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Research Article

Can the VIX Index Be Used As An Indicator for the Borsa Istanbul Sustainability Index and Corporate Governance Index?

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Abstract

In this study, ARDL (Autoregressive distributed Lag Bound Test) and Granger Causality Test were conducted to identify the causal relationship between Volatility Index (VIX), also known as the Fear Index, and the Sustainability Index (XUSRD), which are sub-indices of Stock Istanbul (BIST). The study used weekly series for the VIX and Sustainability Index from November 2014 to December 2020, while the Corporate Governance Index used weekly series from September 2007 to December 2020. When selecting periods, the dates when the Sustainability and Corporate Governance indexes were started to be calculated are taken into account. As a result, it was determined that there was a long-term relationship between the VIX Index and the XUSRD and XKUR indices, and that there was a significant causality of 1% toward the XUSRD and XKUR indices from the VIX Index. This result is in line with the results in the literature. As a result, the VIX Index is a sign that must be followed for investors who are considering investing in companies in the BIST Sustainability Index (XUSRD) and the Corporate Governance Index (XKUR).

Keywords: *Sustainability Index, Volatility Index (VIX), Corporate Governance Index, Granger, ARDL Bound Test*

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VIX Endeksi Borsa İstanbul Sürdürülebilirlik ve Kurumsal Yönetim Endeksi İçin Gösterge Olarak Kullanılabilir mi?

Öz

Bu çalışmada, Korku Endeksi olarak da bilinen Volatility Index (VIX) ile Borsa İstanbul'un (BİST) alt endeksleri olan Sürdürülebilirlik Endeksi (XUSRD) ve Kurumsal Yönetim Endeksi (XKUR) arasındaki nedensellik ilişkisini tespit etmek amacıyla ARDL (Autoregressive Distributed Lag Bound Test) ve Granger Nedensellik Analizi yapılmıştır. Çalışmada, VIX ile Sürdürülebilirlik Endeksi için Kasım 2014-Aralık 2020 zaman aralığındaki haftalık seriler kullanılırken Kurumsal Yönetim Endeksi için Eylül 2007-Aralık 2020 zaman aralığındaki haftalık seriler kullanılmıştır. Dönemler seçilirken Sürdürülebilirlik ve Kurumsal Yönetim endekslerinin hesaplanmaya başlandığı tarihler dikkate alınmıştır. Sonuç olarak VIX Endeksi ile XUSRD ve XKUR endeksleri arasında uzun dönemli bir ilişki olduğu ve VIX Endeksinden XUSRD ve XKUR endeklerne doğru % 1 düzeyinde anlamlı bir nedensellik olduğu tespit edilmiştir. Bu sonuç literatürdeki sonuçlarla paralellik göstermektedir. Sonuç olarak BİST Sürdürülebilirlik Endeksinde (XUSRD) ve Kurumsal Yönetim Endeksinde (XKUR) yer alan şirketlere yatırım yapmayı düşünen kurumsal ve sürdürülebilirlik ilkelerini benimseyen yatırımcılar için VIX Endeksi takip edilmesi gereken bir göstergedir.

Anahtar Kelimeler: *Sürdürülebilirlik Endeksi, Volatilite endeksi (VIX), Kurumsal Yönetim Endeksi, Granger, ARDL Sınır Testi*

