

Application on Detecting Causality Relationships Between the Stock Markets of the Fragile Five Countries

Batuhan MEDETOĞLU  ^a

^a Burdur Mehmet Akif Ersoy Üniversitesi, Burdur, Türkiye. bmedetoglu@mehmetakif.edu.tr

ARTICLE INFO	ABSTRACT
Keywords: Fragile Five Countries Correlation Analysis Granger Causality Analysis Portfolio Diversification Stocks Received 28 November 2024 Revised 25 May 2025 Accepted 30 May 2025 Article Classification: Research Article	Purpose – The aim of the study is to determine the relations between the stock markets of the Fragile Five Countries "BIITS" (Brazil, Indonesia, India, Türkiye and South Africa). The relationships obtained are intended to guide portfolio diversification and investment decisions. Design/methodology/approach – Within the scope of the study, Correlation Analysis and Granger Causality Analysis were applied to determine the relationships. In this context, data for the period 01.01.2010-31.12.2023 were obtained, and indicative stock market data of the countries were used. Direction and severity of relationships with Correlation Analysis; Causality relationships were also determined using the Granger Causality Test. As stated in the literature, determining the relationship between countries' stock markets is important for international portfolio investment. Findings – As a result of the analysis, a low or near medium level correlation was detected between the stock markets of the countries. Causality analysis revealed an intense relationship was found in general. It was concluded that Brazilian indicator exchange is also the Granger cause of the other four indicator exchanges. Discussion – It has also been concluded that relevant countries have a close causal relationship and can be used in terms of portfolio diversification. The results obtained were compatible with those reported in the literature. This study aims to guide investors, markets, and researchers.

1.INTRODUCTION

Markowitz (1952) introduced the concept of portfolio diversification in his article titled "Portfolio Selection," which is important for risk management today. This concept, which is based on the principle of including assets moving in different directions in the same portfolio, is applied to obtain the expected return. Financial risk refers to the possibility that expected returns will not be realized. The failure to obtain the expected return in portfolios is a possible negative situation that investors may not want (Altay, 2015: 3). Portfolio diversification eliminates this risk and ensures that savings are effectively converted into investment. Financial markets are mechanisms that include fund supply and demand units, intermediaries, speculators, arbitrageurs, financial institutions, and legal regulations (Pamukçu, 1999: 3). Markets expressed as suitable environments for the transformation of savings into investments have different classifications and efficiency levels. Fama (1970) divided financial markets into three types: weak form, semi-strong form and strong form efficiency. It is impossible to obtain abnormal returns in strong-form markets. In financial markets, investors have the opportunity to turn their savings into investment opportunities using investment instruments such as stocks, bonds, bills, real estate certificates, warrants, deposits, foreign currency, and precious metals (Korkmaz and Ceylan, 2017: 243). Investors' risk perceptions are among the most influential factors in asset purchases.

With the impact of globalization, the concepts of production, capital, and trade transcend borders, and the mobility of goods and services between countries is accelerating. Countries want to achieve their goals such as economic growth and development by following open policies. As a result, cross-border investments are made and initiatives are carried out not only in the country but all over the world (Yılmaz, 2010: 242). Globalization, which accelerated its pace, especially in the 1990s, increased the integration and mobility of goods and services by increasing the volume of international trade. The increase in globalization activities also

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offers alternatives to investors by affecting exchange rates and financial asset movements (Aktaş, 2010: 124). Therefore, investments go beyond country borders, and international portfolios are created.

The concept of investment is expressed by deferring today's consumption to that of the future. This study is based on the concept of investment and aims to determine the relationships between different stock markets so that investors can diversify their portfolios. Within the scope of the study, the increasing relations between countries with the effect of globalization were taken into consideration, and a study was carried out on the stock markets of the Fragile Five countries, named by Morgan Stanley. The Fragile Five countries are Brazil, India, Indonesia, South Africa, and Türkiye. The relevant countries are similar to Türkiye in macroeconomic terms (Kutlu and Türkoğlu 2023). It is also stated that the relevant countries have common characteristics such as high inflation, foreign trade deficit, and depreciation against the US dollar (Akel, 2015).

