbreaks mentioned above, there are studies investigating the effects of diseases such as AIDS, Bluetongue Virus Serotype. Bloom and Mahal (1997) 51 countries, 1980-1992 period, it is seen that the AIDS epidemic causes to slow economic growth, albeit at a low level, in the study. Gethmann et al (2020) investigated the economic effects of Bluetongue virus serotype (BTV-8) in Germany during 2006-2018. The study determines 132 (73%) and 48 (27%) million Euros for direct and indirect costs.

Armien et al (2008) examine economic cost of the 2005 dengue epidemic in Panama. Health spending was determined as a total cost of $ 11.8 million, government spending to control the outbreak was $ 5 million, economic cost of $ 16.9 million ($ 5.22 per capita). Similarly, Perez-Guerra et al (2012) investigates the economic costs of dengue public health problem in Puerto Rico between 2002 and 2007. The total cost of dengue vector control is $ 46.22 million for the years 2002-2007.

Pendell and Cho (2013) investigates the impact of foot-and-mouth disease (FMD) outbreak on stock markets in 2000, 2002 and 2010, separately, in South Korea. The results show that FMD outbreak affects the stock market, that the market reaction is more gradual than abrupt, increasing the volatility of the disease's daily returns.

DATA AND ECONOMETRIC METHODOLOGY

In order to carry out econometric applications, COVID-19 cases and death numbers representing the epidemic and MSCI indices that World, European, Emerging Market and G7 are used. As of the data range, the coronavirus emerged as of 21 January 2020 and the end date is determined as 07 April 2020. The data are at the daily frequency, and the dead numbers and case numbers for the coronavirus are obtained from the WHO official website www.who.int, and the daily closing data for the stock markets at www.msci.com.

Many methods are used during econometric analysis. In traditional unit root tests such as ADF, PP and KPSS, serious structural changes in time series are ignored. Structural changes in the analysis of time series are of great importance. Structural developments in time series can be caused by various reasons such as epidemic, economic crises, political changes and wars. At this point, it is of high importance that said structural changes cannot be detected by traditional econometric methods. Therefore, spurous or false findings are achieved by using traditional methods. On the other hand, Zivot Andrews (1992) and Lumsdaine-Papell (1997) developed methods that take into account structural breaks. (Çil Yavuz, 2015, 308). However, the disadvantage of these tests is that they internally determine the number of structural breaks and cannot take into account a large number of smooth transient structural breaks.

A fourier series is an expansion in the form of an infinite sum of a periodic *yt* function, cosine and sinuses. Fourier KPSS tests developed by Becker et al. (2006) use trigonometric functions to capture large variations from the mean of the dependent variable. The advantage of this test is that it takes into account a large number of soft transient structural breaks. The econometric model of this test, can be explained as follows;

$$y_t = \lambda_0 + \lambda_1 \sin(\frac{2\pi kt}{T}) + \lambda_2 \cos(\frac{2\pi kt}{T}) + v_t$$

Where, *T* denotes the sample size, λ_1 and λ_2 fourier coefficients, π 3.1416, and *k* is the frequency used to find the optimal value that makes the sum of residual squares the least.

In order to apply this test, it is necessary to first obtain *k*, which gives the sum of the smallest residual squares in the model. After determining the optimal frequency (*k*), it is decided whether the *F* statistic obtained from the model is significant or not. This evaluation is carried out by comparing the obtained statistics with the critical values in the article of Becker et al. (2006). At the last stage, the series of residual squares of the series whose optimal frequency is determined is created and traditional KPSS test is applied to this series. Thus, the existence of unit root will be investigated in the KPSS test in fouirer form. The test is designed to make the best estimate in case the breaks are gradual. Trigonometric terms are used to identify unknown nonlinear states and KPSS (1992) type stationarity test is suggested by emphasizing that the unit rooted zero hypothesis has decreased power in stationary series. According to this method, the zero hypothesis point outs that the series are stationary, while the alternative hypothesis demonstrates that the series has a unit-rooted structure. (Beşel and Uygun, 2017).

In the study, the long-term relationship between variables is investigated by Tsong et al. (2015) Fourier Cointegration. This method operates in a similar manner as the FKPSS unit root test and uses the same mathematical formula presented above. In this context, FKPSS unit root test results are obtained in the absence of independent variable and fourier function according to the method in question. If the independent variable is available and the fourier function is not significant, Shin (1994) cointegration test results will appear. The significance of the test statistics regarding the Fourier function will reveal the cointegration test results of Tsong et al. (2015) in the form of fourier. In this way, the method will be called the Fourier Shin cointegration test. This test derives strong results against the form and number of structural changes using trigonometric functions. Thus, the Fourier cointegration test can go beyond a certain number of structural breaks in traditional methods, and determine many soft transition structural breaks. This method shows that there is a cointegration relationship in the null hypothesis opposite the conventional cointegration tests, and the alternative hypothesis shows that there is no cointegration (Yılancı et al., 2017).