Introduction

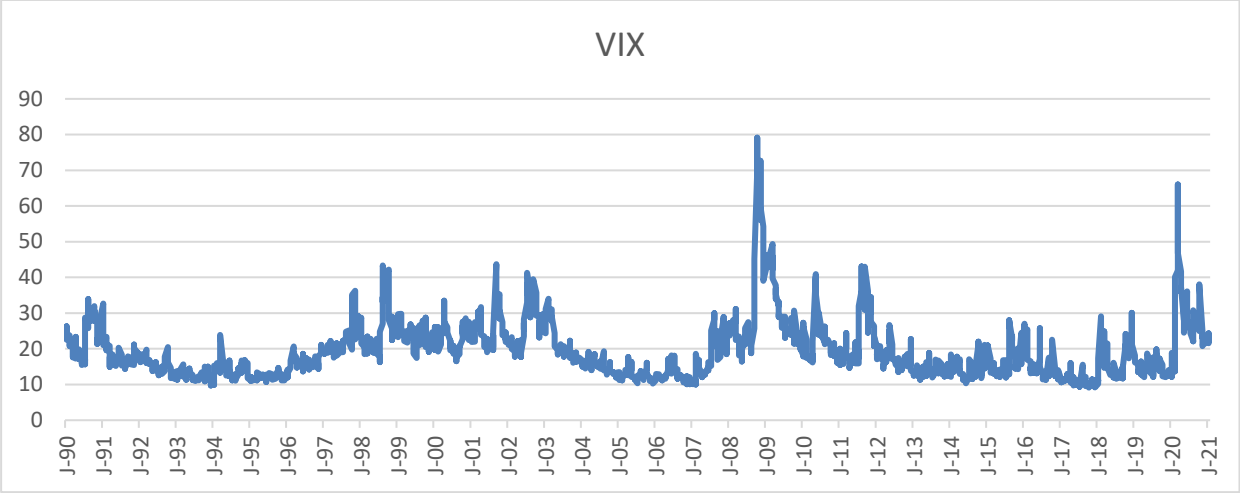
Today, financial markets are affected by many factors. Stock markets, which help financial markets to deepen and develop, are the markets most affected by the increase in the circulation rate of capital along with financial globalization. Technological advances have also increased the integration of financial markets all over the world. This situation has pushed all markets globally to act jointly against the risks affecting the markets. One of the generally accepted indicators affecting this common behavior is the VIX index, known as the fear index. The economies all around the world is suffering from COVID-19, which has made the entire world panic and the pandemic virus has taken over almost 195 countries in its grip. It is quite evident that the enterprises in the MSME and a lot of sectors are the most vulnerable ones in the era of covid-19 pandemic because of their size, scale of operation, limited financial managerial resources and more importantly they don‟ t have the capacity to deal with something so unexpected (Sipahi, 2020).

The VIX was developed by Whaley in 1993 and is used to show market volatility. The index has become an indicator that is followed and respected by market participants around the world, as it provides information about the uncertainties of the financial markets. Media organizations operating in the USA have named the VIX index as the "Fear Index" and this name has been accepted by market participants. An increase of the VIX index above 30% indicates that the risk perception has increased, while investors have a bad expectation, while falling below 20% means that the risk perception has decreased (Kaya et al., 2014:2).

Global investors prefer to determine their positions by looking at the VIX index while taking investment positions. It is understood from the studies in the literature that the VIX index is also used by the Central Banks for policy determination. Due to the VIX's ability to be a market volatility predictor and its negative correlation with the stock market, futures contracts in VIX are widely used for investment and risk management purposes (Anthropelos et al., 2017: 27).

Graph 1

VIX Index Graph



When Graph 1 is analyzed, the VIX Index increased excessively in 2008. This situation was caused by the 2008 crisis and investors moved away from the markets. Another peak occurred during the pandemic period. This situation also helps to explain why the VIX Index is called "Investor fear indicator". It is possible to explain this relationship with the risk-return balance. When the volatility increases, the investor demands lower returns and moves away from the stock market, unwilling to take risks, causing the prices to begin to fall in the stock market (Whaley, 2000: 32).

The concept of sustainability was first included in the Brutland (1987) report as "Sustainable Development". The concept of sustainability has been the subject of many studies recently. Although not mandatory, companies prefer sustainability reporting that shows their social and environmental performance to make a difference. KPMG has been publishing the International Corporate Responsibility Reporting Survey since 1993. While 50% of the world's largest 250 companies published sustainability reports in 2005, this ratio increased from 80% in 2008 to 95% in 2011 and to 96% in 2020. In Turkey, the rate of companies publishing sustainability reports in 2020 is 56% (KPMG 2005, 2008, 2001, 2020).

Sustainability Index is an index that includes companies in BIST with high corporate sustainability performance. The index, which has been calculated since January 2014, is seen as a tool that enables investors to distinguish companies that adopt sustainability and corporate social responsibility principles and to invest in these companies (BIST, 2020). There are 58 shares in the BIST Sustainability Index between December 2020 - October 2021 (BIST, 2020).

This index, which is seen as a tool that allows investors to distinguish and invest in companies that adopt the principles of sustainability and corporate social responsibility mentioned in the

basic rules of the sustainability index, is to study how this index relates to the VIX index, which interacts with all markets in the world and affects the investment strategies of investors. is the basic research question (BIST, 2020). Determining the relationship in question is important for investors who are sensitive to social and environmental responsibilities, who will invest in capital markets. The demonstration of the relationship will provide an opportunity for insight to the investors in question.

