# COVİD-19 FİNANSAL BULAŞMAYA SEBEP OLDU MU?

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**Öz:** Çin'in Wuhan şehrinde ortaya çıkan ve tüm dünyaya hızla yayılan COVID-19 salgınının finansal piyasalarda bulaşmaya neden olup olmadığı araştırılmıştır. Bu amaçla, COVID-19 salgınının finansal piyasalarda bulaşma etkisi olup olmadığı ve etkinin yönü incelenmiştir. Finansal bulaşma etkisinin belirlenmesi için on altı ülke seçilmiş ve bu ülkelerin COVID-19 vaka sayıları ile borsa endeksleri arasındaki ilişki incelenmiştir. Analize tabi olan tüm ülkelerde COVID-19 vaka sayısı ile borsa endeksi değişkenleri arasında istatistiksel olarak % 1 önem düzeyinde anlamlı ve negatif bir ilişki bulunmuştur. SARS, Domuz Gribi, MERS ve COVID-19 gibi salgınların, oluştukları bölgelerin dışına yayıldığını göz önünde bulundurursak, dünya bu tür salgınlara açık olduğu ve bu nedenle ülkelerin finansal piyasalarının kırılganlıklarını azaltmak için gerekli önlemleri almasını zorunlu hale getirmiştir.

**Anahtar Kelimeler:** COVID-19, Finansal Bulaşma, Pandemi, Korelasyon
**Jel Kodları:** G01, G15. F65

# DID THE COVID-19 PANDEMIC CAUSE FINANCIAL CONTAGION?

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**Abstract:** The purpose of this paper is to investigate whether or not the COVID-19 pandemic that occurred in Wuhan city of China and spread rapidly all over the world causes the effect of contagion in financial markets. For this purpose, it has examined whether the COVID-19 pandemic had a contagion effect in the financial markets and the direction of the impact. Sixteen countries have been selected for the determination of the financial contagion effect and the correlation between cases  number of these countries and the stock market indices has been examined.  A statistically significant and negative relationship between COVID-19 case number and stock market index variables at the % 1 significance level has been found in all countries subject to the analysis. Considering that outbreaks such as SARS, Swine Flu, MERS and COVID-19 spread outside the regions they occur, have a negative impact on financial markets and the world is open to such the epidemics; has made it compulsory for countries to take the necessary measures to reduce their vulnerability to the financial markets.

**Keywords :** COVID-19, Financial Contagion, Pandemic, Correlation
**Jel Classification :** G01, G15. F65

**INTRODUCTION**

Rapid developments in technology and financial liberalization have caused significant changes in financial markets, as well as eliminating the boundaries between the markets. Thus, a financial market has begun to be affected not only by the factors of the country in which it is located, but also by events occurring in other markets in which it interacts. This interaction between financial markets has revealed the necessity of international diversification in reducing the risks of each investor's investments. Thus, the risk arising from negativity in a market can be reduced through a different market with a low correlation. Integration between financial markets has brought important advantages such as increasing investment alternatives and international diversification for investors, as well as posing an important risk such that the negativity that may occur in one market would spread to other markets. Considering the financial crises experienced in the world in the recent past, it can be said that the effect of the contagion between financial markets is a significant risk.

The concept of contagion is defined in different ways for different disciplines. In terms of financial markets; it can be defined as the rapid and severe consequences of an event occurring in one country within a few hours or days in different countries. Theories related to an infection can be discussed under three headings as Herding, Financial Linkages and, other explanations. Herding is the spread of the financial crisis in a country to international borders. Financial contamination is the contamination caused by the integration between the markets. Except for these two theories; effects such as trade connections, herd behavior, liquidity, and competitive devaluation are addressed under other explanations (Kaminsky et al.; 2003).