The empirical findings, conclusions and policy suggestions obtained in the following sections of the study will be included.

EMPIRICAL FINDINGS

The first process to decide on the cointegration tests used in examining the relationships between the variables is to determine the stationarity levels. In this context, Becker et. al. Fourier KPSS unit root test (2006) is used to determine the stationarity levels of the series. According to the results obtained, all case and index series have unit roots in level values. As a result of the first difference, it is seen that the mentioned series are stationary. Because while the test statistics at the level are above the critical values, the test statistics decreases below the critical value and become stationary as a result of the first difference taking. Findings related to the test in question are presented in Table 3.

Table 3: Fourier KPSS Unit Root Test Results

	F (k)	Level	First Dif.
Total Case	1	0.2371	0.0208***
Total Death	1	0.2086	0.0177***
MSCI World	1	0.1792	0.022***
MSCI European	1	0.1969	0.0371***
MSCI G7	1	0.1738	0.0209***
MSCI Emerging Markets	1	0.2072	0.0308***

Note: The critical values were obtained from the study named "Becker, R., Enders, W. ve Lee, J. (2006). A Stationary Test in the Presence of an Unknown Number of Smooth Breaks, Journal of Time Series Analysis, 27 (3), 381-409". *** 99%, ** 95% and * 90% represent level of significance with reliability.

According to the results, fourier frequency is determined as one for each cointegration relationship and the total cases moves together with each stock market in the long run. Moreover, each stock market has a cointegrated structure with the total deaths in the long run. It is understood that the zero hypothesis cannot be rejected when the test statistics are compared with the critical values. For this reason, the null hypothesis is accepted, which indicates the existence of a long-term relationship between the series. In such a case, the existence of the cointegration relationship allowed to test the significance of trigonometric terms. In this case, the coefficients are found to be significant since the f statistic is above the critical values. The main advantage of this test is that it takes into account structural changes with smooth transition structural transition.

Table 4: Fourier Cointegration Test Results

	MinSSR	F (k)	F_m (k)	T_m (k)
Total Case – MSCI World	0.0013	1	38.4887	0.0524***
Total Case – MSCI European	0.02017	1	19.2483	0.0521***
Total Case – MSCI G7	001382	1	40.3776	0.0517***
Total Case – MSCI Emerging Market	0.0117	1	28.9493	0.0561***
Total Death – MSCI World	0.01415	1	33.5017	0.0545***
Total Death – MSCI European	0.01434	1	54.4904	0.0437***
Total Death – MSCI G7	0.01437	1	34.7676	0.0539***
Total Death – MSCI Emerging Market	0.01131	3	9.4909	0.1657***

Note: F_m(k) Table values which compare F_m(k) were taken from Tsong et al. (2015) and it's 3.352 for %10, 4.066 for % and 5.774 for %1. Table values which compare (k=1) T_m(k) were taken from Tsong et al. (2015) and it's 0.198 for %1, 0.124 for %5, 0.095 for %10 and (k=3) T_m(k) it's 0.507 for %1, 0.304 for %5 and 0.225 for %10. *** 99%, ** 95% and * 90% represent level of significance with reliability.

To determine the direction of this relationship, the cointegration estimator phase may be a post phase of the study. However, it is theoretically certain that the direction of the relationship will be negative. For this reason, it is not necessary to reveal an already known fact by analyzing the cointegration relationship.

The results show that the COVID-19 outbreak affects the whole world economically as well as many other sectors. In this case, the right suggestion to be given to investors; by following the number of cases and deaths, if the epidemic increases the spread, they will be directed to sell the shares they have. However, considering that the stock markets will bottom down at the point where the number of cases and deaths peak, the shares to be bought on this date can provide serious gains. Moreover, turning to markets where COVID-19 cases and deaths are rare will be a good investment option. Investing in derivatives at other times of such high risk can be another right investment tool. However, due to the increasing importance of technology and the increasing importance of virtual money, another suggestion may be to invest in crypto -currency markets.

