Hacettepe Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi
Hacettepe University Journal of Economics and Administrative Sciences
https://dergipark.org.tr/tr/pub/huniibf
ISSN:1301-8752 E-ISSN:1309-6338

Başvuru Tarihi / Submission Date: 17/01/2022
Kabul Tarihi / Acceptance Date: 19/10/2022

DOI: 10.17065/huniibf.1058943
2022, 40 (4), 762-775

Araştırma Makalesi / Research Article

Analysis of the Causality Relationship Between the VIX (Fear) Index and Futures Markets

Ethem Kılıç[1], Hamide Özyürek[2]

Abstract

The crisis experienced in any financial market in the world also affects other financial markets. Financial indices, which are accepted as primary in international markets, directly affect the decisions made by individual and institutional investors. One of the most important among these financial indices is the VIX Fear Index. According to literature review, it has been understood that there is no study that deals with the VIX index and the BIST 30 futures market together. Therefore the main purpose of the study is to examine the causal relationship between the VIX index and the futures market. In this context, BIST 30 Futures market and Gold Futures market variables were used for the period between 01.01.2012 and 21.11.2021. The Hatemi-J causality test was used to explain the causal relationship between the variables. According to the Hatemi-J asymmetric causality test results, it was determined that there was positive causality from VIX index to BIST 30 futures. VIX index should be considered for investors who want to invest in the BIST 30 futures market. According to the findings, Increases in the VIX index allow to predict possible crises in the markets.

Keywords: *VIX Index, BIST 30 Futures, Gold Futures, Hatemi-J causality.*

VIX Korku Endeksi ile Vadeli İşlemler Piyasası Arasındaki Nedensellik İlişkisinin Analizi

Öz

Dünyanın herhangi bir finansal piyasasında yaşanan kriz diğer finansal piyasaları da etkilemektedir. Uluslararası piyasalarda birincil olarak kabul edilen finansal endeksler, bireysel ve kurumsal yatırımcıların aldıkları kararları kararları doğrudan etkilemektedir. Bu finansal endeksler arasında en önemlilerden birisi de VIX Korku Endeksi'dir. Literatür incelendiğinde VIX korku endeksi ile ilgili pek çok çalışma yapılmasına rağmen VIX endeksi ile vadeli işlemler piyasasını ele alan çalışmaya rastlanmamıştır. Bu nedenle çalışmanın temel amacı VIX endeksi ile vadeli işlemler piyasası arasındaki nedensellik ilişkisini incelemektir. Bu bağlamda, VIX korku endeksi, BIST 30 Vadeli işlemler piyasası ve Altın Vadeli işlemler piyasası değişkenleri 01.01.2012 – 21.11.2021 dönemi için kullanılmıştır. Değişkenler arasındaki nedensellik ilişkisini açıklamak için Hatemi-J nedensellik testinden yararlanılmıştır. Hatemi-J asimetrik nedensellik testi sonuçlarına göre VIX endeksinden BIST 30 vadeliye doğru pozitif yönde nedensellik olduğu saptanmıştır. VIX endeksi BIST 30 vadeli işlemler piyasasına yatırım yapmak isteyen yatırımcılar açısından dikkate alınmalıdır. Elde edilen bulgulara göre VIX endeksindeki artışlar piyasalarda olası krizleri tahmin edilmesine olanak tanımaktadır.

Anahtar Kelimeler: *VIX endeksi, BIST 30 Vadeli, Altın Vadeli, Hatemi-j Nedensellik.*

[1] Sorumlu Yazar (Corresponding Author), Instructor Asst., Bingol University Social Sciences Vocational School, Finance, etemklc@hotmail.com, https://orcid.org/0000-0002-6247-9024
[2] Assoc. Prof.Dr, Ostim Technical University FEAS, hamide.ozyurek@ostimteknik.edu.tr, https://orcid.org/0000-0002-2574-954X

Atıf: Kılıç, E., Özyürek, E. (2022), Analysis of the causality relationship between the VIX (Fear) index and futures markets. *Hacettepe Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 40 (4), 762-775.

INTRODUCTION

Due to globalization in the 21st century world, it is possible to say that capital movements are circulating between countries rather than physical goods. This circulation in capital causes new effects to occur in international financial markets. Globalization facilitates the circulation of capital, and the capital reaching outside the borders of the country causes the funds of both institutional and individual investors to spread around the world. In this case, it is possible to say that international capital flows have increased and this increase continues day by day. Financial integration caused by globalization brings with it some risks. The crisis experienced in any financial market in the world also affects other financial markets. The fact that the country's economies have become financially and commercially open to the outside has made the contamination of the world's crises and the domino effect inevitable (Ayhan, 2019).

Looking at the crises experienced, it can be said that the volatility is high and the confidence of the investors has decreased. Therefore, ensuring stability in variables such as inflation, exchange rate, interest rates, uncertainty and volatility is important for sustainable economic growth (Kartal et al., 2021). Volatility in financial markets causes negative effects on financial markets. This situation leads investors to be more careful.

