Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi
Yıl: 2024 Cilt-Sayı: 17(4) ss: 1036-1049

Academic Review of Economics and Administrative Sciences
Year: 2024 Vol-Issue: 17(4) pp: 1036-1049

https://dergipark.org.tr/tr/pub/ohuiibf

Araştırma Makalesi
Research Article

ISSN: 2564-6931
DOI: 10.25287/ohuiibf.1542780
Geliş Tarihi / Received: 03.09.2024
Kabul Tarihi / Accepted: 30.09.2024
Yayın Tarihi / Published: 10.10.2024

EFFICIENT MARKET HYPOTHESIS DURING COVID-19 PANDEMIC: BRICS-T COUNTRIES[1]

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Abstract

The impact of COVID-19 on financial markets has become a significant topic of research in the literature. Particularly, the declaration of the outbreak as a global pandemic by the World Health Organization on March 11, 2020, altered investors' risk perceptions and led to major fluctuations in stock markets. In this study, the response of stock indices in BRICS-T countries (Brazil, Russia, India, China, South Africa, and Türkiye) to the pandemic declaration was analyzed using the Event Study method. The event window was set as -5 to +5 days, and the estimation window was selected as the 90 days preceding the event. As a result of the analysis based on the comparison of normal and abnormal returns, it was found that all BRICS-T stock markets, except China, were not semi-strong form efficient. In addition, the results of the paired sample t-test applied to all stock markets demonstrated that the difference between abnormal returns calculated before and after COVID-19 was statistically significant. In this context, it was concluded that, unlike previous outbreaks, the COVID-19 pandemic led to significant fluctuations in financial markets. This study provides an important contribution to understanding the effects of the pandemic on emerging markets and examining investor behavior.

Keywords *: The Efficient Market Hypothesis, COVID-19, BRICS Countries, Event Analysis*

JEL Classification *: C32, G14, G15.*

[1] Bu makale 8-10 Temmuz 2024 tarihleri arasında Niğde'de düzenlenen 3. Uluslararası Sigortacılık Bankacılık ve Finans Sempozyumu'nda sunulan özet bildiriden geliştirilmiştir.

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***Atıf/Citation (APA 6)*:**
Öztürk, M. B., Çelik, M. S., & Avbaz, G. (2024). Efficient market hypothesis during COVID-19 pandemic: Brics-t countries. *Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 17*(4), 1036-1049. http://doi.org/10.25287/ohuiibf.1542780.

Öztürk, M. B., Çelik, M. S., & Avbaz, G. (2024). Efficient market hypothesis during Covid-19 pandemic: Brics-t countries. *Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 17*(4), 1036-1049.

COVID-19 PANDEMİSİ SIRASINDA ETKİN PİYASA HİPOTEZİ: BRICS-T ÜLKELERİ

Öz

COVID-19'un finansal piyasalara etkisi, literatürde önemli bir araştırma konusu olmuştur. Özellikle 11 Mart 2020'de Dünya Sağlık Örgütü tarafından salgının, küresel bir pandemi olarak ilan edilmesi, yatırımcıların risk algısını değiştirmiş ve hisse senedi piyasalarında büyük dalgalanmalara yol açmıştır. Bu çalışmada, BRICS-T ülkelerinin (Brezilya, Rusya, Hindistan, Çin, Güney Afrika ve Türkiye) borsa endekslerinin pandeminin ilanına nasıl tepki verdiği, Olay çalışması (event study) yöntemi ile analiz edilmiştir. Olay penceresi -5 ile +5 gün olarak belirlenmiş ve tahmin penceresi ise olaydan önceki 90 gün olarak seçilmiştir. Normal ve anormal getirilerin karşılaştırılması yoluyla yapılan analiz sonucunda; Çin harici BRICS-T ülke borsalarının tamamının yarı-güçlü formda etkin olmadığı tespit edilmiştir. Ayrıca tüm borsalar için uygulanan bağımlı örneklem t-testi sonuçları, COVID-*19 öncesi ve sonrası dönemde hesaplanan anormal getiriler arasındaki farkın, istatistiksel olarak anlamlı olduğunu göstermektedir. Bu bağlamda, COVID-19 pandemisinin, önceki salgınlardan farklı olarak finansal piyasalarda önemli dalgalanmalara yol açtığı sonucuna varılmıştır. Bu çalışma, pandeminin gelişmekte olan piyasalardaki etkilerini anlamak ve yatırımcı davranışlarını incelemek için önemli bir katkı sağlamaktadır.*