In the past two decades, serious epidemics such as SARS (2002), Swine Flu (2009), MERS (2015) and finally, the COVID-19 outbreak occurred, In general, the financial contagion examined through financial crises has also been examined in terms of these pandemics, and the impact of pandemics on financial markets has also been an important topic for researchers. The increase in epidemic diseases and the fact that they have significant effects have triggered international organizations. For the Ebola epidemic in West Africa between 2014 and 2016, the World Bank has played an effective role in preparation and response against the outbreak, and established the Pandemic Emergency Financing Facility (PEF). In the past two decades, serious epidemics such as SARS (2002) and in the Ebola epidemic in West Africa between 2014 and 2016, the World Bank has played an effective role in making a response against the outbreak, and established the Pandemic Emergency Financing Facility (PEF).

In December 2019, coronavirus (COVID-19), an alarmingly infectious primary atypical (viral) pneumonia, erupted in Wuhan, China. Due to the fact that China is a commercial center, a large number of people are traveling to this country and the possibility of one person infecting an average of three people, COVID-19 has reached and influenced the whole world in a very short time. With this development, the World Health Organization declared Public Health Emergency of International Concern (PHEIC) on January 30, 2020. On February 4, 2020, the United Nations was asked to establish a Crisis Management Team (CMT) to prepare countries for COVID-19 and provide the necessary assistance.

As a result of this epidemic, which reached 1,394,781 active cases, 127,493 deaths and 489,795 recovered cases as of March 15, 2020, serious health and social costs emerged within the scope of the measures countries have to take, along with public health costs. It is the main objective of the countries to alleviate the increasing social and economic problems that occur during the discovery of medicines and vaccination to provide immunity, which is necessary for

the elimination of the epidemic. Economic effects of the pandemic need to be put forward in order to eliminate economic problems, both during and after the pandemic. COVID-19, which affects all social and economic factors in the world, also had very serious effects on financial markets. The effects of the epidemic on financial markets have been realized very quickly due to the high integration of financial markets with each other. Determining the economic and financial impacts of a global pandemic is important in terms of exposing the contamination effect as well as providing an idea of where the effects in the regions where the risk continues (https://covid-19-response.org).

The COVID-19 pandemic, which has turned into a global financial crisis, raises important issues about how financial systems are designed and represented, and what could be the consequences of such concepts and representations. Due to the strong links between the financial markets, the COVID-19 epidemic also affected all markets with the impact of contagion. This impact continues with increasing factors such as negative economic conditions, shrinkage of real markets, asymmetric information, herd behavior caused by the pandemic.

In this study, it is aimed to determine whether the number of COVID-19 cases occurring in countries has an impact on the financial markets and the direction of their impact. For this purpose, firstly, literature information about financial contagion is going to be given and then methods and findings will be presented.

### LITERATURE

The number of studies examining the effect of outbreaks on financial contagion is very few. Financial contagion has generally been examined in terms of financial crises. For this reason, in the literature section, some financial contagion studies related to both epidemic and financial crises will be included.

Peckham (2013) aimed to create a model to demonstrate the dynamics of financial shocks and infection spread by evaluating the global crisis that emerged in the USA at the end of 2007 and the influenza (H1N1) outbreak that broke out in 2009. He argued that financial and biological contagion is important in understanding the global effects of risk. In addition, by revealing the results of how the effects of financial crises are formulated in the study, it raised important problems in how the financial system is designed and represented.

In their study, which aimed to achieve asymptotic results for the size of infection, Amini et al. (2016) extended the studies on smear on random graphics with a certain degree and weight distribution. They also measured the flexibility of the bankruptcy of a small financial institution to a large financial network and the shocks of the infection to the network. As a result, they stated that the role played by the contagion connections is important and the simulations prepared are well suited to realistic dimensions.

Gai and Kapadia (2010) have investigated how to develop an analytical contagion effect in arbitrary networks and how the probability and impact of contagion are affected by specific shocks, changes in the network structure and asset market liquidity. As a result of the study, they determined that financial systems have a common structure which is strong and fragile that effects the problems arising, although the transmission effect is low.