The research question within the scope of the study is how power, direction, and causality relations occur between the indicator stock markets of the Fragile Five countries. The reason for carrying out the study is to have quantitative information about the stock markets of relevant countries for investments in terms of international portfolio diversification. Another motivation for this study was to determine the level of Türkiye influence on relevant countries. With these aims and motivations, indicative stock market data of the Fragile Five countries were obtained, and the relations of the relevant countries were determined.

The indicator stock markets analyzed in the study are important for countries and serve as indicators. For this reason, determining the relations between the related stock exchanges also provides information about some economic indicators of the countries. Many academic studies have been carried out on the related exchanges (İltas, 2020; Hersi, 2020; Siddiqui et al., 2022). The academic studies are generally aimed at determining relationships such as cointegration, causality, regression, correlation and volatility. The aim of this study is to provide information to the literature on relationship detection with current data. Thus, it is ensured that the relationships can be compared for future studies.

The originality of this study is that it conducts research using an up-to-date dataset and analyzes a relatively new country group. After the introduction, the study continues with a literature review, and it is seen that studies on country groups, with priority on the Fragile Five countries, are listed. The equations for the Granger Causality Analysis are presented in the Methods section, and the findings are included in the analysis section. The results obtained are interpreted in the Results and Evaluation section and suggestions for future studies are presented. The findings obtained from this study are expected to be important for researchers in terms of evaluating different samples.

2.LITERATURE REVIEW

Country-stock exchanges are important for issues such as determining the relationships between financial assets and economic indicators, portfolio creation, asset pricing, and price mobility. In the literature, attempts have been made to detect relationships using different variables and periods. In this part of the study, country groups such as Fragile Five and studies aimed at determining the causal relationship are listed. Few studies on BRICS countries, to which the Fragile Five countries are close, have been reported in the literature. Related studies have offered ideas for determining relationships and guiding future research.

Narayanamoorthy et al. (2009) conducted a study to determine the causality relationships between foreign direct investment and the growth of BRICS countries. As a result of the analyses carried out within the scope of the study to determine cointegration and causality relations, the existence of cointegration was detected and the results of the VECM and causality relations were interpreted.

Akel (2015) conducted a study investigated the relationships between the stock market indices of Fragile Five countries. Data between 2000 and 2013 were obtained within the scope of the study, and Johansen cointegration analysis and Granger causality test were applied. The findings regarding the existence of short- and long-term cointegration and causality relationships were obtained.

Gürsoy and Eroğlu (2016) conducted a study to determine the interaction between the share markets of the Fragile Five countries. Within the scope of the study, data between 2006 and 2015 were used and the multivariate VAR E-GARCH model was used as the method. As a result, a significant relationship was

determined between the share markets of the relevant countries, but the volatility spread did not cover all countries.

Turgut and Köroğlu (2017) conducted a study to determine the relationships between the stock markets of the Fragile Five countries. Within this study's scope, cointegration and causality analyses were conducted using data from 2005 to 2015. Consequently, short- and long-term causalities were reported within the scope of this study.

Öner (2018) carried out a study examined the integration of a group of countries called Fragile Five, consisting of Argentina, Egypt, Qatar, Pakistan, and Türkiye. Within the scope of this study, the analysis was conducted using Granger causality analysis with data from January 2009 to March 2018. As a result, causality relationships between countries were interpreted, and evaluations were made.

Helhel (2019) conducted a study to determine the relationship between stock market development and economic growth in the Fragile Five countries. Panel cointegration and causality tests were conducted using data from 2002-2016 period. The cointegration and causality results were interpreted and evaluated within the scope of this analysis.

Temurlenk and Lögün (2021) conducted a study on the relationship between the BRICS stock market indices and exchange rates. In the study where data between the period 2003:01-2019:03 was used, different cointegration approaches and the Granger Causality Test were applied as methods. As a result, the cointegration and causality relationships were interpreted and evaluated.