Financial indices, which are accepted as primary in international markets, directly affect the decisions or decisions made by individual and institutional investors. One of the most important among these financial indices is the VIX Fear Index. One of the most important indicators of its mobility in international markets is considered to be the VIX fear index (Öner, 2018). The Chicago Board Options Exchange (CBOE) measures market expectations of short-term volatility implied by stock index options prices. It has been calculating the volatility index VIX since 1993 to calculate expectations metrics (Fernandes et al., 2014). The VIX index, which was calculated over the S&P 100 index in the first years, is now calculated over the S&P 500 index. As a result of the calculation, a fixed 30-day measure of the expected volatility of the US stock market is produced. After the VIX is priced as a percentage, it is approximated to the expected movement in the S&P 500 Index over the next 30 days and then annualized (Smales, 2022). The stocks of the said index are based on option pricing. The VIX index emerges in the difference between stock trading options. If the difference between the trading option is high, the VIX ratios are high, and if it is low, the VIX ratios are low. During periods of high uncertainty, the VIX index is expected to be above 30%, and in times of high risk, it is expected to be below 20% during periods of low uncertainty, and it can be said that the risk is low (Sarıtaş and Nazlıoğlu, 2019). The VIX index is very important for investors who invest in international stocks. Because it informs investors about uncertainties and investors make their decisions accordingly (Tuncel and Gürsoy, 2020). The VIX Index, a real-time market index, also represents the market's 30-day forward volatility expectation. The VIX Index measures expected or implied volatility (Dai et al., 2020). The index, which expresses a common opinion about the expected market volatility in the future, is determined by the investors. (Whaley, 2000). It has been determined that the VIX index collects information about the contribution of past bounces to total volatility, while at the same time showing increasing information about future bounce efficiency (Becker et al., 2009). The VIX index expresses the anxiety levels of investors. It affects both investment decisions and demand, which is effective in determining the direction of the market. The VIX index is an index that is followed not only in times of crisis but also in normal processes (Yıldırım, 2019).

Due to the high VIX index in times of crisis, the VIX Index is also referred to as the fear index. It is accepted as a measure of fear, especially in the developing countries' markets like Turkey (Bektaş & Babuşcu, 2019). It is also known as the "Investor Fear Measure" (Da et al., 2015), "Fear Meter" or "Fear Index" (Ding et al., 2021). The higher the VIX Index, the greater the fear. High VIX levels typically reflect pessimism, causing stock prices to go too high on the downside and hence subsequent rallies. Conversely, low VIX levels will reflect the peace of mind among market participants, disappoint the market and increase the possibility of a market correction (Fernandes et al., 2014).

It is possible to say that the VIX index has serious impacts, especially on developing countries' stock markets. It was determined that there are a lot of studies about causal relationships between the VIX index, stock markets, exchange rate and gold. In the literature, the effects of the changes in the VIX index on the financial indicators in the national markets have been investigated. Studies have shown that the change in the VIX index causes changes in the BIST 100 index, dollar and euro exchange rate, industrial production index, real sector and consumer confidence index, purchasing managers index and risk appetite (Akdağ, 2019). Akdağ et al. (2020) tested the volatility spillover effects between the VIX and RISE indices and the global risk appetite, and found that there was a unilateral causal relationship from VIX to the RISE index (Akdağ et al. 2020). Telek (2020) investigated whether the VIX index has an effect on portfolio investments and exchange rates for Turkey. In the study, which used quarterly data for the period 2004:1-2019:4, ARDL Bounds test was used to determine the cointegration relationship between the variables. According to the results obtained, no cointegration relationship was found between the VIX index and exchange rates. Ercan and Demirbaş (2020) used ARDL bounds test on working day data between 01.01.2010- 31.03.2020 in the study in which they compared the US Dollar index and the VIX Fear index. With the Granger causality test, it was examined whether there was a causal relationship between the variables. The results show that there is a long-term relationship between the VIX fear index and the dollar index, and that there is unidirectional causality from the Fear index to the dollar index.

It is possible to say that the studies carried out in Turkey are in this parallel according to the information obtained through the literature review, it has been understood that there is no study that deals with the VIX index and the futures market together. As a result of this situation, the relationship between the VIX (Fear) index, which is considered to be lacking in the literature, and the futures market will be examined in this study.

1. LITERATURE REVIEW

Studies examining the relationships between the VIX index, gold in Turkey and abroad, and stock markets are summarized below.

Jubinski and Lipton (2013) analyzed the relationships between the VIX index and oil, silver, and gold futures. The VIX index and oil are not statistically significant. They found that there is a significant effect between the VIX and the gold and silver futures markets.

Erdoğdu and Baykut (2016) investigated the effects of the VIX index and the MOVE index on the BIST bank index with daily data for the 1998-2015 period. The relationship among the variables was analyzed with the ARDL Bound test and the Toda-Yamamoto Granger test. When the analysis is evaluated, no long-term relationship was found between the BIST Bank index and the MOVE and VIX indices. In accordance with the Granger causality test, while there is a causal

relationship between the VIX index to BIST Bank, there is not any causality relation between the MOVE index to BIST Bank.

In their study, Ertunga and Çakar (2016) investigated the effects of the VIX index and Global Liquidity Indicator (GLI) value on stock prices and the nominal exchange rate of US dollar/TL between the 2000-2015 periods. The results of the research show that the VIX index is effective in the Turkish financial markets.