Aiming to model financial contagion as a balance, Allen and Gale (2000) stated that liquidity preference shocks have a defective relationship between regions, and they are successful for risk-

sharing when there is no uncertainty. They also found that a small liquidity preference shock in a region had an impact on the economy.

Pericoli and Sbracia (2003) aimed to establish a theoretical framework to identify possible channels of international transmission of a financial shock. For this purpose, they categorized the debate about contagion and used an asset model to explain how the crisis in one economy spread to other economies. With this model, they have demonstrated in particular how crises have been contagious across countries.

Corsetti et al. (2005) aimed to carry out bivariate correlation analysis by reviewing the empirical literature, based on the contagion in financial markets and stock returns. As a result of the analysis, they showed that country-specific shocks arise from arbitrary and unrealistic shocks. They also concluded that the shocks that emerged in Hong Kong cannot be denied that 16 of 17 countries do not have interdependence.

Aiming to measure financial contagion between some developed and emerging stock markets, Boubaker et al. (2016) examined the contagion effect by focusing on the US subprime crisis. As a result of the study, they showed that after the financial crisis, there is evidence of significant contagion effects between the US stock market and the developed and emerging stock markets.

As a result of the analysis, it is stated that there is important evidence for the contagion effect between the US stock market and both developing and developed stock markets before and during the subprime crisis.

Horta et al. (2008) aimed to determine the contagion effect of the US subprime crisis in developed capital markets and whether this effect differs between countries. As a result of the study, they found that the capital markets of Canada, Japan, Italy, France, and the UK had a significant contagion effect. They also stated that the Canadian capital market has the highest contagion density.

Naoul et al. (2010) investigated financial contagion after the US subprime crisis using the Dynamic Conditional Correlation Model. As a result of the study, the existence of financial contagion between 6 developed and 10 developing countries included in the study was determined.

In the context of the US subprime global crisis, Aloul et al. (2011) aimed to identify the contagion effects and financial dependencies of the USA and some selected emerging markets. In their study, they found that there is a financial dependency between the Brazilian, Russian, Indian and Chinese markets and the US markets, and the dependency is stronger for commodity prices.

Altan and Yıldırım (2019) examined the contagion effect of the financial markets in the ARDL model, which is going to provide investors with information on portfolio diversification. As a result of their analysis, they determined that there was a contagion effect on Borsa Istanbul from The New York Stock Exchange.

Kaminsky and Reinhart (2000), who stated that the epidemic caused by epidemiological contamination due to any disease or event occurring far above normal expectation, used concepts such as coefficient of contamination and endemic balance in their studies, and developed mathematical models for public health tools to manage micro and macro parasitic infections and they combined ecological and medical methods to the dynamics of population and parasite interaction.

Kolb (2011) mentioned the difference between the concepts of epidemic and contagiousness by referring to the origins of the word contamination in the medical literature and pointed out the difference between the spread of the financial distress due to the epidemic and the fact that it was caused by the contamination. The source of an outbreak will be contamination as well as external factors. In addition, the fact that the financial shock spread into an epidemic by spreading to more than one market or geographical region may not always indicate the presence of the contamination effect and stated that the epidemic should not be considered as an infection only if it is caused by an external factor.

Budak (2007) stated that financial contagion in turbulent periods will decrease the advantage of investors diversification, therefore the effects of the contamination are important for local and international investors. For this reason, by making a compilation for the studies related to financial transmission in his study, he mentioned the channels causing the transmission and showed the results of the empirical studies causing the transmission.

Pericoli and Sbracia (2003) aimed to establish a theoretical framework to identify the channels that cause financial shocks to be transferred to international markets, and to classify the elements of contagion and to determine how crises spread to the markets using the pricing model. As a result of the study, they revealed that different channels are caused by the spread of crises in the markets and the shocks that create normal dependency between the markets occur outside the temporary portfolio management rules and market defects.