Wu and Wu (2021) conducted a study to determine the relationship between global economic policy uncertainty and tourism activities in the Fragile Five countries. In this study, the wavelet transform structures were examined using data from 1997 to 2016. The findings were generally positive and changed over time, and suggestions were offered to the policymakers.

Onat and Ertürk (2022) conducted a study analyzed the causality relationships between foreign direct investment inflows. Fragile Five countries were used as the samples. In this study, data between 1971 and 2019 were obtained, and unit root tests and Toda-Yamamoto causality analyses were applied. The results of this study indicate that various causality relationships were determined.

Hoque et al. (2022), who touched upon the importance of the impact of trade policy uncertainty on the global economy, aimed to determine the stock returns and price volatilities of developed and developing economies. Within the scope of the study, Diebold and Yılmaz's (2012) methodology was used and various GARCH models were applied. Consequently, the shocks and volatility spreads were evaluated.

Çeştepe and Ergun Tatar (2022) conducted a study to determine the causality relationships between financial development and economic growth variables of the Fragile Five countries. Data from 1980 to 2019 were used within the scope of this study, and an asymmetric panel causality analysis was applied. Consequently, they evaluated the existence of the supply led, demand-led, and feedback hypotheses.

Kutlu and Türkoğlu (2023) conducted a study to determine the asymmetric return and volatility spread between the Fragile Five countries and the VIX index. Within the scope of this study, the analysis uses data from 2014 to 2021. As a result, the volatility spillover relationships among the fragile five countries are interpreted.

Determining the relations between country groups is important, and relevant information offers great benefits to investors, the sector, and researchers. The literature review carried out within the scope of this study mainly includes studies on the Fragile Five countries. In addition, few studies on BRICS countries, a similar group of countries, have been added. It is generally observed that cointegration, causality, and volatility propagation methods are used in these studies. The results of the studies indicated that the relationship was detected by mentioning the similarity between country groups. In addition, the importance of which countries the relations are from is also mentioned. This study contributes to the literature by determining causality relationships using current data from the Fragile Five countries. In addition, it will guide future studies in terms of its findings and enable the observation of changes in relations in future studies.

3.METHODOLOGY

The Granger Causality Test and Correlation Analysis were applied within the scope of the analysis. Before applying the Granger causality test, Augmented Dickey Fuller (ADF) and Phillips Perron (PP) unit root tests. Relevant tests were applied to determine whether the dataset contained a unit root and stationarity. In the tests, the hypotheses were that the series contains a unit root and is not stationary and that the series does not contain a unit root and is stationary (Dickey-Fuller, 1979,1981; Phillips and Perron, 1988; Bozkurt and Altın, 2018: 171).

The ADF unit root test stages are shown using Equations 1, 2, and 3.

$$\Delta Y_t = \gamma Y_{t-1} + \sum_{i=1}^p \beta_i \Delta Y_{t-i} + \varepsilon_t \quad (1)$$

$$\Delta Y_t = \alpha + \gamma Y_{t-1} + \sum_{i=1}^p \beta_i \Delta Y_{t-i} + \varepsilon_t \quad (2)$$

$$\Delta Y_t = \alpha + \beta_t + \gamma Y_{t-1} + \sum_{i=1}^p \beta_i \Delta Y_{t-i} + \varepsilon_t \quad (3)$$

Another method that tests the unit root status of a series is the Phillips Perron (PP) test, which was introduced by Phillips and Perron (1988). The stages of the relevant test are shown below with the help of the equations.

$$Y_t = \hat{\mu} + \hat{\alpha} Y_{t-1} + \tilde{u}_t \quad (4)$$

$$Y_t = \hat{\mu} + \tilde{\beta} \left(t - \frac{1}{2} \lambda \right) + \tilde{\alpha} Y_{t-1} + \tilde{u}_t \quad (5)$$

Granger Causality test is a method developed by Granger (1969) that enables the determination of causality relationships through dependent and independent variables. The method is used to determine whether variable X affects variable Y. In cases where there is significance, results such as the X variable Granger cause of the Y variable or the Y variable Granger cause of the X variable are obtained, and one-way or two-way causality relationships are obtained and interpreted. This method reveals the power of variables that influence each other. A method that enables causality detection in a stationary time series is frequently preferred in the literature to determine the direction and strength of a relationship (Takım, 2015; Sarıtaş et al., 2018). The hypotheses and stages of the method are shown below using equations (Granger, 1969).