Basher and Sadorsky (2016) used GO-GARCH, DCC, and ADCC methods to model the volatility among stock prices of an emerging market, VIX, oil, bond, and gold prices. The analysis results using daily data for the years 2000-2014, VIX, show that oil, gold, and bonds are useful in protecting stock prices, while oil is the best tool for hedging.

Bouri et al. (2017) investigated the cointegration and non-linear causal connection between oil, gold, and VIX index with daily data for the period of 01 June 2009 to 31 May 2016. They found that cointegration relations exist. Accordingly, it is understood that the implied volatility of oil and gold has a non-linear and positive effect on the implied VIX index volatility.

Huang and Wang (2017) used VIX as a calculation of investors' fear in their research. In research, the changes' effect on VIX in the Taiwan stock market, which has an important place among the emerging markets and mostly consists of individual investors, has been analyzed. The researchers, who evaluated the stocks traded between January 1, 2007, and December 31, 2014, in the 1989 trading day period, determined that there is a relation between the Fear Index (VIX) and Taiwan's Stock Exchange. They concluded that the change in the Fear Index (VIX) affects the investor's behavior.

Öner (2018) analyzed the causality relationship among the gold, exchange rate, oil, and interest VIX index with daily data for the period 02.01.2008- 10.05.2017. He found that there is not any causal relationship between VIX and gold.

Öner et al. (2018) studied the VIX index effect on the developing countries' stock markets. They carried out the study with daily data for the period 23.10.2006 – 10.05.2017. As an outcome of the analysis, they determined that there is a long and short-term relationship among the stock markets of developing countries and the fear index.

Ruan (2018) investigated the VIX index effect on the Chinese stock markets. He found that the VIX index has a major effect on the Chinese stock markets. According to Ruan, the VIX index can take into consideration as one of the best measurements of future market trends.

Başarır (2018) examined the VIX index effects on Borsa Istanbul. In the study, BIST 100 index was used to represent Borsa Istanbul. The research was carried out with the help of a frequency domain causality test with daily data covering the period of 03 January 2000 to 09 February 2018. A permanent and temporary one-way causality relationship was found from BIST 100 to the VIX index. On the contrary, there is no permanent or temporary causality relation from BIST 100 to the VIX index.

Kuzu (2019) studied the relationship between the BIST 100 and VIX index. It investigated the short, medium, and long-term relationship with daily data covering the period of January 03, 2000 to January 23, 2019. As a result of the analysis, BIST 100 has no effect on the VIX index, but the VIX index has long, short, and medium-term effects on BIST 100.

Kang et al. (2019) examine the interconnectedness and dynamic spreads between VIX, stock, bond, and commodity. In the research, stock markets of Austria, Japan, Australia, India, China, Brazil, South Africa, Denmark, Germany, France, Ireland, Spain, Italy, Korea, Russia, United Kingdom, USA, and Switzerland were used. Taking into account daily data series from 19 July 2010 to 27 December 2017 (1942 observations), the results of the research show that emerging stock markets are the net recipients of shocks. According to the findings, while commodity markets provide an opportunity for weakness in the short term, portfolio strategy using shocker and shocker knowledge provides better hedging efficiency.

Özdemir (2020) compared the return and friskiness interactions among the Fear Index and the BIST 30 and BIST 30 futures markets. In this direction, they analyzed the daily data for the period 09.06.2012- 31.10.2019 with the help of the EGARCH model. They found that positive information shocks are less effective than negative information shocks for BIST 30 and BIST 30 futures variables. With the inclusion of the Fear Index in the model, it was found that the volatility persistence of the BIST 30 variable was the same, but the volatility persistence in the BIST 30 futures market decreased.

Gülhan (2020) examined the relationship among VIX index and exchange rate, gold prices, oil and BIST 100 with the help of weekly data for the 2015-2019 period and the Granger causality test. They found causal relations between the VIX index and gold prices, exchange rate, oil, and BIST 100.

Gürsoy (2020) examined the relations between the VIX index and BRICS country's stock markets. The Toda – Yamamoto causality test and daily data from 24.02.2011 to 06.01.2020 were used in the study. At the end of the analysis results, it was determined that there is a bidirectional causality relation between the VIX index and the stock markets of South Africa and Russia and unidirectional causality relations among the stock markets of China and India. However, he found that there is not any causal relation between the VIX index and the Brazilian stock market.

Tuncay (2021) investigated the volatility spread among the sector indices with daily data for the period 2013 – 2020 and VIX fear index. The multivariate CCC-GARCH model was used in the work. At the analysis end, it was determined that the volatility interactions between the variables were statistically significant and weak, as well as negative information shocks were more effective.

Münyas and Bektur (2021) investigated the relationship between CDS, Dollar, Euro, BIST 100, Gold and VIX index. In their study, the long-term relations with the ARDL model was analyzed using the data from thr 03 January 2005 to 31 December 2019. As a result of the study, a positive relation among the VIX index and gold was found.

Çonkır et al. (2021) investigated the causality relationships among the developing countries' stock markets and the VIX index. They found that there is a one-way causality relation among BIST 30 and VIX index. However, they found that there are no causal relations between the VIX index and the Mexican, Indian, Russian and Indonesian stock markets.