Anahtar Kelimeler **:** *Etkin Piyasa Hipotezi,* COVID-*19, BRICS Ülkeleri, Olay Analizi*

JEL Sınıflandırması **:** *C32, G14, G15.*

INTRODUCTION

The impact of the COVID-19 pandemic on the global economy and financial markets has attracted considerable attention at both academic and practical levels. The pandemic has profoundly affected the functioning of financial markets and investor behavior, which has become an issue that needs to be examined with various analytical methods and approaches. The environment of uncertainty created by the pandemic caused great concern in the perception of systematic risk, especially in the early stages of the pandemic, causing investors to prefer less risky investment instruments and sell their shares quickly. For this reason, sudden value losses were experienced in the world stock markets, which have an integrated structure. With the effect of technological developments, investors rapidly changed their positions in the face of global developments and caused market fluctuations.

Although the Efficient Markets Hypothesis has its origins in Fama (1970), it is based on Paul Samuelson's (1965) hypothesis that "in an information efficient market, price changes should be unpredictable if security prices fully reflect all expectations and available information of market participants." Roberts (1967) and Fama (1965a; 1965b; 1970) further developed Samuelson's ideas. In addition, Virgilio (2015) states that the origin of the hypothesis dates back to the nineteenth century when it was proposed in the early 1900s by the stochastic behavior of stock markets and later supported by his compatriot Louis Bachelier. The Efficient Market Hypothesis is considered in three different forms to understand how financial markets function with varying levels of information. Past price movements do not affect future prices. Weakly efficient if all past information is already reflected in prices; all publicly available information is reflected in prices. Quasi-triple is efficient if new information is quickly integrated into prices, all public and private information is reflected in prices, and efficient solid if no investor gains an advantage over the market. In this context, the event study method stands out as one of the most common approaches used to measure the impact of a specific event on financial markets. Event study is a frequently used method in the literature, mainly to test market efficiency and to analyze the instantaneous reflections of events on stock prices. In our study, 11 March 2020, when the pandemic announcement was made, was set as the event date; the

event window was defined as -5 to +5 days, and the forecast window was defined as -90 days to -5 days. These parameters enabled the collection and processing of the data required to analyze the event's impact on stock market indices.

This study investigates how markets respond during periods that can be considered crises. Understanding the level of market efficiency helps financial regulators and policymakers assess the impact of their actions. It is also essential in terms of more efficient allocation of resources, investor confidence, market participation and hence increased liquidity. This study aims to explain the reactions of financial markets in extraordinary periods for investors and policymakers and to guide the development of resource allocation and investment strategies based on this information. This study contributes significantly to understanding how a globally influential event such as a pandemic reverberates in emerging markets and examines how investors' behavior is shaped. It also demonstrates how an event study method effectively analyzes sudden and unexpected events in emerging markets.

This study consists of four chapters. After outlining the theoretical framework in the introduction, the first section presents a literature review. The second section provides information about the analysis and the dataset. In the third section, the Event Study method is explained. After presenting the analysis results in the fourth section, the study is concluded with the conclusion section.

I. LITERATURE REVIEW

Although the Efficient Market Hypothesis (EMH) argues that financial asset prices reflect available information, the validity of this theory under extraordinary market conditions is open to debate. In extraordinary circumstances such as financial crises, global pandemics, or sudden market shocks, market participants may overreact and cause large fluctuations in asset prices. The validity of the EMH under such extraordinary market conditions stands out as an issue that needs to be revisited through theoretical and empirical research.

In this context, many national and international studies examine the level of market efficiency during the COVID-19 pandemic, which can be considered a crisis regarding its economic effects. When the existing studies contributing to the literature are examined, it is seen that the impact of the COVID-19 pandemic on various markets and indices such as gold, silver and platinum spot prices (Horta, Dias, Heliodoro, Alexandre & Chambino, 2023), foreign exchange markets (Azzam, El-Masry & Yamani, 2023), bitcoin (Avşarlıgil, 2020), VIX index (Dima, B., Dima, Ş.M., & Ioan, 2021), SRI and SCI indices (Khan, A., Khan, M.Y., Khan, A.Q., Khan, M.J. & Rahman, 2020) are analyzed. The common findings of these studies, which generally use panel regression, cointegration, short-term and long-term memory tests, and running tests, are that the markets and indices analyzed are inefficient or their efficiency levels have decreased with the pandemic process.