Granger causality analysis hypotheses are established as follows: variable X is not the Granger cause of variable Y and variable X is the Granger cause of variable Y.

$$Y_t = \sum_{i=1}^n \alpha_i X_{t-i} + \sum_{j=1}^n \beta_j Y_{t-j} + v_{1t} \quad (6)$$

$$X_t = \sum_{i=1}^n \lambda_i X_{t-i} + \sum_{j=1}^n \delta_j Y_{t-j} + v_{2t} \quad (7)$$

4.ANALYSIS AND FINDINGS

This study was conducted to determine the relationships between the indicative stock markets of the Fragile Five countries. Determining the relationships among the indicator stock markets of country groups is important for international portfolio diversification. The inclusion of similar countries in the country group considered in this study ensured a homogeneous dataset. The countries included in this study are Türkiye, Brazil, India, Indonesia, and South Africa. Data were obtained between 01.01.2010 and 31.12.2023 to analyze

from a broad perspective and ensure integrity over the years. The data are daily closing prices, and the sample was created by taking logarithmic returns. The selection of the data range used in the study was chosen to cover periods such as crisis periods, war, pandemic, economic crisis. Thus, the relevant crisis periods were included in the analysis and the analysis was carried out from this perspective. The choice of methodology has been applied by analyzing the studies and methods used in the literature. The causality analysis was supported by correlation analysis to determine the relationship. The days when the country's stock exchanges had common data were taken, and the total number of data points was 2726. Analyses were performed using Eviews software. The countries taken as samples, their indicator exchanges, codes, and date ranges are listed in Table 1.

Table 1. Data Set

Country	Stock Market	Code	Date
Türkiye	BIST 100	XU100	
Brazil	BOVESPA	BVSP	01.01.2010
India	NIFTY NEXT 50	NN50	-
Indonesia	IDX COMPOSITE	JKSE	31.12.2023
South Africa	FTSE South Africa	FTSE	

Source: (Investing.com, 2024).

In the first stage of the analysis, descriptive statistics were determined; the relevant reports are presented in Table 2.

Table 2. Descriptive Statistics

	BVSP	FTSE	JKSE	NN50	XU100
Mean	0.000278	0.000339	0.000234	0.000555	0.000478
Median	0.000345	0.000310	0.000828	0.001522	0.001358
Maximum	0.130223	0.069399	0.097042	0.061898	0.094219
Minimum	-0.159930	-0.094747	-0.092997	-0.123695	-0.110633
Standard Deviation	0.014996	0.011296	0.010385	0.011174	0.015928
Observations	2726	2726	2726	2726	2726

Table 2 presents the mean, median, maximum, minimum, standard deviation, and number of observations for the sample. In the continuation of the analysis, Correlation Analysis was carried out to determine the direction and intensity of the relations between the Fragile Five countries. A correlation Analysis enables the determination of opportunities for international portfolio creation and diversification. Table 3 presents the results of these analyses.