Tunçel and Kocabıyık (2021) studied the causality relations among precious metals and the VIX index with daily data for the period 10 January 2014 – to 02 January 2020. According to the results of the Toda-Yamamoto causality test; They found bidirectional causality relations among gold and VIX index, palladium and platinum.

At the end of the literature research, there are many studies on the VIX Fear Index. However, when the literature is examined, it can be said that there are no studies dealing with the relations between the futures market and VIX Fear Index. For this reason, it is thought that this study, which analyzes the relations between the futures market and VIX Fear Index, will contribute to the finance literature.

2. DATA SET AND METHOD

The main purpose of this study is to investigate the relationship between the futures market and the VIX index. In this direction, the VIX index, BIST 30 Futures market, and Gold Futures market variables are used. Weekly 5-day data for the period 01.01.2012 – 21.11.2021 were used in the study. The data is taken from investing.com.

Table 1: Variables Used in the Study

Variable	Description	Data Source	Period
VIX Index	VIX Index	investing.com	01.01.2012/21.11.2021
BIST 30 Index	BIST 30 Futures market traded on Borsa Istanbul		
Gold Futures	Gold futures index traded on the futures market		

Hatemi-J asymmetric causality test was applied to analyze the causality relations among VIX index, BIST 30 futures and Gold futures market. EViews 9 and Gauss 6 package programs were used for the analysis.

Toda-Yamamoto causality test (1995) is applied to test the causality relationship among the variables. Toda-Yamamoto (1995) causality test produces a single statistic by considering and evaluating all of the analyzed periods (Toda & Yamamoto, 1995). However, if the errors are not normally distributed, the bootstrap Monte Carlo simulation model is applied to obtain the critical values. But it is possible to talk about the shortcomings of the model. This shortcoming is due to the inability to distinguish between negative and positive shocks in the model. Hatemi-J (2012) developed the asymmetric causality test. As a result of this test, it is possible to obtain different results against positive and negative shocks due to the presence of asymmetric information in the financial market and financial instruments and the inhomogeneity of financial instruments in the market (Çevik and Zeren, 2014). Therefore, the results can be misleading. The Hacker and Hatemi-J (2006) Bootstrap Granger Causality Test and the Hatemi-J Asymmetric Causality Test (2012) separate negative and positive shocks. This will give information about the dynamics of the series in asymmetric causality analysis. Thus, it will enable us to make predictions about the future (Yılancı and Bozoklu, 2014). It is considered appropriate to use this test in studies dealing with financial time series.

It is possible to describe the Hatemi-J asymmetric causality relationship among two financial assets as follows (Hatemi, 2012);

$$y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{10} + \sum_{i=1}^{t} \varepsilon_{1i} \quad \text{ve} \; y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{20} + \sum_{i=1}^{t} \varepsilon_{2i} \qquad (1)$$

Equation (1) $t = 1, 2, \ldots T$, describes the constant terms, y_{1t} ve y_{2t} the initial value, and ε_{1i} ve ε_{2i} the error terms. The negative and positive shocks are explained as in equation (2);

$$\varepsilon_{1i}^{+} = \max\ (\varepsilon_{1i}, 0)\,, \varepsilon_{2i}^{+} = \max\ (\varepsilon_{2i}, 0), \varepsilon_{1i}^{-} = \min\ (\varepsilon_{1i}, 0)\ \text{ ve }\ \varepsilon_{2i}^{-} = \min\ (\varepsilon_{2i}, 0) \qquad (2)$$

$\varepsilon_{1i} = \varepsilon_{1i}^{+} + \varepsilon_{1i}^{-}$ ve $\varepsilon_{2i} = \varepsilon_{2i}^{+} + \varepsilon_{2i}^{-}$ şeklinde özetlenebilir.

It is possible to summarize Equation (1) and (2) as follows.

$$y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{1,0} + \sum_{i=1}^{t} \varepsilon_{1i}^{+} + \sum_{i=1}^{t} \varepsilon_{1i}^{-}, \qquad (3)$$

$$y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{2,0} + \sum_{i=1}^{t} \varepsilon_{2i}^{+} + \sum_{i=1}^{t} \varepsilon_{2i}^{-}. \qquad (4)$$

The cumulative form of negative and positive shocks for each financial asset is explained as follows;

$$y_{1t}^{+} = \sum_{i=1}^{t} \varepsilon_{1i}^{+}\,, \quad y_{1t}^{-} = \sum_{i=1}^{t} \varepsilon_{1i}^{-}\,, \quad y_{2t}^{+} = \sum_{i=1}^{t} \varepsilon_{2i}^{+}\,, \quad y_{2t}^{-} = \sum_{i=1}^{t} \varepsilon_{2i}^{-}\,, \qquad (5)$$

Hatemi-J expresses positive shocks $y_t^{+} = y_{1t}^{+}, y_{2t}^{+}$ in asymmetric causality. The parameter $y_t^{-} = y_{1t}^{-}, y_{2t}^{-}$ describes negative shocks.