CONCLUSION REMARKS

Stock markets are places where financial instruments are bought and sold. Stock markets can be affected by many social, political and cultural factors, especially economic and financial factors. With the COVID-19 outbreak being declared a global pandemic by WHO, significant declines occurred in stock markets worldwide. With this process, the values of firms registered on the stock markets decreased, prices of financial instruments decreased, investors lost wealth. Despite the low number of cases and deaths at the beginning, the reason for the sharp decline in the stock markets is the ability of the stock markets to react suddenly to the emerging information. Stock exchanges responded quickly to the risks arising from COVID-19 and stock market indices showed rapid depreciation.

With the spread of the COVID-19 epidemic, some precautions were taken, especially the curfew. The COVID-19 outbreak caused production to slow down, sales to drop, needs to be delayed, and economies to slow down. This study, it was investigated that the effect of COVID-19 outbreak on global markets. The indices of MSCI' World, emerging markets, European and G7 are used to represent global markets. COVID-19 is expressed in the number of cases and deaths. The results of the study show that all the indices used are long term relationship with the COVID-19 outbreak.

In the studies conducted in the literature, the effects of epidemic diseases are generally investigated and it is found that epidemic diseases negatively affect the stock markets. Epidemic diseases are found to affect the stock markets negatively on Nippani and Washer (2004), Loh (2006), Chen et al (2009), Qui et al (2018) and Lou and Tsang (2020) in the studies. There is a long-term relationship between epidemics and stock markets Chen et al (2018) and Zeren and Hizarci (2020) in the studies. The results obtained in this study are similar to those of Chen et al (2018) and Zeren and Hizarci (2020).

This study is conducted while the COVID-19 outbreak continues. The effects of the outbreak are not over yet, and it is curious how the effects of the outbreak will be after that. Determining the effects of the outbreak will reveal more accurate results to be carried out after the outbreak in the studies.

REFERENCES

Armien, B., Suaya, J. A., Quiroz, E., Sah, B. K., Bayard, V., Marchena, L. and Shepard, D. S. (2008). Clinical Characteristics and National Economic Cost of the 2005 Dengue Epidemic in Panama. The American journal of Tropical Medicine and Hygiene. 79(3), 364-371. 20.03.2020.

Ayittey, F. K., Ayittey, M. K., Chiwero, N. B., Kamasah, J. S., and Dzuvor, C. (2020). Economic Impacts of Wuhan 2019-nCoV on China and the World. Journal of Medical Virology.

Becker, R. Enders, W. and Lee, J. (2006). A Stationary Test in the Presence of an Unknown Number of Smooth Breaks. Journal of Time Series Analysis, 27, 3, 381-409.

Beşel, F. and Uygun, U. (2017). The Relationship Between Economic Growth and Tourism Income: The Case of Turkey. 3rd SCF International Conference on "Economic and Social Impacts of Globalization", Antalya, 5-7 October.

Bloom, D. E., and Mahal, A. S. (1997). Does the AIDS Epidemic Threaten Economic Growth?. Journal of Econometrics, 77(1), 105-124.

Chen, C.-D., Chen, C.-C., Tang, W.-W. and Huang, B.-Y. (2009). The Positive and Negative Impact of the SARS Outbreak: A Case of the Taiwan Industries. The Journal of Developing Areas, 281-293.

Chen, M-P., Lee, C.C., Lin, Y-H. and Chen, W-Y. (2018). Did the SARS Epidemic Weaken the Integration of Asian Stock Markets? Evidence from Smooth Time_Varying Cointegration Analyisis. Economic Research. 31(1), 908-926.

Çil Yavuz, N. (2015). Finansal Ekonometri, Der Yayınları, Istanbul.

Edu-Afful, F. (2019). Deconstructing Ebola in West Africa: Options for Future Response. https://www.tandfonline.com/doi/abs/10.1080/17502977.2018.1493840?journalCode=risb20 23.03.2020

Estrada, M. A. R. and Park, D. (2020). The Economic Impact of Massive Infectious and Congagious Diseases: The Case of Wuhan Coronavirus. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3533771 20.03.2020

Gethmann, J., Probst, C., and Conraths, F. J. (2020). Economic Impact of a Bluetongue Serotype 8 Epidemic in Germany. Frontiers in Veterinary Science, 7, 65, 1-12.

Giudice, A. D. and Paltrinieri, A. (2017). The Impact of the Arab Spring and the Ebola Outbreak on African Aquity Mutual Fund Investor Decisions. Research in International Business and Finance. 41, 600-6012.

Ichev, R. and Marinc, M. (2018). Stock Prices and Geographic Procximity of Information: Evidence from the Ebola Outbreak. International Review of Financial Analysis. 56, 153-166.