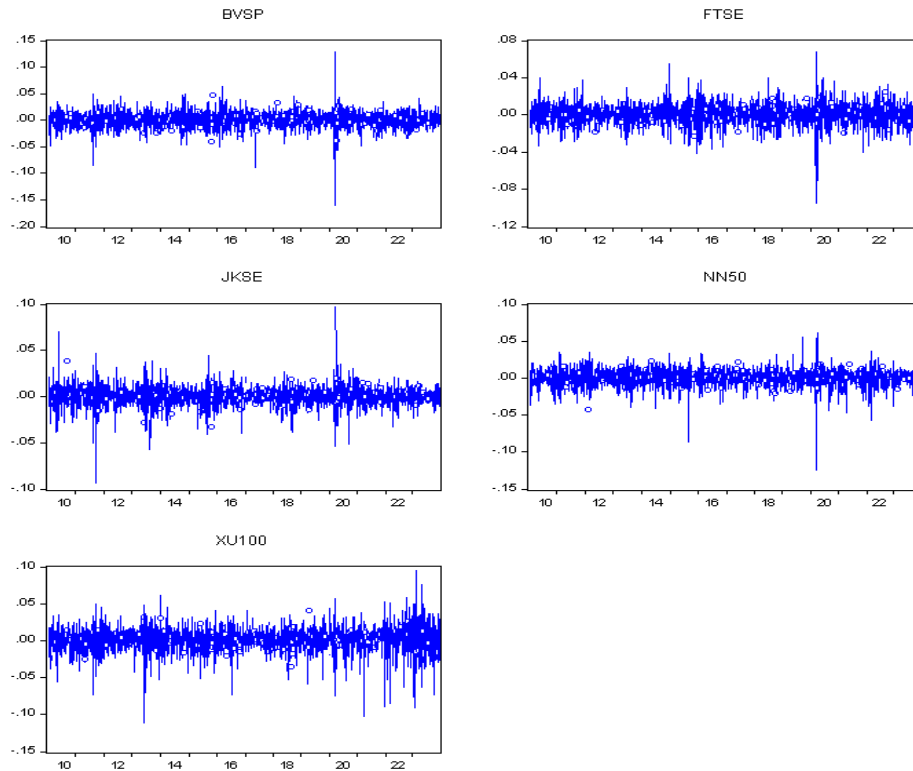
Table 3. Correlation Analysis

	BVSP	FTSE	JKSE	NN50	XU100
BVSP	1				
FTSE	0.351421*	1			
JKSE	0.177831*	0.327765*	1		
NN50	0.258412*	0.364446*	0.356118*	1	
XU100	0.237920*	0.322460*	0.202763*	0.240592*	1

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

Table 3 presents the results of the correlation analysis. Correlation analysis is a type of analysis that provides information about the direction and strength of the relationship between variables. In the analysis, the correlation coefficient was interpreted, and the relevant coefficient was between -1 and 1. While a correlation coefficient of -1 or 1 indicates a complete relationship, approaching these values increases the severity of the relationship. A positive coefficient indicates a linear relationship, and a negative coefficient indicates an opposite relationship (Tabachnick and Fidell, 2015). When Table 3 is examined, a weak-to-medium-level

relationship between the variables is observed. Therefore, it's concluded that there are no problems with the relevant variables in terms of portfolio diversification and use in the analysis. The return series created using logarithmic returns are shown in Graph 1.



Graph 1.Return Series

Graph 1 shows the graphs of the return series. In the graphs of the data covering the period 01.01.2010-31.12.2023, fluctuations were observed in the indices. The analysis was continued with unit root tests. To apply the Granger Causality Test, the data must be stationary at level. The relevant assumptions were tested by performing ADF and PP unit root tests, as shown in Table 4.

Table 4. Unit Root Test Results

At Level		ADF		PP	
		t-statistic	Probability	t-statistic	Probability
Constant	BVSP	-15.2638	0,0000*	-53.1639	0,0001*
	FTSE	-25.4393	0,0000*	-55.0325	0,0001*
	JKSE	-12.9173	0,0000*	-51.1304	0,0001*
	NN50	-13.3127	0,0000*	-50.5541	0,0001*
	XU100	-11.3008	0,0000*	-53.5028	0,0001*
		t-statistic	Probability	t-statistic	Probability
Constant and trend	BVSP	-15.3416	0,0000*	-53.2084	0,0000*
	FTSE	-25.4433	0,0000*	-55.0421	0,0000*
	JKSE	-12.9153	0,0000*	-51.1205	0,0000*
	NN50	-13.3534	0,0000*	-50.5860	0,0000*
	XU100	-11.5233	0,0000*	-53.6223	0,0000*
At First Difference		ADF		PP	
		t-statistic	Probability	t-statistic	Probability
Constant	BVSP	-18.4368	0,0000*	-856.1494	0,0001*
	FTSE	-17.4995	0,0000*	-687.7170	0,0001*
	JKSE	-18.8090	0,0000*	-971.5619	0,0001*