### DATA AND METHODOLOGY

In this study, it will be investigated whether or not the COVID-19 pandemic that occurred in Wuhan city of China and spread rapidly all over the world causes the effect of contagion in financial markets. For this purpose, it will be determined whether the number of COVID-19 cases occurring in the countries in Table 1 has an impact on the selected indices representing the financial markets and the direction of the impact. Country-based COVID-19 case numbers (COV) were obtained from the World Health Organization's official website and index data (SE) from Investing.com. In the analysis, daily data of the period of 21.01.2020 –13.04.2020 were used. The reason for choosing the start date as 21.01.2020 is that WSO started to offer COVID-19 data as of this date. The data used are included in the analysis by taking their logarithms.

**Table 1.** Countries Included in the Analysis

| Countries | Stock Markets Indices |
|---|---|
| Australia | ASX200 |
| China | SSEC |
| Finland | CSXFI |
| France | CAC40 |
| Germany | DAX |
| Italy | FTMIB |
| Japan | Nikke225 |
| Malaysia | FTBM100 |
| Republic of Korea | KRX100 |
| Russian Federation | MOEX |
| Singapore | SGXRS20 |
| Spain | IBEX35 |
| Thailand | SET |
| United Arab Emirates | DFMGI |
| United Kingdom | FTSE100 |
| United States of America | DOW30 |

In the analysis period, descriptive statistics of countries regarding COVID-19 case numbers and index data are presented in Table 2 and Table 3.

**Table 2.** Descriptive Statistics of COVID-19 cases

| Countries | Minimum | Maximum | Mean | Std. Dev. |
|---|---|---|---|---|
| Australia | 3 | 6322 | 1347,6 | 2192,0 |
| China | 278 | 83597 | 61537,1 | 29702,5 |
| Finland | 1 | 2974 | 533,0 | 845,1 |
| France | 3 | 139422 | 17134,2 | 30212,4 |
| Germany | 1 | 123016 | 22830,5 | 37796,5 |
| Italy | 2 | 156363 | 38111,0 | 51471,1 |
| Japan | 1 | 7255 | 998,5 | 1608,1 |
| Malaysia | 3 | 4683 | 939,5 | 1436,2 |
| Republic of Korea | 1 | 10537 | 4623,6 | 4364,3 |
| Russian Federation | 2 | 18328 | 1609,1 | 3778,8 |
| Singapore | 1 | 2532 | 397,4 | 575,9 |
| Spain | 1 | 166019 | 32451,4 | 52151,5 |
| Thailand | 2 | 2579 | 505,2 | 821,6 |
| United Arab Emirates | 4 | 4123 | 441,3 | 924,8 |
| United Kingdom | 2 | 84283 | 11262,1 | 21283,7 |
| United States of America | 1 | 524514 | 62907,4 | 130996,2 |

As of 13.04.2020, when Table 2 is examined, the first three countries with the highest COVID-19 cases are USA (524514), Spain (166019) and Italy (156363), respectively. The highest standard deviation of cases belongs to these countries. When Table 3 is examined, it is seen that the highest standard deviation of the indices belongs to Italy (3697), USA (3536) and Japan (2468).

**Table 3.** Descriptive Statistics of Stock Market Indices

| Countries | Minimum | Maximum | Mean | Std. Dev. |
|---|---|---|---|---|
| Australia | 4546 | 7162,5 | 6176,5 | 912,4 |
| China | 2660,17 | 3071,6 | 2881,9 | 113,3 |
| Finland | 479,54 | 751,3 | 637,2 | 95,4 |
| France | 3754,84 | 6111,2 | 5187,2 | 831,6 |
| Germany | 8441,71 | 13789 | 11679,0 | 1852,7 |
| Italy | 14894,44 | 25477,5 | 20777,7 | 3697,7 |
| Japan | 16552,83 | 24031,3 | 20979,1 | 2468,4 |
| Malaysia | 8214,63 | 11106,4 | 9991,2 | 870,0 |
| Republic of Korea | 3224,95 | 4947,7 | 4308,8 | 503,7 |
| Russian Federation | 2112,64 | 3209,2 | 2786,7 | 327,3 |
| Singapore | 290,54 | 477,7 | 396,0 | 62,0 |
| Spain | 6107,2 | 10083,6 | 8355,6 | 1422,3 |
| Thailand | 1024,46 | 1574,9 | 1332,8 | 191,7 |
| United Arab Emirates | 1682,08 | 2854,9 | 2337,7 | 451,3 |
| United Kingdom | 4993,89 | 7610,7 | 6535,6 | 927,1 |
| United States of America | 18591,93 | 29551,4 | 25497,6 | 3536,5 |