Corporate governance practices, which modern finance has focused on in recent years, increase its importance day by day. The understanding of corporate governance includes all activities carried out to ensure that stakeholders, who have different interests in the company, contribute to the achievement of the company's objectives and serve the purpose in the best way. Poor corporate governance can be seen as a cause of crises and bankrupt companies. Corporate governance index also adopts principles such as transparency, accountability and responsibility included in the sustainability index. Calculations for BIST began on 31 August 2007. In addition to increasing the competitiveness of companies, the Corporate Governance practice also contributes to the competitiveness of the country and helps to overcome economic crises more easily (Çonkar et al., 2008)

In this study, it is aimed to determine the causality relationship between VIX index and BIST Sustainability and Corporate Governance index. In line with this purpose, the beginning of the analysis period of September 2007 was accepted for the Corporate Governance index of November 2014, when the sustainability index was first created. We used weekly data for the period of November 2014 and December 2020 for the Corporate Governance index for the Sustainability Index, and for the period of September 2007 and December 2020. In determining this relationship, the Granger causality test was applied after the ARDL test.

Literature Review

With globalization and technological developments, financial markets have been integrated with each other and investors in different countries have had the opportunity to invest in other countries. This situation is mostly seen in financial markets due to the ease of accessibility. The investor who will invest in the financial market in a different country examines the factors affecting the financial market in the decision-making process and shapes the investment decision based on these factors. When the literature is examined, we see the VIX index, which is known

to interact with almost all markets (Kaya, 2015). Investors see the VIX index as a factor that affects financial markets.

Darrat, Rahman, and Zhong (2003) concluded that high transaction volume causes high return volatility under the hypothesis of an asymmetric distribution of information. Dowling and Muthuswamy (2005) developed the AVIX (Australian Market Mobility Index) index based on the VIX index in the study. In the study in question, the relationship between the S&P 500 and the ASX 200 (Australia) index was also examined. In the analysis results, it was determined that there is a negative relationship between AVIX and ASX 200. In other words, it is concluded that the AVIX index is evaluated as a fear index for Australian stock markets.

Zhou et al. (2012) analyzed the spreading effect among 11 stock market indices in Asia, Europe, China and North America using the VAR model. It has been argued that the 2008 mortgage crisis period had a negative impact on other markets and that the Chinese markets had a positive impact since 2005. Toyoshima and Hamori (2013) examined the relationship between Japan and Singapore stock markets. It has been determined that there is a dynamic bidirectional relationship between these stock markets. Korkmaz and Çevik (2009) tested whether the VIX index is effective on the stock markets of 15 developing countries with the GJR-GARCH model. It is stated that the VIX index has a leverage effect on the conditional variance of developing countries and negative news reflected on the market increases volatility.

Chandra and Thenmozhi (2015) tested the asymmetrical relationship between stock market returns and the Indian volatility index (India VIX). As a result of this study, they revealed that there is a negative relationship between the Indian VIX index and Indian stock markets. It shows that the VIX index can be used as a risk management tool in Indian markets. Neffelli and Resta (2018) examined the relationship between the US capital market and BRIC countries capital markets and the VIX index, covering the period between January 2007 and February 2018, covering the 2008 crisis. As a result of this study using the generalized moments method (GMM), the VIX index showed an extreme increase during the 2008 crisis and the reactions of the investors were revealed in the results. It has been determined that this situation is also valid for BRIC countries.

When the literature is examined, although there is no study dealing with the BIST sustainability index and VIX, there are few studies examining the relationship between VIX and BIST. Korkmaz and Çevik (2009) examined the relationship between the VIX index and the share

markets of 15 developing countries, including Turkey, using the GRJ-GARCH method, and in the analysis made without taking into account the structural breaks in VIX, the VIX has reached the conclusion that the index is related. In his analysis without considering the structural breaks, a relationship was found between VIX and 11 share markets, including Turkey.

Kaya (2015) investigated the causality relationship between VIX and BIST-100 index, and used the Johansen-Jeselius cointegration test and vector error correction (VEC) models to analyze this relationship. As a result of the analysis, it determined that there was a long-term relationship between VIX and BIST-100, and concluded that BIST-100 index was affected by VIX. As a result, it has been revealed that VIX is a variable to be followed while making investment decisions.