	NN50	-16.4197	0,0000*	-670.6242	0,0001*
	XU100	-16.8235	0,0000*	-625.6741	0,0001*
		t-statistic	Probability	t-statistic	Probability
Constant and trend	BVSP	-18.4332	0,0000*	-855.9874	0,0001*
	FTSE	-17.4961	0,0000*	-694.5052	0,0001*
	JKSE	-18.8053	0,0000*	-971.7552	0,0001*
	NN50	-16.4174	0,0000*	-670.7837	0,0001*
	XU100	-16.8223	0,0000*	-625.0245	0,0001*

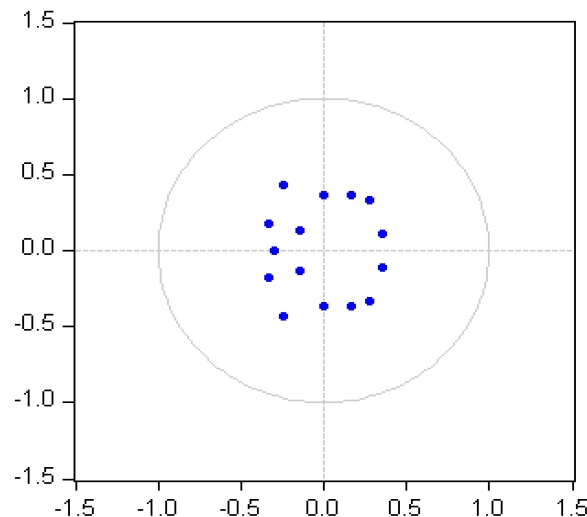
Note: *, **, and *** indicate significance at the 1%, 5%, and 10% levels, respectively.

When the unit root test results are examined, all variables are stationary at level, that is, $I(0)$, according to both the ADF and PP unit root tests. Therefore, the data appears to be suitable for Granger Causality Analysis. The appropriate delay length was determined in continuation with this analysis. The results of the relevant analysis are presented in Table 5.

Table 5. Appropriate Lag Length Results

Lag	LogL	LR	FPE	AIC	SC	HQ
1	40343.92	310.6088	4.83e-20	-30.28844	-30.22210*	-30.26444*
2	40374.29	60.49067	4.81e-20	-30.29248	-30.17085	-30.24846
3	40416.79	84.48808	4.74e-20*	-30.30563*	-30.12871	-30.24160
4	40439.39	44.85100	4.75e-20	-30.30383	-30.07163	-30.21980
5	40460.76	42.31081	4.76e-20	-30.30110	-30.01361	-30.19706
6	40486.93	51.73215	4.76e-20	-30.30197	-29.95920	-30.17793
7	40515.28	55.93545*	4.75e-20	-30.30449	-29.90643	-30.16044
8	40526.21	21.52865	4.80e-20	-30.29392	-29.84058	-30.12986

Table 5 lists the results of the delay-length determination. In academic studies, the Akaike Information Criterion (AIC) or Schwarz Information Criterion (SC) tests are generally preferred when choosing lag length (Köycü and Ege, 2023). In the results in the table, the VAR model was established with an appropriate lag length of 3 based on the AIC and FPE criteria. After determining the delay length, assumption tests are conducted. In this context, the AR characteristic polynomial inverse roots were tested, as shown in Graph 2.



Graph 2. Inverse Roots of the AR Characteristic Polynomial

When the results in Graph 2 are examined, it can be seen that all the roots are located within the circle and are therefore suitable for analysis. An autocorrelation analysis was performed as the final hypothesis test. The results of the relevant analysis are presented in Table 6.

Table 6. Autocorrelation Test

Lag	LRE* stat	Prob.
1	27.14223	0.3488
2	17.80694	0.8505
3	33.32786	0.1231

When the autocorrelation test results in Table 6 are examined, there is no autocorrelation problem between the variables because the probability values for all lag values are greater than 0.005. Finally, the Granger Causality Test was applied. The causality relationship between the indicator stock markets of the Fragile Five countries is reported in Table 7.