3. RESULTS

Figure 1: VIX Index

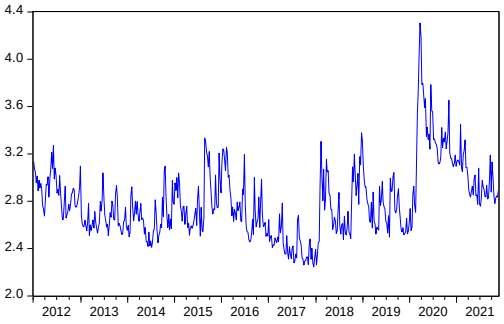

Figure 2: BIST 30 Futures

Figure 3: Gold Futures

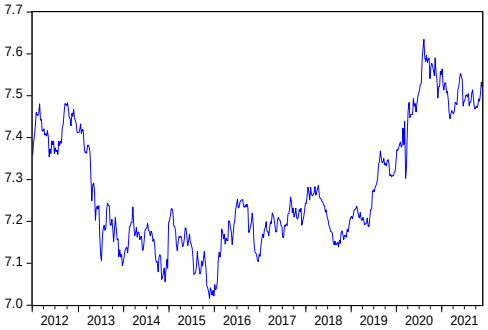

Figure 1 and Figure 2 present VIX Index and BIST 30 Futures respectively, and Figure 3 shows It is observed that there are minor fluctuations in the VIX index and gold futures variables. It is possible to say that there was a sharp rise in BIST 30 futures in the second half of 2015, and on the contrary, there was a sharp decline in the second half of 2016. Analyzes were made by taking natural logarithm of the data.

Table 2: Descriptive Statistics of the Series

	VIX Index	BIST 30 Futures	Gold Futures
Mean	2.796	6.101	7.276
Median	2.750	6.927	7.228
Maximum	4.305	7.564	7.635
Minimum	2.247	4.108	7.016
Std. Deviation	0.305	1.284	0.145
Jarque-Bera	229.568	82.188	41.072
Probability	0.000	0.000	0.000

Descriptive statistics of the series are given in Table 2. As a result of the review, it is determined that the highest average value is Gold futures, while the lowest value is the VIX index. Considering the std. deviation value of the series, it has been determined that the series with the highest volatility belongs to BIST 30 futures and the lowest volatility belongs to gold futures. According to Jarque-Bera results, it was determined that the series were not normally distributed.

Table 3: Unit Root Test Results

	ADF		PP	
	Fixed	**Constant and Trend**	**Fixed**	**Constant and Trend**
Level Values				
VIX Index	-4.846*	-5.163*	-5.372*	-5.811*
Probability	0.000	0.000	0.000	0.000
BIST 30 Futures	-1.305	-2.441	-1.313	-2.716
Probability	0.629	0.358	0.625	0.231
Gold Futures	-1.301	-1.872	-1.301	-1.866
Probability	0.631	0.668	0.631	0.671
1. Difference Values				
VIX Index	-27.947*	-27.922*	-33.409*	-33.400*
Probability	0.000	0.000	0.000	0.000
BIST 30 Futures	-20.651*	-20.636*	-33.602*	-33.595*
Probability	0.000	0.000	0.000	0.000
Gold Futures	-22.920*	-22.971*	-22.925*	-23.050*
Probability	0.000	0.000	0.000	0.000

Note: **: It is significant at the 5% level.

The stationarity of the variables of the VIX index, BIST 30 futures and Gold futures series were tested with ADF and PP unit root tests. The stationarity tests results performed are given in Table 3. As a result of the analysis, it was determined that the level values of the variables other than the VIX index contain unit root. However, it was found that all series became stationary at the first difference. It is seen that PP and ADF tests' results support each other and the results are given in Table 3.

Table 4: Johansen Cointegration Test Results

Hypothesized	Eigenvalue	Trace Statistic	%5 Critical Value	Prob.**
None *	0.056	37.507	29.797	0.005
At most 1	0.012	7.854	15.495	0.481
At most 2	0.003	1.449	3.841	0.229
Hypothesized	**Eigenvalue**	**Max-Eigen Statistic**	**%5 Critical Value**	**Prob.****
None *	0.056	29.653	21.132	0.003
At most 1	0.012	6.405	14.265	0.562
At most 2	0.003	1.449	3.841	0.229

Note: **: It is significant at the 5% level.

Johansen cointegration test results are presented in Table 4. As a result of the analysis, it was determined that the variables at the 5% significance level were cointegrated. Since the value of Trace Statistic and Max-Eigen Statistic test statistic is higher than 5% Critical Value, we can say that there is a cointegration relationship.

Table 5: Hatemi-J Asymmetric Causality Test Results

Aspect of Causality	Test Statistics	Bootstrap Critical Values		
		%1	%5	%10
VIX Index (+) > BIST 30 Futures (+)	6.943**	11.925	4.285	2.184
VIX Index (-) > BIST 30 Futures (-)	0.621	13.951	6.659	4.538
BIST 30 Futures > VIX Index (+)	0.895	11.412	4.178	2.237
BIST 30 Futures (-) > VIX Index (-)	12.210**	13.011	6.589	4.626
VIX Index (+) > Gold Futures (+)	0.936	7.188	3.931	2.659
VIX Index (-) > Gold Futures (-)	0.268	6.712	3.805	2.699
Gold Futures (+) > VIX Index (+)	3.160	6.877	3.718	2.591
Gold Futures (-) > VIX Index (-)	0.168	6.991	3.965	2.773

Note: **: It is significant at the 5% level.