Kaya and Çoşkun (2015) analyzed the effect of VIX on BIST-100 using daily data between 03.01.1995-30.04.2014. After it is understood that the indices are stable at the level with the Unit root test, a causality from VIX to BIST-100 has been determined by Granger causality analysis. In addition, the causality effect was examined and it was revealed that the VIX index negatively affected BIST-100. Kaya and Çoşkun (2015) study also supports the result of Anthropelos et al. (2017) study.

Erdoğdu and Baykut (2016), one of the first studies examining the relationship between VIX and Sub-indices, examined the relationship between BIST bank index (XBANK) and VIX and MOVE indices. The period between 1998-2015 was analyzed using daily data, the long-term relationship with ARDL was analyzed and no long-term relationship was found. In addition, the causality relationship was examined, it was revealed that the VIX index is the one-way cause of the XBANK index, while there is no evidence that the MOVE index is the cause of the XBANK index. In the studies of Kula and Baykut (2017), the relationship between the daily data of August 2007 and December 2015 and the VIX and the BIST Corporate Governance Index was tested with the ARDL Model, and it was determined that there was a long-term relationship between them. Öner et al. (2018) examined the short and long-term relationship between the VIX index and the stock indices of developing countries, taking the indices of ten countries and using daily data between 23.10.2006 and 10.05.2017, Engel-Granger Cointegration Test, Granger Causality They analyzed the test and the relationships between variables with the help of Error Correction Model. As a result of the analysis, short and long-term relationships with the indices of all other countries except Argentina were determined. Sakarya and Akkuş (2018) examined the causality relationship between the VIX index and selected BIST indices, a long-term relationship was

found between the VIX and selected indices, and a unidirectional causality was found from VIX to selected indices. Başarır (2019) tried to determine the causality relationship between VIX and BIST-100 index, and performed a frequency domain causality test using the log series between 03.01.2000-09.02.2018. According to the results of the analysis, it could not find an effect on VIX from BIST-100 index, and both permanent and temporary unidirectional causality from VIX to BIST-100 index was detected. This result can be used by investors when making predictions both in the short and long term.

The results of the study in the literature show that there is a causality from VIX to stock indices. (Sakarya and Akkuş, 2018). This study is important for investors and companies that are sensitive to the environment and give importance to corporate governance, and its results will contribute to the literature.

Data and Methodology

In this study, it is aimed to determine the long-term relationship and causality relationship between the VIX index and the BIST Sustainability and Corporate Governance index. In line with this purpose, the beginning of the analysis period in November 2014, when the sustainability index was first started, and in September 2007, when the corporate governance index was first started to be created, were accepted. The period of December 2020 was chosen as the end of the analysis period and weekly data were used. The data of the VIX index, the BIST Sustainability Index (XUSRD) and the Corporate Governance Index (XKUR), which are the subject of the analysis, were obtained from the websites "www.finance.yahoo.com" and "investing".

Dickey-Fuller Test

This test is used to determine whether the series is stationary or not in the observed series. This method is used by Dickey D.A. and W.A. Fuller's articles published in 1979. It is absolutely necessary to perform DF (Dickey-Fuller) test in order to determine whether the series has unit root or not.

We can use the following data-generating process to explain the use of the test;

Model: $Yt = pYt\text{-}1 + ut$ ut = stochastic error term

The equation can be shown as follows.

$yt - yt\text{-}1 = (p\text{-}1)\ yt\text{-}1 + ut$

Subtracting yt-1 from both sides of the equation, the equation becomes $(p\text{-}1) = y$.

$\Delta yt = \gamma yt\text{-}1 + ut$ Ho : p=1, H1: p<1

In the case of (p-1) = 0 or γ = 0, the yt series contains one unit root. However, if IpI <1, the series is stationary. The "T" (tau) statistic, which was created in Dickey and Fuller's Monte Carlo application, is used.

If the absolute value of the calculated 'T' value exceeds the absolute value of Dickey-Fuller or McKinnon Dickey-Fuller critical values, we cannot reject the hypothesis that the time series is stationary. If Ho: p = 1 'is rejected, the time series is stationary.