Table 7. Granger Causality Test Results

Direction of Causality	Chi-Square Statistics	Probability Value	Status
FTSE → BVSP	2.665267	0.4462	Not a Granger Cause.
JKSE → BVSP	15.20390	0.0017*	Granger Cause.
NN50 → BVSP	8.241557	0.0413**	Granger Cause.
XU100 → BVSP	0.181995	0.9804	Not a Granger Cause.
BVSP → FTSE	85.24605	0.0000*	Granger Cause.
JKSE → FTSE	12.65675	0.0054*	Granger Cause.
NN50 → FTSE	24.14222	0.0000*	Granger Cause.
XU100 → FTSE	11.88725	0.0078*	Granger Cause.
BVSP → JKSE	101.1317	0.0000*	Granger Cause.
FTSE → JKSE	13.30944	0.0040*	Granger Cause.
NN50 → JKSE	5.494898	0.1389	Not a Granger Cause.
XU100 → JKSE	32.60780	0.0000*	Granger Cause.
BVSP → NN50	58.76986	0.0000*	Granger Cause.
FTSE → NN50	17.55055	0.0005*	Granger Cause.
JKSE → NN50	3.683323	0.2978	Not a Granger Cause.
XU100 → NN50	4.192395	0.2414	Not a Granger Cause.
BVSP → XU100	19.42370	0.0002*	Granger Cause.
FTSE → XU100	2.704873	0.4394	Not a Granger Cause.
JKSE → XU100	5.039851	0.1689	Not a Granger Cause.
NN50 → XU100	7.417009	0.0597***	Granger Cause.

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

When the results of the Granger Causality Test are examined, it is observed that the causality relations between the Fragile Five countries are intense. When the causality results were examined, a causal relationship was observed in 13 out of 20 relationships.

The results are reported in Table 8. When the relationship types in the table were examined, it was determined that there were 5 one-way, 4 bi-directional, and 1 non-existent relationships. The causality relationships reached by the analysis were as follows:

- There is Granger causality from the Indonesian indicator stock market to the Brazilian indicator stock market.
- There is Granger causality from the Indian indicator stock market to the Brazilian indicator stock market.
- There is Granger causality from the Brazilian indicator stock market to the South African indicator stock market.

- There is Granger causality from the Indonesian indicator stock market to the South African indicator stock market.
- There is Granger causality from the Indian indicator stock market to the South African indicator stock market.
- There is Granger causality from the Türkiye indicator stock market to the South African indicator stock market.
- There is Granger causality from the Brazilian indicator stock market to the Indonesian indicator stock market.
- There is Granger causality from the South African indicator stock market to the Indonesian indicator stock market.
- There is Granger causality from the Türkiye indicator stock market to the Indonesia indicator stock market.
- There is Granger causality from the Brazilian indicator stock market to the Indian indicator stock market.
- There is Granger causality from the South African indicator stock market to the Indian indicator stock market.
- There is Granger causality from the Brazilian indicator stock market to the Türkiye indicator stock market.
- There is Granger causality from the Indian indicator stock market to the Türkiye indicator stock market.

Table 8. Causality Test Results

FTSE	≠	BVSP	One Way Causality
BVSP	=	FTSE	
JKSE	=	BVSP	Two Way Causality
BVSP	=	JKSE	
NN50	=	BVSP	Two Way Causality
BVSP	=	NN50	
XU100	≠	BVSP	One Way Causality
BVSP	=	XU100	
JKSE	=	FTSE	Two Way Causality
FTSE	=	JKSE	
NN50	=	FTSE	Two Way Causality
FTSE	=	NN50	
XU100	=	FTSE	One Way Causality
FTSE	≠	XU100	
NN50	≠	JKSE	No Causality
JKSE	≠	NN50	
XU100	=	JKSE	One Way Causality
JKSE	≠	XU100	
XU100	≠	NN50	One Way Causality
NN50	=	XU100	

5.RESULT AND DISCUSSION

Investment decisions are expressed as a concept made with the perception of expected return and risk, motivated to consume in the future, and provide both return and protection against inflation by turning savings into investment opportunities. Decisions that can be made on different financial assets in financial markets are made on international assets under the influence of globalization. Finance theories, which have been introduced in the literature since the second half of the 1900s, are important in terms of issues such as numerical measurement of risk, portfolio calculations, and market efficiency. In addition to expected returns and risks, external factors are also effective in investment decisions. These factors include epidemics, wars, financial crises, inflationary environments, economic contractions, and personality traits. Some of these factors are referred to as systematic risk, which cannot be reduced to zero even through diversification.