The Hatemi-J asymmetric causality results applied to the causality relation among the VIX index and BIST 30 futures and gold futures are given in Table 5. According to the results of

Hatemi-J asymmetric causality test; It has been determined that the positive causality results from the VIX index on the BIST 30 futures are 6.943 and the critical value is 4.285 according to the 5% significance level. Since the 5% critical value is smaller than the test statistic, it was found to be statistically significant. In this case, it is seen that there is a positive causality relationship from the VIX index to the BIST 30 futures. VIX Index (-)> BIST 30 Futures (-) Since the 5% critical value is greater than the test statistic, there is no negative causal relation from VIX index to BIST 30 futures. It has been found that there is no positive causality on the VIX index from BIST 30 futures. However, the negative Hatemi-J asymmetric causality result on the VIX index from BIST 30 futures was found to be statistically significant because the test statistic was higher than the 5% significance level. In this case, it has been determined that there is a negative causality on the VIX index of BIST 30 futures. The positive and negative Hatemi-J asymmetric causality results between the VIX index and the gold futures were found to be statistically insignificant because the test statistic was smaller than the 5% significance level. Thus, there is no positive or negative causality relation among the VIX index and gold futures.

4. CONCLUSION AND POLICY IMPLICATIONS

Technological developments allow the flow of information in financial markets to become transparent and increase. It also causes the integration of financial markets. This situation has begun to affect each other and act jointly in instruments traded in financial markets. All these developments have affected the behavior of investors and have caused investors to act together. The VIX index effect on financial markets and financial instruments has been very important in the finance literature in recent years. For this reason, the causality relation among the VIX index and the futures market has been examined in this study. Accordingly, VIX index, BIST 30 futures and Gold futures variables are discussed. Weekly data for the period 01.01.2012 – 21.11.2021 were used. In the study, the Hatemi-J asymmetric causality test was used to analyze the causal relation among the variables.

According to the results obtained in the Hatemi-J asymmetric causality test; It has been determined that there is positive causality towards VIX index, BIST 30 futures and negative causality relationship towards BIST 30 Futures, VIX index. It was determined that there was a cointegration relationship between the variables. It is seen that these results are similar to the studies in the literature Tuncay (2021), Kuzu (2019), Öner, İçellioğlu and Öner (2018), Başarır (2018) and Ruan (2018). There is no causal relation among the VIX index and gold futures. This result is similar to Öner (2018) study in the literature. In the literature, Jubinski and Lipton (2013), Bouri et al. (2017) Münyas and Bektur (2021), Gülhan (2020) studies differ from the findings.

It is possible to say that the VIX index, espressed as the fear index, leads to crises that are likely to occur in the markets. The presence of a causal relation among the VIX index and the BIST 30 futures market is important for investors who want to invest in the BIST 30 futures market. Increases in the VIX index allow to predict possible crises in the markets. In such a case, it will cause investors to act cautiously. When faced with such a situation, investors will want to withdraw their investments and will want to turn to reliable markets. It is thought to be the right decision for rational investors who want to maximize their profits.

Studying the stock futures market only on the sample of Turkey and limiting it to the data for the period 01.01.2012- 21.11.2021 constitute the limitations of this research. In future studies, studies using indices representing the exchange rate futures market and the

international futures market will make significant contributions to the literature. It will be useful to examine the subject with different methods in future studies.

AUTHOR STATEMENT

Statement of Research and Publication Ethics

This study has been prepared in accordance with scientific research and publication ethics.

Author Contributions

The authors contributed equally to the study.

Conflict of Interest

There is no conflict of interest for the authors or third parties arising from the study.

REFERENCES

Akdağ, S. (2019). VIX korku endeksinin finansal göstergeler üzerindeki etkisi: Türkiye örneği. *Hitit Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *12*(1), 235-256. 235-256. https://doi.org/10.17218/hititsosbil.522619

Akdağ, S. İskenderoğlu, & Alola, AA. (2020). Risk İştahı Endeksleri Arasında Volatilite Yayılma Etkileri: VIX ve Yükselişten İçgörü. Letters in Spatial and Resource Sciences, 13(1), 49-65. https://doi.org/10.1007/s12076-020-00244-3

Ayhan, F. (2019). Türkiye Ekonomisinde Döviz Kuru Oynaklığının Dış Ticaret Üzerindeki Etkisinin Analizi. *Business and Economics Research Journal*. *10*(3), 629-647, https://doi.org/10.20409/berj.2019.190

Basher, S. A., & Sadorsky, P. (2016). Hedging emerging market stock prices with oil, gold, VIX, and bonds: A comparison between DCC, ADCC and GO-GARCH. *Energy Economics*. 54, 235-247. https://doi.org/10.1016/j.eneco.2015.11.022

Başarır, Ç. (2018). Korku endeksi (VIX) ile BİST 100 arasındaki ilişki: Frekans alanı nedensellik analizi. *İşletme Fakültesi Dergisi. 19*(2), 177-191. https://doi.org/10.24889/ifede.468802