There are three types of equations that Dickey-Fuller put forward;

Dickey-Fuller equation with no trend :$\Delta Yt = \gamma Y(t\text{-}1) + ut$

Dickey-Fuller equation without trend with constant:$\Delta Yt = a + \gamma Y(t\text{-}1) + ut$

Dickey-Fuller equation with constant trend: $\Delta Yt = a + bt + \gamma Y(t\text{-}1) + ut$

Two hypotheses are used to test the existence of the unit root. These;

H1: γ<0 (p<1) (There is no unit root in series) (series is stationary)

H0 : γ=0 (p=1) (series has unit root) (series is not stationary)

The number of autoregressive processes considered to be included in the DF test model discussed above is accepted as AR (1). However, this is not always the case with the series. Therefore Dickey D.A. and W.A. Fuller (1981) in their articles published in the journal "Econometrica" and use the existing test equation in the most general way:

ADF equation (widest ADF equation) : $\Delta Yt = a + bt + \gamma Y(t\text{-}1) + c\Sigma\Delta Y(t\text{-}1) + ut$

Phillips and Perron Test

Dickey-Fuller Test assumes that error terms have constant variance and are statistically independent. Dickey-Fuller's assumption of error terms was extended by Phillips and Perron (1988). This can be understood more clearly in the regression below .

$Yt = a0^* + a1^* yt\text{-}1 + \mu t$ $Yt = a0\bullet + a1\bullet\ yt\text{-}1 + a2\bullet\ (t\text{-}T/2) + \mu t$

T= Number of observations μt= Expresses the distribution of error terms

It is not necessary here that there is no intrinsic correlation between the assumption of homogeneity or the error terms. From this point of view, independence and homogeneity

assumptions of Dickey-Fuller test are accepted as heterogeneous distribution and weak dependence of abandoned error terms in Phillips-Perron test. Thus, Phillips-Perron Dickey-Fuller did not take into account the limitations of the assumptions of error terms in developing t statistics (Enders, 1995).

ARDL Bound Test

ARDL bound test, developed by Pesaran and Shin (1999), tests the cointegration expressed as a combination of two series that are not stationary at level. Used to understand long and short term relationships.

Existence of cointegration is tested using the F- test (Pesaran, 2009). The obtained F-statistic is compared with Pesaran et al (2001) critical value table. After this stage, the long-term coefficients of the estimated error correction model are interpreted.

Granger Causality Test

According to the causality analysis revealed by Granger in 1969, if the prediction of X_t provides a better prediction when the delayed values of Y_t are used compared to the case where the delayed values of Y_t are not used, then Y_t is the Granger cause of X_t. The stationary Granger series expresses causality correctly. If the series are not stationary, it means that the causality relationship will change over time. Granger's two-variable basic causality model consists of two stationary time series such as X_t and Y_t and is expressed as follows. The Granger causality test requires the first step of estimating the following VAR model: (Granger (1969)

$$X_t = \sum_{j=1}^{m} a_j X_{t-j} + \sum_{j=1}^{m} b_j Y_{t-j} + \varepsilon_t$$

$$Y_t = \sum c_j x_{t-j} + \sum d_j y_{t-j} + \eta_t$$

The error terms εt and ηt are white noise series with no relation between them. According to Granger's (1969) definition of causality, b_j must be non-zero for Y_t to be Granger causality to X_t.

Similarly, for X_t to be Granger causal to Y_t, c_j must be non-zero. If both of these situations occur (if both b_j gem and c_j are not zero), there is a feedback (bidirectional causality) relationship between X_t and Y_t.. The Granger causality test includes the F test to test whether the use of the delayed values of Y*t* in the presence of delayed values of X_t provides statistically significant information about X_t.

Analysis of Data and Findings

Descriptive statistics of VIX Index and XUSRD Index are presented in Table 1, VIX and XKUR in Table 2. Since the variables contain different time series, two different descriptive statistics are presented.

Table 1

XUSRD and VIX Descriptive Statistics

Variables	Number of Observations	Mean	Standard deviation	Minimum	Maximum
XUSRD	318	1157.739	166.7494	884.27	1550.64
VIX	318	14.92134	4.159323	9.14	79.13

Table 2

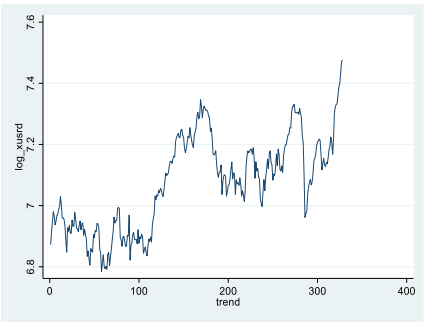
XKUR and VIX Descriptive Statistics

Variables	Number of Observations	Mean	Standard deviation	Minimum	Maximum
XKUR	695	1157.739	166.7494	884.27	1550.64
VIX	695	19.97049	9.858298	9.14	79.13