Although there have been many epidemics, the economic, psychological and social effects have not been as widespread as the effects of the COVID-19 pandemic. The main reasons for this situation include that previous pandemics generally remained at the regional level, information and reporting systems were not as developed as they are today, and financial integration has not yet been achieved. For these reasons, while the impact of previous pandemics on financial markets has been the subject of a limited number of studies in the literature, the effects of the COVID-19 pandemic have been investigated both independently and in comparison with major economic crises and social events. For example, the study by Horta et al. (2023) comparing the global pandemic with the Russian invasion of 2022 determined that the random walk hypothesis was valid in gold, silver and platinum markets during calm periods. However, it was found that the random walk hypothesis was rejected in all commodity markets during stress periods and these markets did not show weak-form efficiency. In another study by Choi (2021), the effects of the COVID-19 pandemic and the 2008 global financial crisis on financial markets were analyzed. As a result of the study, it was determined that the US S&P 500 index was not fully efficient in both periods, and it was also determined that efficiency levels may differ across sectors. In a different study conducted for the S&P500 index of the USA, one of the most

developed capital markets in the world, it was also found that the random walk was rejected and the market was not efficient in the period between 02.01.2020 and 30.04.2020 (Vasileiou, 2021).

In studies measuring the effects of the pandemic period on financial markets, it is frequently observed that weak-form efficiency is tested. In the Ozkan (2021) study using the WBAVR (Wild Bootstrap Automatic Variance Ratio) test, six developed countries most affected by the pandemic were considered. According to the results of the analyses, the US, Spain, UK, Italy, France and Germany markets were inefficient in the weak form during the pandemic period. In a different study (Enow, 2021), where the efficiency of 5 major markets was tested using the Run test, it was found that the pandemic significantly affected the efficiency of the JSE and JPX Nikkei 400 indices. On the other hand, no significant effect of the pandemic was observed in the efficiency of the Nasdaq, DAX, and CAC 40 indices. According to the results of another study (Suyadal, 2021) conducted using the Run test for the five countries with the highest number of cases (USA, India, Brazil, France, Russia) and Türkiye, which ranks sixth, it was determined that the weak form of efficiency was accepted for the stock market returns of countries other than the USA and Brazil. In the study by Okorie and Lin (2021), changes in the efficiency levels of similar country markets during the pandemic period were analyzed with different tests. According to the Martingale Difference Spectral (MFS) and Conditional Heteroskedasticity test statistics used in the study, the pandemic did not significantly change the market efficiency level in the US and Brazilian markets in the short, medium and long term. On the other hand, it was concluded that the Indian market lost its efficiency in the long run with the pandemic, while the Russian markets became more efficient. In another study which was conducted by applying panel data analysis for 32 developed and 26 emerging markets (Lee, C.C., Lee, J.D., & Lee, C.C., 2010), it was found that the stock price series between January 1999 and May 2007 were stationary, that is, the weak form of efficiency was invalid.

An analysis of the studies testing the efficiency levels of European and Asian markets reveals that the level of capital market development of countries generally has a determining effect on their efficiency levels. These studies suggest that countries with more developed capital markets typically achieve higher market efficiency. On the other hand, countries with less developed capital markets tend to have lower levels of market efficiency. These findings suggest that market efficiency is closely related to countries' economic structures and the maturity of their financial systems. Iordache (2024), using nonparametric tests, tested the weak-form efficiency of 14 European stock exchanges. According to the findings, while it was shown that the EMH could not be rejected in countries with more developed capital markets, such as France, Germany, Italy, and Poland, it yielded different results in Central and Eastern European countries. For example; EMH was rejected for Latvia and Lithuania, Hungary and Slovenia markets were found to be efficient, while Estonia and Romania markets were found to be less efficient after the pandemic. Similar interpretations can be drawn from a different study for ASEAN stock markets (Kok & Geetha, 2023). As a result of the study, CSX, VHINDEX and VNINDEX indices were found to be weakly efficient. At the same time, the efficiency of Malaysia, Indonesia and Thailand stock markets decreased with the pandemic, and the efficiency of LSXC and STI indices increased. On the other hand, in a different study (Pontoh & Budiarso, 2022) for ASEAN-5 countries (Indonesia, Malaysia, Singapore, Thailand, and the Philippines), it was found that the markets were weakly efficient except for Singapore. Only Singapore's market movements became more predictable in 2021 and its efficiency deteriorated.