Becker, R., Clements, A. E., & McClelland, A. (2009). The Jump Component of S&P 500 Volatility and the VIX Index. *Journal of Banking & Finance. 33*(6), 1033-1038. https://doi.org/10.1016/j.jbankfin.2008.10.015

Bektaş Çağlar, N. & Babuşcu, Ş. (2019). VIX korku endeksi ve CDS primlerinin büyüme ve döviz kuruna etkisi; Türkiye Örneği. *Ufuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*. *8*(16), 97-111. Erişim adresi: https://dergipark.org.tr/en/pub/ufuksbedergi

Bouri, E., Jaın, A., BISWAL, P.C., & Roubaud, D. (2017). Cointegration and nonlinear causality amongst gold, oil, and the Indian stock market: Evidence from implied volatility indices. *Resources Policy. 52*, 201-206. https://doi.org/10.1016/j.resourpol.2017.03.003

Çevik, Z., & Zeren, F. (2014). Tarım kredilerinin finansal gelişim üzerindeki etkisinin asimetrik nedensellik testi ile incelenmesi. *Yönetim ve Ekonomi Araştırmaları Dergisi*. *24*, 197-208. https://doi.org/10.11611/JMER303

Çonkır, D., Meriç, E., & Esen, E. (2021). Korku Endeksi (VIX) ile Gelişmekte Olan Ülke Borsaları Arasındaki İlişkinin Analizi: Yatırımcı Duyarlılığı Üzerine Bir Çalışma. *İnsan ve Toplum Bilimleri Araştırmaları Dergisi. 10*(1), 109-132. https://doi.org/10.15869/itobiad.7444011

Da, Z., Engelberg, J., & Gao, P. (2015). The Sum of all FEARS İnvestor Sentiment And Asset Prices. *The Review of Financial Studies*. *28*(1), 1-32. https://doi.org/10.1093/rfs/hhu072

Dai, Z., Zhou, H., Wen, F., & He, S. (2020). Efficient predictability of stock return volatility: The role of stock market implied volatility. *The North American Journal of Economics and Finance*, *52*, 101174. https://doi.org/10.1016/j.najef.2020.101174

Ding, W., Mazouz, K., & Wang, Q. (2021). Volatility timing, sentiment, and the short-term profitability of VIX-based cross-sectional trading strategies. *Journal of Empirical Finance. 63*(2021), 42-56. https://doi.org/10.1016/j.jempfin.2021.05.003

Ercan, S., & Demirbaş, B. (2020). ABD dolar endeksi ile VIX korku endeksi arasındaki ilişki: Ardl sınır testi yaklaşımı. *Bilgi Ekonomisi ve Yönetimi Dergisi*. *15*(2), 115-129.

Erdoğdu, H., & Baykut, E. (2016). BIST banka endeksi'nin (XBANK) VIX ve MOVE endeksleri ile ilişkisinin analizi. *Bankacılar Dergisi, 98*, 57-72.

Ertunga, E. İ., & Çakar, Ş. S. (2016). The effects of global financial conditions on selected financial variables of Turkey. *Ekonomik Yaklaşım, 27*(100), 69-86. https://doi.org/10.5455/ey.3.35936

Fernandes, M., Medeiros, M. C., & Scharth, M. (2014). Modeling and predicting the CBOE market volatility index. *Journal of Banking & Finance*, *40*, 1-10. https://doi.org/10.1016/j.jbankfin.2013.11.004

Gülhan, Ü. (2020). Altın fiyatları ile VIX Endeksi, BİST 100 endeksi, döviz kuru ve petrol fiyatları ilişkisi: Ekonometrik bir analiz. *Gümüşhane Üniversitesi Sosyal Bilimler Dergisi*, *11*(2), 576-591.

Gürsoy, S. (2020). Investigation of the relationship between VIX index and BRICS countries stock markets: an econometric application. *Mehmet Akif Ersoy Üniversitesi Uygulamalı Bilimler Dergisi, 4*(2), 397-413. https://doi.org/10.31200/makuubd.735380

Hacker, R. S., & Hatemi-J, A. (2006). Tests for Causality Between Integrated Variables Using Asymptotic and Bootstrap Distributions: Theory and Application. *Applied Economic*, 38, 1489-1500. https://doi.org/10.1080/00036840500405763

Hatemi-j, A. (2012). Asymmetric causality tests with an application. *Empirical Economic, 43*(1), 447-456.

Huang, T. C., & Wang, K. Y. (2017). Investors fear and herding behavior: Evidence from the taiwan stock market. *Emerging Markets Finance and Trade*, 53(10), 2259-2278. https://doi.org/10.1080/1540496X.2016.1258357

İnvesting (2021). 21 November 2021. investing.com

Jubinski, D., & Lipton, A. F. (2013). VIX, Gold, Silver, and Oil: How Do Commodities React to Financial Market Volatility? *Journal of Accounting and Finance*; *13*(1), 70 – 88.