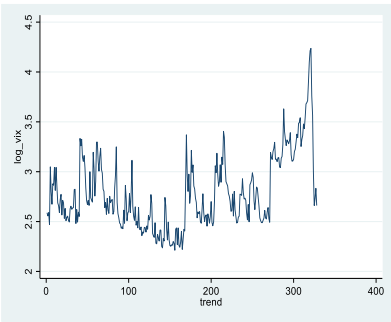
Cartesian graphs of change values are presented in Graphic 2, in order to make a visual evaluation of the stationarities of the series.

Graph 2

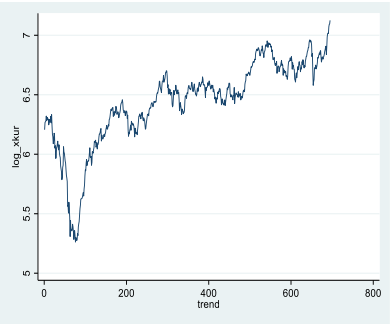
XUSRD, XKUR and VIX Gradient Graph



(XUSRD)



(VIX)



(XKUR)

When Graph 2 is examined, it will be understood that XUSRD and XKUR series are not stationary and have a trending graph, but it will be certain with the stationarity tests. Although it is understood that the VIX Index series is likely to be stationary at the level, it will become certain after the stationarity tests.

Table 3

XUSRD, ADF and PP Unit Root Tests

XUSRD (ADF)	**With constant and trend**	**Without Constant and trend**
LEVEL I(0)	-2.113	-2.580
	(-3.960)	(1.066)
LEVEL I(1)	-3.960***	-3.430***
	(-16.166)	(-16.167)
XUSRD (PP)	**With constant and trend**	**Without Constant and trend**
LEVEL I(0)	-11.296	0.082
	(-29.500)	(-13.800)
LEVEL I(1)	-576.421***	-575.147***
	(-29.500)	(-13.800)

*** Refers to the significance level of 0.01. Critical values are given in parentheses

When Table 3 is examined, it was examined by both tests that the XUSRD series was not stationary at the level, and the first difference was taken and it was stabilized at the level of I (1).

Table 4

XKUR, ADF and PP Unit Root Tests

XKUR (ADF)	**With constant and trend**	**Without Constant and trend**
LEVEL I(0)	-2.897	-0.760
	(-3.120)	(2.570)
LEVEL I(1)	-7.772 ***	-7.726***

	(-3.120)	(-2.570)
XKUR (PP)	**With constant and trend**	**Without Constant and trend**
LEVEL I(0)	-15.280	-2.421
	(-18.300)	(-11.300)
LEVEL I(1)	-789.470***	-792.056***
	(-18.300)	(-11.300)

*** Refers to the significance level of 0.01. Critical values are given in parentheses

When Table 4 is examined, it was examined by both tests that the XKUR series was not stationary at the level, and the first difference was taken and it was made stable at the level of I (1).

Table 5

VIX, ADF and PP Unit Root Tests

VIX(ADF)	**Sabitli**	**Sabitsiz**
LEVEL I(0)	-3.560 **	-2.980**
	(-3.960)	(-3.430)
VIX(PP)	**Sabitli**	**Sabitsiz**
LEVEL I(0)	-33.213***	-19.223**
	(-29.500)	(-20.700)

*** 0.01 denotes the ** 0.05 significance level. Critical values are given in parentheses.

When Table 5 is examined, it is seen in both tests that the VIX series is stationary at level I (0).

Table 6

Lag Values for VIX and XUSDR

Lag	FPE	AIC	HQIC	SBIC
0	0. 000125	-3.30749	-0.219083	-0.204776
1	0. 000011	-5.71438	-1.84433	-1.80141
2	0. 000011*	-5.77783*	-5.74559*	-5.69554*
3	0.000422	-2.09358	-2.02695	-1.9268

When the literature is examined, Akaike Information Criterion and Final Prediction Error Criteria values are used to determine the values. When Table 6 is examined, the generally accepted AIC and FBE values indicate that the delay value is 2.