It is observed that the event study method is generally preferred in international studies conducted to measure the efficiency of financial markets in a semi-strong form during the COVID-19 pandemic period. This methodology, which we will also use in our analyses, offers the opportunity to evaluate a specific event's short-term and long-term effects on financial markets in detail. One of the studies on this subject was conducted by Syarifudin (2020) for the US S&P500 index. The study examines the performance of the companies in the index for 200 trading days before the pandemic was declared (20 January 2020). In the analysis results, it was determined that the market could not react quickly enough to an unexpected event such as a pandemic; that is, it was inefficient in a semi-strong form. In a different study (Eren, K. Goker & Karaca, 2021) based on a similar event day, the reactions of significant stock market indices of 22 developed countries in the MSCI ACWI index to the global pandemic announcement on 11 March 2020 were measured. As a result of the analysis, it was found

that the stock exchanges of developed countries were not efficient in the semi-strong form on and around 11 March 2020. In a different study (Okiki, 2022), in which the pandemic announcement announcement was based on 15 March 2020, the semi-strong form efficiency of the Kenya Nairobi Stock Exchange (NSE) was tested. According to the analysis results, most of the companies in the index (90.91%) responded positively to the pandemic announcement. Still, the abnormal returns observed in stock returns were not statistically significant. These results suggest that the Nairobi Stock Exchange has a generally stable response to large-scale events such as the COVID-19 pandemic and that the market is efficient in the semi-strong form. In a study (Harabida & Radi, 2020) based on 16 March 2020, the day of the emergency declared in Morocco, the reactions in the prices of companies traded on the Moroccan Casablanca Stock Exchange were analyzed. According to the study, market reactions were more pronounced in short event windows, especially on the event date and the days around it, while the responses were less in long event windows. In a different study (Alam, M.N., Alam, M.S. & Chavali, 2020), where the event day was 24 March 2020, the data of 31 random companies listed in the Bombay capital market in India were analyzed. According to the analysis results, positive abnormal returns were detected around the closing days. The observed positive abnormal returns indicate that the market fails to process such information efficiently and thus does not meet the semi-strong efficiency criteria. In a different study (Tursun, 2022), in which the dates of the partial closure announcement (13 April 2021) and full closure announcement (26 April 2021) in Türkiye are taken as event dates, the efficiency levels of selected markets within Borsa Istanbul are analyzed in the semi-strong form. According to the results of the analysis, partial closure decisions hurt the selected markets within the BIST, while full closure decisions have a positive effect. These findings indicate that the market is not efficient in the semi-strong form.

The results of the literature review point to the scarcity of studies analyzing the efficiency levels of countries' capital markets in the semi-strong form in a period considered extraordinary on an international scale, such as the global pandemic caused by COVID-19. Existing studies generally focus on developed countries (Eren et al., 2021) or a single country (Alam et al., 2020; Harabida & Radi, 2020; Okiki, 2022; Syarifudin, 2020; Tursun, 2022). In this study, in addition to the existing studies in the literature, the semi-strong form efficiency levels of the stock market indices of the BRICS-T countries, which include both developed and developing countries and constitute approximately 40% of the world population, will be evaluated. These countries play an essential role in the global financial system and have high trading volumes. During the pandemic, BRICS-T economies experienced unprecedented capital outflows as investors channeled large amounts of capital from emerging markets to safe havens. This led us to consider the BRICS-T countries as an essential case study to examine market reactions and capital flows during the pandemic. In this context, the study aims to understand the effects of the pandemic on financial markets by analyzing the semi-strong form efficiency levels of the stock market indices of BRICS-T countries.

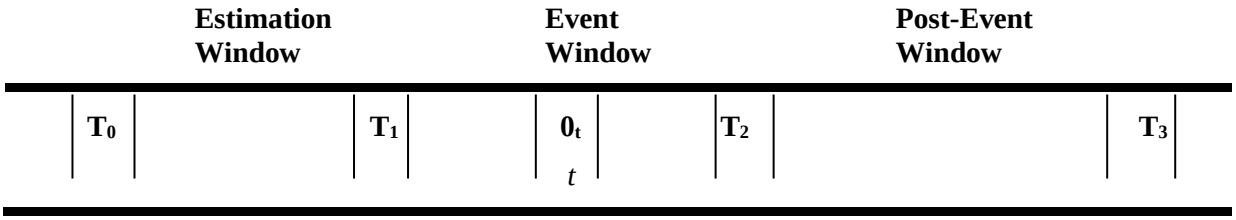
II. DATA AND METHODOLOGY

In our study, event analysis was carried out with the benchmark stock market indices data of BRICS-T countries between 02.12.2019 and 29.05.2020. For the countries, daily data obtained from BOVESPA, RTSI, BSE SENSEX 30, SHANGHAI, SOUTH AFRICA TOP40, and BIST100 indices were used respectively, and the MSCI Emerging Markets Index (MSCIEF) was used as a benchmark index. All these data were obtained from the website www.investing.com.