To determine the contamination effect of the epidemic caused by COVID-19 on the financial markets, correlation analysis will be conducted between the COV and **S**E variables of all countries included in the analysis. In order to make correlation analysis between variables, it is determined by Tests of Normality whether the series show normal distribution or not. Shapiro-Wilk and Kolmogorov-Smirnov tests were applied for testing compatibility with normal distribution. Tests of Normality results are presented in Table 4.

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**Table 4.** Tests of Normality

| Countries | Variables | Kolmogorov- | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|---|
| | | Statistic | df | Sig. | Statistic | df | Sig. |
| China | COV | 0,364 | 53 | 0,000 | 0,417 | 53 | 0,000 |
| | SE | 0,134 | 53 | 0,019 | 0,943 | 53 | 0,014 |
| Republic of Korea | COV | 0,259 | 58 | 0,000 | 0,797 | 58 | 0,000 |
| | SE | 0,154 | 58 | 0,002 | 0,897 | 58 | 0,000 |
| Japan | COV | 0,100 | 59 | 0,200 | 0,953 | 59 | 0,023 |
| | SE | 0,499 | 59 | 0,000 | 0,272 | 59 | 0,000 |
| Singapore | COV | 0,092 | 56 | 0,200 | 0,969 | 56 | 0,166 |
| | SE | 0,455 | 56 | 0,000 | 0,330 | 56 | 0,000 |
| Malaysia | COV | 0,211 | 55 | 0,000 | 0,874 | 55 | 0,000 |
| | SE | 0,476 | 55 | 0,000 | 0,162 | 55 | 0,000 |
| Australia | COV | 0,208 | 55 | 0,000 | 0,859 | 55 | 0,000 |
| | SE | 0,439 | 55 | 0,000 | 0,203 | 55 | 0,000 |
| Italy | COV | 0,215 | 51 | 0,000 | 0,814 | 51 | 0,000 |
| | SE | 0,171 | 51 | 0,001 | 0,864 | 51 | 0,000 |
| France | COV | 0,232 | 55 | 0,000 | 0,854 | 55 | 0,000 |
| | SE | 0,187 | 55 | 0,000 | 0,857 | 55 | 0,000 |
| Germany | COV | 0,220 | 54 | 0,000 | 0,868 | 54 | 0,000 |
| | SE | 0,182 | 54 | 0,000 | 0,877 | 54 | 0,000 |
| Spain | COV | 0,221 | 50 | 0,000 | 0,856 | 50 | 0,000 |
| | SE | 0,183 | 50 | 0,000 | 0,852 | 50 | 0,000 |
| United Kingdom | COV | 0,176 | 50 | 0,000 | 0,893 | 50 | 0,000 |
| | SE | 0,160 | 50 | 0,003 | 0,868 | 50 | 0,000 |
| Russia Federation | COV | 0,254 | 50 | 0,000 | 0,796 | 50 | 0,000 |
| | SE | 0,447 | 50 | 0,000 | 0,198 | 50 | 0,000 |
| Finland | COV | 0,224 | 52 | 0,000 | 0,812 | 52 | 0,000 |
| | SE | 0,173 | 52 | 0,001 | 0,859 | 52 | 0,000 |
| United Arab Emirates | COV | 0,152 | 54 | 0,003 | 0,910 | 54 | 0,001 |
| | SE | 0,195 | 54 | 0,000 | 0,807 | 54 | 0,000 |
| Tailand | COV | 0,206 | 59 | 0,000 | 0,892 | 59 | 0,000 |
| | SE | 0,200 | 59 | 0,000 | 0,863 | 59 | 0,000 |
| United States of America | COV | 0,177 | 58 | 0,000 | 0,887 | 58 | 0,000 |
| | SE | 0,181 | 58 | 0,000 | 0,874 | 58 | 0,000 |