Table 7

Lag Values for VIX and XKUR

Lag	FPE	AIC	HQIC	SBIC
0	9.57774	7.9352	7.9403	7.94839
1	0. 017085	1.60621	1.62152	1.64579
2	0.016982	1.60013	1.62566	1.66611
3	0.017021	1.60247	1.63821	1.69483
4	0. 01706	1.60476	1.6507	1.72351
5	0. 017217	1.61386	1.67002	1.759
6	0. 017408	1.62491	1.69127	1.79643
7	0. 016625*	1.57888*	1.65545	1.7768

When Table 7 is examined, the generally accepted AIC and FBE values indicate that the delay value is 7. It was understood that the VIX series was I (0) XKUR and the XSURD series was I (1). It was understood that the relationship between these variables should be analyzed using the ARDL method, which allows the analysis of the series relations at different levels. Regression was made with the delay determined for the short-term relationship, and the results are presented in Table 8.

Table 8

XUSRD Short Term Relationship with VIX

VIX	**Coefficient**	**P Value**
	-0.06000	0.03
L1	-0.21429	0.02
L2	0.01773	0.00

The 1% increase in the VIX variable causes a 0.060 negative effect in XUSRD, and this effect turns positive in Lag 2.

Table 9

XUSRD Short Term Relationship with VIX

VIX	**Coefficient**	**P Value**
	0.0000509	0.891
L1	-0. 0000953	0.847
L2	-0. 0009492	0.055

L3	0.0005852	0.240
L4	0. 0007299	0.143
L5	0. 0002829	0.569
L6	-0. 0021562	0.000
L7	0. 0022731	0.000

The 1% increase in the VIX variable creates a negative effect of 0.0000953 in XKUR, and this effect turns positive in Lag 3. Error correction model results for VIX and XSURD are presented in the table below. Regression was performed by taking the VIX 2 and XUSRD 2 delay.

Table 10

XUSRD and VIX Long-Term Relationship and Diagnostic Test Results

Dependent: XUSRD		
Independent:VIX		
	Coefficient	**P Value**
ADJ(XUSRD)	**-0.32061**	**0.017**
LR(VIX)	**-0.51094**	**0.024**
SR		
D1	**-0.12179**	**0.041**
LD	**0.007**	**0.279**
L2D	**0.0223**	**0.001**
R2: 0.9590	**Adjusted R^2:** 0.9583	
F-statistics : 7.028	**DW-statistic:** 2.127955	
X2BG: 0.3198		

When Table 10 is examined, if the p value of ADJ is less than 5%, it indicates the existence of a long-term relationship. ADJ coefficient implies that the relationship will start after 0.32 terms. When we examine the LR, we can state that the VIX will affect XUSRD in the long term. This effect is a negative effect. This result is in line with the literature results. When the diagnostic values are examined, Autocorrelation is the X2BG test value. There is no problem as the X2BG value is greater than 5%. There does not appear to be a problem in the Durbin-Watson test, either.

Table 11

XKUR and VIX Long-Term Relationship and Diagnostic Test Results

Dependent: XKUR		
Independent:VIX		
	Coefficient	**P Value**
ADJ(XKUR)	**-0. 0119108**	**0.012**
LR(VIX)	**-0. 061992**	**0.001**
SR		
D1	**0.0007893**	**0.042**
LD	**0. 0006939**	**0.074**
L2D	**-0. 0002553**	**0.509**
L3D	**0.00033**	**0.389**
L4D	**-0. 0003999**	**0.292**
L5D	**-0. 000117**	**0.758**
L6D	**-0.0022731**	**0.000**
R2: 0.1053	**Adjusted R^2:** 0.0921	
F-statistics : 7.028	**DW-statistic:** 2.0253	
X2BG: 0.2634		

When Table 11 is examined, if the p value of ADJ is less than 5%, it indicates the existence of a long-term relationship. The ADJ coefficient indicates that the relationship will start after 0.011 period. When we examine the LR, we can state that the VIX will affect XKUR in the long term. This effect is negative and this result is in line with the literature results. When the diagnostic values are examined, Autocorrelation is the X2BG test value. There is no problem as the X2BG value is greater than 5%. There does not appear to be a problem in the Durbin-Watson test, either.