The event study method is a beneficial analysis method for measuring the impact of a particular event on the market and asset prices. This method, developed by Fama, Fisher, Jensen and Roll (1969), has been chosen as the method in our study since it is frequently preferred in the literature to test market efficiency and to examine the instantaneous reflections of the event on the market. Various time parameters should be determined meticulously to conduct an event study healthily. These parameters include the event date, event window and forecast window.

In our study, 11.03.2020, declared a global pandemic by the World Health Organisation, was determined as the event date. The event window was set as -5 +5 and the forecast window as -90 -5.

Event date is the date of the specific event/announcement whose impact on the asset is investigated. The event window is when the event's effect is measured and abnormal returns are calculated. This period covers the days when the event occurred and the days when the effects of the event may continue. The event window measures how the market reacts to the announcement (MacKinlay, 1997). The forecast window calculates the expected returns of stocks by selecting a period in which the event is assumed to be absent (Brown & Warner, 1985). This period does not reflect the event's impact on the index. In addition to these parameters, a post-event window is also determined. This window can be used for control purposes at any time. The timeline used in Event Study studies is shown in Figure 1.



Source: MacKinley, A.C. (1997). Event Studies in Economics and Finance. *Journal of Economic Literature*, 35, 13-39.

Figure 1. Timeline for Event Study

The Event Study timeline is divided into three periods. These are:

1. Estimation Window (T0-T1): This is a period during which the event's effect is not seen. The estimated parameters and normal return estimation for each index to be used for the event window are calculated using data from this period.

2. Event Window (T1-T2): Abnormal Returns (AR) and Cumulative Abnormal Returns (CAR) are calculated by subtracting the normal returns from the actual returns during this window.

3. Post-Event Window (T2-T3): This window can be controlled at any desired time.

There is no certainty about the duration of each window in the Event Study method. The researcher will determine the duration of the windows specified in Figure 1 depending on the determined event (Mazgit 2013; 233).

The change rates in the prices of the indices included in the study and the MSCI Emerging Markets Index (MSCIEF) were calculated using the logarithmic return calculation method. The following formula was used to calculate these change rates (Brown & Warner 1980-1985);

$$R_{it} = \ln (P_{it} / P_{it-1}) \quad (1)$$

R_{it} = Logarithmic return of the index in period t

P_{it} = price of index in period t

P_{it-1} = price of index in period t-1.

The rates of change in the prices of the MSCIEF index, which is used as market return in the study, are calculated using the logarithmic return calculation method. The following formula was used to calculate these change rates;

$$R_{mt} = \ln (P_{mt} / P_{mt-1}) \quad (2)$$

R_{mt} = Logarithmic return of the MSCIEF index in period t

P_{mt} = price of MSCIEF index in period t

P_{mt-1} = price of MSCIEF index in period t-1.

Abnormal return and expected return rates were calculated using the market model. The expected return $E(R_{it})$ rate for each index was calculated with the help of the parameters α and β in the formula.

$$R_{it} = \alpha + \beta\, R_{mt} + \varepsilon_{it} \quad (3)$$

R_{it} = logarithmic return of index in period t

R_{mt} = logarithmic return of MSCIEF in period t

The difference between the expected return $E(R_{it})$ and the observed return gives the abnormal return.

$$R_{it} = (\hat{\alpha} + \hat{\beta}\, R_{mt})$$

Abnormal returns are obtained by subtracting the actual returns from the expected returns.

$$AR_{it} = R_{it} - \widehat{R_{it}} \quad (4)$$

AR_{it} = abnormal returns of index in period t

$\widehat{R_{it}}$ = returns predicted for period t from the regression equation

After calculating the abnormal returns, the Average Abnormal Return (AAR) was calculated as for all country index.

$$AAR_t = \sum_{i=1}^{N} (1/N) AR_{it} \quad (5)$$

AAR_t = average abnormal return on day t.

Cumulative Abnormal Return (CAR) was calculated for each day in the event window.

$$CAR_t = \sum_{i=1}^{N} AAR_t \quad (6)$$

CAR_t = cumulative abnormal return in period t.

Cumulative Average Abnormal Return (CAAR) was calculated based on the Cumulative Abnormal Return (CAR).

$$CAAR_t = AAR_t + CAAR_{t-1} \quad (7)$$

This study examines the effects of the pandemic announcements during the COVID-19 pandemic on BRICS-T country indices and how quickly this information is reflected in the markets. In this direction, the presence of abnormal returns (AR) around the event dates and the significance level of these returns will be analyzed. The hypotheses tested in the study are as follows:

Hypothesis (H_0): There is no significant cumulative abnormal return (CAR) around the event date (pandemic announcement) and this value is equal to zero.