When the results of compatibility tests for normal distribution were examined, it was determined that the COV and SE variables of all countries were not suitable for normal distribution at the %5 significance level. Since the data are not suitable for normal distribution, the Spearman Correlation coefficient, one of the nonparametric statistical methods, will be calculated to determine the correlation between the variables. Spearman Correlation analysis results between COV and SE variables are presented in Table 5.

**Table 5.** Result of Spearman's rho Analyses

| Countries | COV -SE | |
|---|---|---|
| | Correlation | Sig. |
| China | -0,517 | 0,000 |
| Republic of Korea | -0,856 | 0,000 |
| Japan | -0,768 | 0,000 |
| Singapore | -0,788 | 0,000 |
| Malaysia | -0,790 | 0,000 |
| Australia | -0,787 | 0,000 |
| Italy | -0,816 | 0,000 |
| France | -0,804 | 0,000 |
| Germany | -0,810 | 0,000 |
| Spain | -0,794 | 0,000 |
| United Kingdom | -0,839 | 0,000 |
| Russia | -0,685 | 0,000 |
| Finland | -0,860 | 0,000 |
| United Arab Emirates | -0,943 | 0,000 |
| Tailand | -0,879 | 0,000 |
| United States of America | -0,811 | 0,000 |

When Table 5 is analyzed, a statistically significant and negative relationship between COV and SE variables at the % 1 significance level was found in all countries subject to the analysis. The fact that there was a significant relationship between the COV and SE variables mean that the COVID-19 pandemic had a negative effect on Stock Markets, in other words, it caused financial contagion. As a result of these findings, it can be stated that the COVID-19 epidemic had a contagion effect in the financial markets and this effect was negative.

When the correlation coefficients are analyzed, it is seen that the financial market most affected by the COVID-19 outbreak is China (-0,517). The most affected financial markets following China are Russia (0,685), Japan (-0,768) and Australia (-0,787). It has been determined that the degree of exposure of all countries to the epidemic is -0,797.

**COUNCLUSION**

Financial contagion can be defined as the rapid and severe consequences of an event occurring in one financial market in different financial markets. Financial contagion requires taking measures to reduce these effects in financial markets and causes investor behavior to change. Since many different factors can cause financial contagion, this contagion effect in financial markets makes it necessary to ask the question "which events have this effect?" on market actors. In addition, it is an important issue to know what the market actors and markets will react to when this situation is causing financial contamination.

In this study, it was investigated whether the COVID-19 pandemic had a contagion effect in the financial markets and the direction of the impact. Sixteen countries, where the COVID-19 pandemic was first seen, were selected for the determination of the financial contagion effect and the correlation between the number of cases of these countries and the stock market indices was examined. 21.01.2020 - 13.04.2020 was used as the review period.

As a result of the correlation analysis, it was determined that there was a statistically significant and negative correlation between COVID-19 case numbers and stock market indices of all countries in all sixteen countries subject to the study. This result can be interpreted as the COVID-19 pandemic caused financial contagion and negatively affected the markets. In the event of such an epidemic that will arise in the next period, investors and market actors should quickly review their market transactions according to the adverse effects that may occur. In addition, financial market executives should quickly implement the measures they have taken.

Considering that outbreaks such as SARS, Swine Flu, MERS and COVID-19 spread outside the regions they occur, and have a negative impact on financial markets; has made it compulsory for countries to take the necessary measures to reduce the vulnerability of their financial markets. Financial contagion is an issue that needs to be emphasized more, especially for developing countries, as it will cause capital outflow from financial markets.

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