Kwiatkowski D., Phillips P. C. B., Schmidt P and Shin Y. (1992). Testing the Null Hypothesis of Stationarity against the Alternative of a Unit Root. J Econom, 54, 159-178.

Loh, E. (2006). The Impact of SARS on the Performance and Risk Profile of Airline Stocks. International Journal of Transport Economics. 33(2), 401-422.

Lumsdaine, R. L. and Papell, D. H. (1997). Multiple Trend Breaks and the Unit-Root Hypothesis. The Review of Economics and Statistics. 79(2), 212-218.

Luo, S., and Tsang, K. P. (2020). How Much of China and World GDP Has The Coronavirus Reduced?. Available at SSRN 3543760. https://papers.ssrn.com/sol3/Papers.cfm?abstract_id=3543760 20.03.2020

Mann, C. (2020). Real and Financial Lenses to Assess the Economic Consequences of COVIS-19. Economics in the Time of Covid-19. Edit. Baldwin, R. and Mauro, B. W. Cepr Press. UK.

McKibbin, W. and Fernando, R. (2020). The Global Macroeconomic Impacts of COVID-19: Seven Scenarios. https://www.brookings.edu/wp-content/uploads/2020/03/20200302_COVID19.pdf

Nippani, S. and Washer, K. M. (2004). SARS: a Non-Event for Affected Countries' Stock Markets?. Applied Financial Economics, 14(15), 1105-1110.

Pendell, D. L., and Cho, C. (2013). Stock Market Reactions to Contagious Animal Disease Outbreaks: An Event Study in Korean Foot-and-Mouth Disease Outbreaks. Agribusiness, 29(4), 455-468.

Pérez-Guerra, C. L., Halasa, Y. A., Rivera, R., Peña, M., Ramírez, V., Cano, M. P., and Rico, P. (2010). Economic Cost of Dengue Public Prevention Activities in Puerto ico. https://apps.who.int/iris/handle/10665/170983

Qiu, W., Chu, C., Mao, A. and Wu, J. (2018). The Impact on Healty, Society, and Economy of SARS and H7N9 Outbreaks in China: A Case Comparison Study. Journal of Environmental and Public Healty. 1-9.

Shin Y. (1994) A Residual-Based Test of the Null of Cointegration against the Alternative of no Cointegration. Econom Theory 10 (1), 91–115.

Sukumar, N. (2020). The World Federation of Exchanges Warns against Short-Selling Bans. https://www.world-exchanges.org/news/articles/world-federation-exchanges-warns-against-short-selling-bans. 30.03.2020

Tsong, C. C., Lee, C, F, Tsai, L. J. and Hu, T. C. (2015). The Fourier Approximation and Testing for the Null of Cointegration, Empirical Economics 51 (3): 1085–1113. Doi: 10.1007/s00181-015-1028-6.

UNCTADa (2020). The Covid-19 Shock to Developing Countries. https://unctad.org/en/PublicationsLibrary/gds_tdr2019_covid2_en.pdf 04.04.2020

UNCTADb. (2020). Impact of the Coronavirus Outbreak on Global FDI. https://unctad.org/en/PublicationsLibrary/diaeinf2020d2_en.pdf 21.03.2020

UNCTADc. (2020). The Coronavirus Shock: A Story of Another Global Crisis Foretold and What Policymakers should be doing about It. https://unctad.org/en/PublicationsLibrary/gds_tdr2019_update_coronavirus.pdf 21.03.2020

Wang, J., Yao, J. and Bonne, G. (2020). The Coronavirus Market Impact Spreads Globally. https://www.msci.com/www/blog-posts/the-coronavirus-market-impact/01732620365 20.03.2020

WHO (2020). Novel Coronavirus (2019-nCoV) Situation Report - 1, https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports/ 20.03.2020

Yılancı, V., Aslan, M. and Özgür, Ö. (2017). Testing the Validity of PPP Theory for African Countries, Applied Economics Letters, DOI: 10.1080/13504851.2017.1418066.

Zeren, F. and Hizarci, A. E. (2020). The Impact of COVID-19 Coronavirus on Stock Markets: Evidence from Selected Countries. Bulletin of Accounting and Finance Reviews. 3(1), 78-84.

Zivot, E. and Andrews, W. K. (1992). Further Evidence on the Great Crash, the Oil-Price Shock, and the Unit-Root Hypothesis. Journal of Business & Economic Statistics. 10(3), 251-270.