Hypothesis (H_1): There is a significant cumulative abnormal return (CAR) around the event date (pandemic announcement) and this value is different from zero.

Paired Samples T-Test will be applied to determine whether there is a statistically significant difference between the averages of cumulative abnormal returns before and after the event date. This test assesses whether the difference between two averages is substantial, assuming that the pre-event and post-event returns are correlated. Accordingly, firstly, the abnormal returns around the event window will be averaged to evaluate the collective response of the index returns to the event day. Then, cumulative average abnormal return values will be calculated. The t-statistic to be used is presented in Equation 8.

$$t - statistic = \frac{CAAR_t}{\sigma} \quad (8)$$

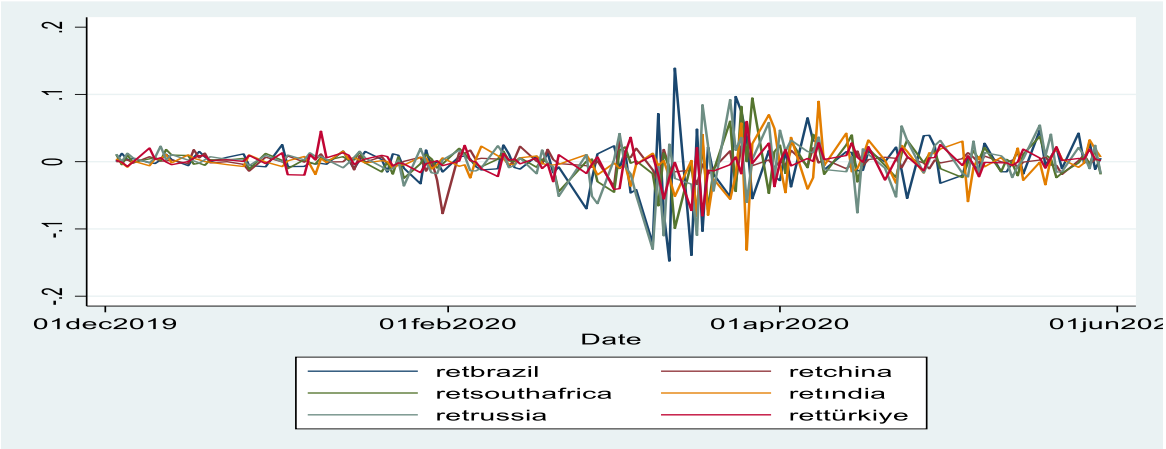
In the numerator of the equation, the cumulative average abnormal returns of all country indices are used; in the denominator, the standard deviation of the cumulative average abnormal returns determined in the estimation window is used (Brown & Warner, 1985). Whether there is a difference between the calculated pre-event and post-event cumulative average abnormal returns will be tested

with the Dependent Sample t-Test. The Dependent Sample t-test, one of the parametric hypothesis tests, tests whether the difference between pre-and post-event cumulative average abnormal returns is significant (Ercan, 2021: 8). The dependent sample t-test is shown in Equation 9 (Field, 2009: 327).

$$t = \frac{\bar{D} - \mu_D}{S_D / \sqrt{N}} \quad (9)$$

The $\bar{D}$ value in the numerator of the equation shows the mean of the dependent sample differences and , $\mu_D$value shows the expected mean. The $S_D / \sqrt{N}$ value in the denominator expresses the standard errors of the dependent sample differences.

III. EMPIRICAL RESULTS



Graph 1. Return Chart of BRICS-T Countries Stock Indices

Chart 1 shows the stock market index returns of BRICS-T countries between December 2019 and June 2020. The countries represented are Brazil, South Africa, Russia, China, India, and Türkiye. From December 2019 - February 2020, the returns of all countries exhibited similarly low volatility. The returns are generally near zero, indicating a relatively calm period in the stock markets. However, severe fluctuations were observed in March 2020. It is possible to say that this period was the period when the impact of the COVID-19 pandemic on global markets was most intensely felt. There were sharp declines in stock markets in general. After the significant volatility in March, a slight recovery and stabilization is observed in the markets in April. The returns started to move close to zero again and volatility decreased. This chart clearly shows the impact of the pandemic's beginning on BRICS-T stock market returns.