This study contributes to the literature on investment decisions and portfolio diversification. For this purpose, the Fragile Five countries were used as samples. The countries involved were similar. To evaluate from a broad perspective, data were obtained between 01.01.2010 and 31.12.2023. Correlation analysis and Granger causality tests were applied to the dataset created based on the common days in the relevant data. The analysis detected low- or medium-level correlations between the indicator stock markets of the countries, and causality was found in 13 of 20 relationships.

When causality relationships were evaluated, the Brazilian indicator stock market was determined to be the Granger-cause of the indicator stock markets in the four countries in the sample. It was concluded that the Indian indicator stock market was the Granger cause of the three-country indicator stock market. Finally, it was determined that the indicator stock markets of Indonesia, South Africa, and Türkiye are the Granger causes of the indicator stock markets of the two countries. The Brazilian indicator stock market has the power to influence other countries as well. The South African indicator stock market has been identified as being the most affected by other countries. Additionally, when evaluated bilaterally, there were five unidirectional, four bidirectional, and one non-Granger causality relationships between the countries.

When the obtained results were compared with those reported in the literature, they were found to be generally compatible. The results of this study indicate that the relevant countries can be used for portfolio diversification and that they affect each other. In this respect, this study parallels Akel (2015) and Turgut and Köroğlu (2017).

The findings obtained are important in terms of determining the relationships between the indicator stock markets of the Fragile Five countries. When evaluated in terms of international portfolio diversification, it was determined that the relevant indices have low or medium correlation and that they can be invested. In addition, when causality relationships were evaluated, it was determined that the Brazilian indicator stock market is the Granger cause of the indicator stock markets of other countries. The impact and being affected situations between stock markets are also important in terms of investment decisions. The determination that investors can make optimum decisions using scientific methods through the studies carried out is also an inference of the study. In contrast to the current anomalies and heuristics within the scope of behavioral finance and herd behavior, making optimum decisions using scientific methods is important in terms of the efficiency of capital markets. It is stated that the analyses to be carried out in the decisions to be made on stocks or different financial assets will also prevent excessive valuation or value losses. Within the scope of the study, an analysis was made on a group of countries that can be evaluated in terms of international portfolio investments and the situation of being evaluated within the scope of investment opportunities was determined.

In future studies, studies on the assets included in the country group indices will support the guiding nature of academic studies. As in the literature, it is also suggested to determine the relationships by applying methods such as regression analysis, volatility propagation or regression analysis. Comparing the results obtained in this study with the academic studies to be carried out in the following periods is important in terms of both the approaches in crisis periods and the relationships in stationary periods.

The limitation of the study can be shown as taking a single country group as a sample. Therefore, examining the studies on portfolio diversification and other country groups is intended to overcome this limitation. When the study is evaluated in general, it is seen that the findings confirm globalization. In this context, the countries

in the relevant country group show similar characteristics. However, bidirectional causality is observed in some countries and unidirectional causality is observed in some countries. In some countries, no causality relationship is detected. As stated in the conceptual framework, the concept of portfolio diversification is important in terms of achieving the expected return through these movements and results.

When a general evaluation is made, determining the relationship between the indicator stock markets of countries is important for both investment decisions and policymaking. It is hoped that this study, which is thought to be important for making future decisions based on past data, will serve as a guide for those concerned. The findings of this study are expected to contribute to researchers, sector representatives, and investors. Analyzing the relevant sample with data from different periods and methods and comparing it with this study is recommended to valuable researchers.

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