Kang, S. H., Maitra, D., Dash, S. R., & Brooks, R. (2019). Dynamic Spillovers and Connectedness Between Stock, Commodities, Bonds, and VIX Markets. *Pacific-Basin Finance Journal*, *58(*C), https://doi.org/10.1016/j.pacfin.2019.101221

Kartal M. T., Kırıkkaleli D. ve Ayhan, F. (2021). Nexus between Nonperforming Loans and Economic Growth in Emerging Countries: Evidence from Turkey with Wavelet Coherence Approach. *International Journal of Finance and Economics*, https://doi.org/10.1002/ijfe.2474

Kocabıyık T. & Tunçel, M.B. (2020). Kıymetli metaller arası nedensellik ilişkisi üzerine ekonometrik bir çalışma. *Stratejik ve Sosyal Araştırmalar Dergisi*, *4*(2), 366-379. https://doi.org/10.30692/sisad.757998

Kuzu, S. (2019). Volatilite Endeksi (VIX) ile BIST 100 arasındaki johansen eş-bütünleşme ve frekans alanı nedensellik analizi. *Turkish Studies*, *14*(1), 479-493. DOI: http://dx.doi.org/10.7827/TurkishStudies.14943

Münyas, T., & Bektur, Ç. (2021). Korku endeksi (VIX) ile kredi temerrüt Swap (CDS), dolar kuru, euro kuru, BİST 100 ve altın arasındaki ilişkinin değerlendirilmesi: Türkiye örneği. *Tesam Akademi Dergisi*, *8*(2), 555- 571. https://doi.org/10.30626/tesamakademi.959051

Öner, F. H., İçellioğlu Şarkaya, C. & Öner, S. (2018). Volatilite endeksi (VIX) ile gelişmekte olan ülke hisse senedi piyasası endeksleri arasındaki engel-grangereş-bütünleşme ve Granger nedensellik analizi. *Finansal Araştırmalar ve Çalışmalar Dergisi*, *10*(18), 110-124. https://doi.org/10.14784/marufacd.460670

Öner, H. (2018). Altın, Petrol, Döviz Kuru, Faiz ve Korku Endeksi Arasındaki İlişki Üzerine Bir Çalışma. *Akademik Araştırmalar ve Çalışmalar Dergisi*, *10*(19), 396-404. https://doi.org/10.20990/kilisiibfakademik.4111155

Özdemir, L. (2020). VIX Endeksinin BİST30 Endeks ve BİST30 Vadeli İşlem Getirisi Volatilitelerine Etkisinin EGARCH Modeli ile Karşılaştırılması. *Journal of Yasar University*, *15*(59), 534-543. https://doi.org/10.19168/jyasar.699550

Ruan, L. (2018). Research on sustainable development of the stock market based on VIX index. *Sustainability, 10*(11), 1-12. https://doi.org/10.3390/su10114113

Sarıtaş, H. ve Nazlıoğlu, E. H. (2019). Korku endeksi, hisse senedi piyasası ve Döviz Kuru İlişkisi: Türkiye İçin Ampirik Bir Analiz. *Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 12*(4), 542-551. https://doi.org/10.25287/ohuiibf.538592

Smales, L. A. (2022). Spreading the Fear: The Central Role of CBOE VIX in Global Stock Market Uncertainty. *Global Finance Journal, 51*, 100679. https://doi.org/10.1016/j.gfj.2021.100679

Telek, C. (2020). VIX Endeksinin Türkiye'de portföy yatırımları ve döviz kurlarıyla ilişkisi. *İzmir İktisat Dergisi, 35*(3), 635-646. https://doi.org/10.24988/ije.202035314

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of Econometrics, 66*(2), 225-250. https://doi.org/10.1016/0304-4076(94)01616-8

Tuncay, M. (2021). VIX korku endeksinin BIST sektör endeksleri ile Volatilite Etkileşiminin CCC-GARCH ile Araştırılması: 2013-2020 Dönemi. *Dicle Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, *11*(21), 126-146. https://doi.org/10.53092/duiibfd.894094

Tuncel, M. B. & Gürsoy, S. (2020). Korku endeksi (VIX), bitcoın fiyatları ve BİST100 endeksi arasındaki nedensellik ilişkisi üzerine ampirik bir uygulama. *Elektronik Sosyal Bilimler Dergisi, 19*(76), 1999-2011. https://doi.org/10.17755/esosder.712702

Tunçel, M. B., Alptürk, Y., Yılmaz, T., & Bekci, İ. (2021). Korku endeksi (VIX) ile kıymetli madenler arasındaki ilişki üzerine ekonometrik bir çalışma. *Atatürk Üniversitesi İktisadi ve İdari Bilimler Dergisi, 35*(3), 1069-1083. https://doi.org/10.16951/atauniiibd.885956

Whaley, R.E. (2000). The investor fear gauge. *Journal of Portfolio Management*, *26*, 12-17. DOI: https://doi.org/10.3905/jpm.2000.319728

Yılancı, V., & Bozoklu, Ş. (2014). Price and trade volume relationship in Turkish stock market: A time-varying asymmetric causality analysis, *Ege Akademik Bakış Dergisi*, *14*(2), 211-220.

Yıldırım, H. (2019). The long-term relationship of fear index with Dollar Index, DAX Volatility Index and Crude Oil Prices: ARDL Bond Test. Economics and Administrative. Ankara: Akademisyen Kitabevi, 47-58.