Table 1. Cumulative Abnormal Return (CAR) Values of BRICS-T Countries

Event Window	Brazil	Russia	India	China	South Africa	Türkiye
-5	0,01 (0,34)	-0,01 (-0,11)	0,02 (0,60)	0,01 (0,13)	0,16 (0,38)	0,01 (0,27)
-4	-0,02 (-0,50)	-0,02 (-0,40)	-0,02 (-1,04)	0,01 (0,24)	-0,027 (-0,65)	0,05 (1,17)

-3	-0,05 (-1,25)	-0,07 (-1,22)	-0,06 (-2,50)**	0,03 (0,63)	-0,06 (-1,58)	0,05 (1,16)
-2	-0,17 (-3,55)***	-0,20 (-3,41)***	-0,18 (-6,89)***	0,02 (0,37)	-0,18 (-4,38)***	0,06 (1,52)
-1	-0,10 (-2,15)**	-0,20 (-3,54)***	-0,11 (-4,27)***	-0,01 (-0,24)	-0,11 (-2,71)***	0,04 (1,02)
0	-0,18 (-3,86)***	-0,31 (-5,43)***	-0,19 (-7,21)***	0,01 (0,10)	-0,19 (-4,55)***	-0,01 (-0,26)
1	-0,33 (-7,06)***	-0,29 (-4,98)***	-0,34 (-12,84)***	-0,01 (-0,09)	-0,34 (-8,10)***	-0,03 (-0,84)
2	-0,19 (-4,13)***	-0,31 (-5,40)***	-0,20 (-7,60)***	-0,20 (-0,41)	-0,20 (-4,78)***	-0,04 (-0,86)
3	-0,32 (-6,79)***	-0,34 (-5,93)***	-0,33 (-12,64)***	-0,03 (-0,68)	-0,33 (-7,98)***	-0,10 (-2,31)**
4	-0,24 (-5,12)***	-0,42 (-7,73)***	-0,27 (-10,34)***	-0,06 (-1,40)	-0,27 (-6,58)***	-0,06 (-1,46)
5	-0,35 (-7,47)***	-0,36 (-6,29)***	-0,38 (-14,35)***	-0,07 (-1,40)	-0,38 (-9,09)***	-0,15 (-3,35)***

Note: The values in parentheses in the table represent T-Statistics values. ***1%, **5%, *10% indicate significance levels.

When the cumulative abnormal returns of the BRICS-T countries in Table 1 are examined, the results are statistically significant in the examination intervals except for China. A statistically significant and negative cumulative abnormal return (CAR) value was determined for five countries. In general, the effect of the event started on the -2nd day, while this situation is seen on the +3rd day for Türkiye.

These results indicate that the H_1 hypothesis is rejected for China and that the pandemic declaration has an insignificant effect on CAR_t values. We can interpret this situation as the fact that the disease was first seen in China and its impact on financial markets was also seen before. It was determined that there was a statistically significant difference between the pre-event and post-event CAR_t values for other countries except China. In other words, it can be said that the pandemic declaration announcement had a significant effect on the markets.

Table 2. Dependent Sample t-Test Results for CAR Values (-5/+5) (Mar 11)

	N	Mean	Std. Err.	Diff.	t-statistic	p-statistic
Pre-Event CAAR	5	-0.290	0.050	-0.212***	-5.7229	0.0004
Post-Event CAAR	5	-0.780	0.066			

Note: *, **, *** indicate significance at the 10%, 5% and 1% levels, respectively.

For the dependent sample t-test conducted on all stock exchanges used in the analysis, they were divided into two groups: pre-COVID-19 and post-COVID-19. The difference in the CAAR values of these two groups in the event window (-5/+5) was analyzed using the t-test. According to the dependent sample t-test results examined for all stock exchanges in Table 2, the p-value (0.0004) is less than 0.01. This result shows us that there is a statistically significant difference between the abnormal returns before and after the pandemic declaration.

CONCLUSION

The COVID-19 pandemic has deeply shaken world economies and financial markets as one of the biggest global health crises of the 21st century. The spread of the pandemic has caused severe disruptions in countries' economic activities, increased unemployment rates, and brought international trade to a standstill. The uncertainty created by the pandemic has also negatively affected the functioning of financial markets and led to significant fluctuations in stock market indices.