Table 12

VIX and XSURD Cointegration Bound Test Results and Diagnostic Values

K	**F-statistic**	**Lower-bound I(0) %5**	**Upper-bound I(1)%5**
1	7.028	4.953	5.778
K	**T- statistic**	**Lower-bound I(0) %5**	**Upper-bound I(1)%5**
1	-3.489	-2.858	3.233

When Table 12 is examined, it is understood that the F and T statistics are greater than the lower and upper limit, and it can be stated that there is a long-term relationship between the two variables.

Table 12

VIX and XKUR Cointegration Bound Test Results and Diagnostic Values

K	**F-statistic**	**Lower-bound I(0) %5**	**Upper-bound I(1)%5**
1	7.419	4.927	5.759
K	**T- statistic**	**Lower-bound I(0) %5**	**Upper-bound I(1)%5**
1	-2.528	4.927	5.759

When Table 13 is examined, it is understood that the F and T statistics are greater than the lower and upper limit, and it can be stated that there is a long-term relationship between the two variables.

Table 13

VIX and XUSRD Granger Causality Test Results

Dependent Value: (XUSRD)			
Variable	**Chi-sq**	**df**	**Prob.**
VIX	26.441	2	0.000***
All	26.441	2	0.000***

Dependent Value: (VIX)			
Variable	**Chi-sq**	**df**	**Prob.**
XUSRD	0.51226	2	0.774
All	0.51226	2	0.774

***%1, **%5, *%10 significant at the level of

Table 14

VIX and XKUR Granger Causality Test Results

Dependent Value: (XKUR)			
Variable	**Chi-sq**	**df**	**Prob.**
VIX	76.478	7	0.000***

All	76.478	7	0.000***

Dependent Value: (VIX)

Variable	Chi-sq	df	Prob.
XKUR	8.1762	7	0.317
All	8.1762	7	0.317

***%1, **%5, *%10 significant at the level of

When Table 13 and 14 is examined, it is seen that there is 1% causality from the VIX Index to the XUSRD index and XKUR index. This result is in line with the results in the literature.

Conclusion

VIX (Volatility Index) was developed by Whaley in 1993 and used to show market volatility. The index has become an indicator followed and cared for by all market participants, as it provides information about the uncertainties of the financial markets. Media organizations operating in the USA have named the VIX index as the "Fear Index" and this name has been accepted by market participants (Kaya et al., 2014). In the study, the relationship of the VIX index with the Sustainability Index and Corporate Governance was examined, and it was emphasized that the concept of sustainability is a concept that makes it possible to evaluate the sustainability of corporate performance and environmental aspects of all stakeholder groups. It is seen as a normal situation for sensitive national and international investors in environmental and social issues to invest in companies that pay attention to these issues. In this respect, the VIX index is an index that should be followed for investors who will invest in companies included in the Sustainability and Corporate Governance index.

In the study, the long-term relationship and causality relationship between the VIX index and the XUSRD and XKUR indices were examined. In the study, the stationarities of the series were checked with Philips Perron (PP) and Improved Dickey Fuller (ADF) unit root tests. It is concluded that the XUSRD and XKUR indices of the VIX Index are at level I (0), and the I (1) indices are stationary at the first difference. In order to examine the long-term relationship between variables, ARDL limit test was performed and a long-term relationship was found. According to the Granger Causality Test results, it was concluded that there is a one-way

causality relationship from VIX index to XUSRD and XKUR. The results are consistent with the literature explaining that the VIX is a market volatility predictor and has a negative correlation with the stock market. As a result, the VIX index is an indicator that should be followed for investors who want to invest in companies included in the Sustainability index and Corporate Governance index. In future studies, the relationship of the VIX index with all markets where the Sustainability index and Corporate Governance index are calculated can be examined. In addition, the distinction to be made as developed and developing countries will provide the opportunity to examine the relationship between the VIX index and the sustainability and corporate governance indexes of the country groups. In addition, similar to the Neffelli and Resta (2018) study, a study can be conducted to examine only the effect of the pandemic period with the end of the pandemic period we are in.

Statements of Ethics and Conflict of Interest

I, as the Corresponding Author, declare and undertake that in the study titled as “Can the VIX Index Be Used As An Indicator for the Borsa Istanbul Sustainability Index and Corporate Governance Index?”, scientific, ethical and citation rules were followed; Turkish Online Journal of Qualitative Inquiry Journal Editorial Board has no responsibility for all ethical violations to be encountered, that all responsibility belongs to the author/s and that this study has not been sent to any other academic publication platform for evaluation." Sincerely,

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