This study used the event study method to analyze the effects of the COVID-19 pandemic on the stock market indices of BRICS-T countries (Brazil, Russia, India, China, South Africa, and Türkiye). The declaration of COVID-19 as a global threat by the World Health Organization (WHO) on March 11, 2020 led to significant fluctuations in financial markets. The study determined an event window (-5, +5 days) and a forecast window (90 days before the event) centered on this date. The analyses revealed that abnormal returns were observed in the stock market indices of BRICS-T countries after the declaration of the pandemic and that these returns were significant. The results show that market participants experienced sudden increases in their perceptions of uncertainty and risk at the beginning of the pandemic, and this situation had negative reflections on the stock market indices. However, the heterogeneity of market reactions among these countries reflects the effects of economic structures, health systems, and government interventions in different countries. In addition, it is thought that the limited market reactions, even in a country like China, which was the starting point of the pandemic, are due to the earlier declaration of the COVID-19 pandemic in China and that the market priced the pandemic. The study tested semi-strong form efficiency levels with the event analysis method. It was determined that all BRICS-T country stock exchanges except China were inefficient in semi-strong form. In addition, the dependent sample t-test results applied to all stock exchanges show that the abnormal returns before and after COVID-19 are significant. Our study results are parallel to the results of the study conducted by Eren et al. (2021) for developed countries. The study shows that the responses of the stock market indices of BRICS-T countries to the pandemic are heterogeneous. This finding is consistent with the study conducted by Choi (2021) stating that the responses of the US S&P 500 index to the pandemic and the 2008 global financial crisis varied across sectors. Similarly, the study conducted by Horta et al. (2023) found that market efficiency decreased during stress periods in the gold, silver and platinum markets. Still, this efficiency manifested itself differently in different markets. This heterogeneity varies depending on the countries' economic structures, health systems and government policies. The study found that the Chinese stock market

responded more limitedly during the pandemic compared to other BRICS-T countries and that the abnormal returns of this market were not statistically significant. This result is consistent with the study conducted by Okorie and Lin (2021), which found that the Chinese market was exposed to the effects of the pandemic earlier than other countries. Therefore the market priced the pandemic in advance. China, being the first country to experience the pandemic, caused the market to be more prepared for shocks and thus show less volatility.

In conclusion, the stock market indices of BRICS-T countries have shown significant responses to the COVID-19 pandemic, and the magnitude and direction of this response vary depending on countries' preparedness for the pandemic, their economic resilience, and government policies. The study's findings provide significant findings for understanding the implications of the global financial impacts of the COVID-19 pandemic on emerging markets. BRICS-T countries should develop more effective crisis management strategies to maintain financial market stability during pandemics and other international crises. Rapid and decisive government interventions can help markets stabilize during periods of uncertainty. Ensuring market participants have access to accurate information during emergencies such as pandemics is critical to reducing market volatility. Governments and regulators can increase investor confidence by sharing transparent and timely information. Investors and companies should diversify their portfolios and update their risk management strategies to minimize the impacts of global risks such as pandemics on financial markets. This can be especially effective in reducing capital losses during periods of uncertainty. This suggestion is also stated in the study conducted by Alam et al. (2020) on the Indian capital market, pointing out the importance of government interventions to reduce market volatility and increase investor confidence during pandemics.

Since our study results show that the Efficient Market Hypothesis may be valid at different levels of efficiency over time, in future studies, Behavioral Finance Theories can be tested in addition to market efficiency when explaining financial markets. Considering that market conditions, risk perception, or the psychological and emotional states of investors may differ for each country, it can be said that it would be beneficial to evaluate both theories together. For example, empirical studies can be conducted on the validity of the Adaptive Market Hypothesis, which was put forward by Lo (2004) and integrates market efficiency and investor behavior during the COVID-19 period.

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Etik Beyanı : *Etik kurul izin veya yasal/özel izin alınmasına gerek olmayan bu çalışmada araştırma ve yayın etiği kurallarına uyulmuştur. Bu makale 8-10 Temmuz 2024 tarihleri arasında Niğde'de düzenlenen 3. Uluslararası Sigortacılık Bankacılık ve Finans Sempozyumu'nda sunulan özet bildiriden geliştirilmiştir.*

Yazar Katkıları : *Yazarlar makaleye eşit oranda katkı sunmuş olduklarını beyan eder.*

Çıkar Beyanı : *Yazarlar arasında çıkar çatışması bulunmamaktadır.*

Teşekkür (Varsa) : *Yayın sürecinde katkısı olan hakemlere ve editör kuruluna teşekkür ederiz.*

Ethics Statement : *In this study, which did not require ethics committee permission or legal/special permission, the rules of research and publication ethics were followed. This article was developed from the abstract presented at the 3rd International Insurance Banking and Finance Symposium held in Niğde between 8-10 July 2024.*

Author Contributions : *The authors declare that they have contributed equally to the article.*

Conflict of Interest : *There is no conflict of interest between the authors.*

Acknowledgement : *We extend our thanks to the reviewers and the editorial board who contributed to the publication process.*