Letters in Spatial and Resource Sciences (2019) 12:215–232
https://doi.org/10.1007/s12076-019-00238-w

ORIGINAL PAPER

Does VIX scare stocks of tourism companies?

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Received: 2 October 2019 / Accepted: 18 November 2019 / Published online: 25 November 2019

Abstract
In the recent time, there has been increasing importance of tourism development to the global economic dynamics inspite of the global uncertainties. In this regard, the current study is aimed to find out if the volatility index (VIX) affects the returns of the firms operating in the tourism sector in 11 countries. The relationship between the variables in the study was tested through causality and cointegration tests. As a result, the change in the VIX was found to have causality towards the change in the tourism indices of the countries except for the USA and Sri Lanka. In addition, it was found that there was a long-term relationship between the variables and that the increase in VIX caused a decrease in the return of tourism indices. Hence, the current study offers significant policy direction for the tourism industry operations and the government of the examined destination countries.

Keywords Financial contagion · Causality analysis · Tourism firms · Volatility index

JEL Classification C32 · C61 · G17 · G32 · L83

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1 Introduction

The fact that the world is becoming a global village day by day increases the dependence of countries at the universal level (Koçel 2018). The increase in the globalization has accelerated the transition of physical goods among countries as well as the flow of capital. The transition of capital from highly developed countries to underdeveloped or developing countries increases financial integration among countries. This increase also raises the influencing rates of the crisis arising in these counties in other countries (Kula and Baykut 2017; Alola et al. 2019a, b; Alola and Uzuner 2019). It could be said that the integration in financial markets has some negative effects as well as positive ones.

According to the literature regarding finance, any volatility resulting from a negative situation in a country affects both the host country and the other countries with which the host country has achieved integration. This interaction which arises in stock markets uncovers the effects caused by the volatility spread (Wang 2007: 798). The Mexican crisis in 1994, the Asian Crisis in 1997, and the US crisis between 1999 and 2002 could be given as good examples of volatility-spillover. During the crisis periods, unexpected fluctuations were observed in the markets in the US, European countries and Japan. It was stated that the crisis caused by these fluctuations stemmed from the spreading effect of risks (Hassan et al. 2003: 64).

Financial risk is defined as the deviations in the financial plan and objectives of the institutions because of some reasons (Emhan 2009: 210). Risk, which is the main building block in investment-related decisions, is also one of the complex and difficult issues to handle. This situation divides investors into three different groups as risk-averse, those unresponsive to risks and those not afraid of taking risks (Başoğlu et al. 2009: 198). One of the basic issues that measures the risk dimensions of investors and that leads their preferences is the VIX volatility index. The graph of the VIX index between 2000 and 2018 is as follows along with some important events in this process (Fig. 1).

The Volatility Index was first calculated in 1993 by the Chicago Board Options Exchange (CBOE) to measure market volatility (Xin 2011: 1). The index is calculated based on the difference between the option purchase and option sale of the shares (Fountain et al. 2008: 469). As the purchasing and selling prices get closer to one another, the value of the index decreases. The index is determined by the investors, and it expresses the consensus on the volatility of the stock exchange within the next 30 days. The market volatility index (VIX) is also called the investor fear indicator. The higher the VIX is, the greater the fear is (Whaley 2000: 12). VIX index is called implied volatility in some research (Korkmaz and Çevik 2009; Kaya 2015). In some research (Erdoğdu and Baykut 2016; Kula and Baykut 2017; İskenderoğlu and Akdağ 2018), VIX is used as a fear index.

Considering the previous studies of the concept of VIX index, it could be said that various countries have influenced the stock indices of other countries. Sarwar (2012) concluded that the VIX index had negative effects on the stock indices of the US, China, Brazil and India. Ozair (2014) found a two-way relationship

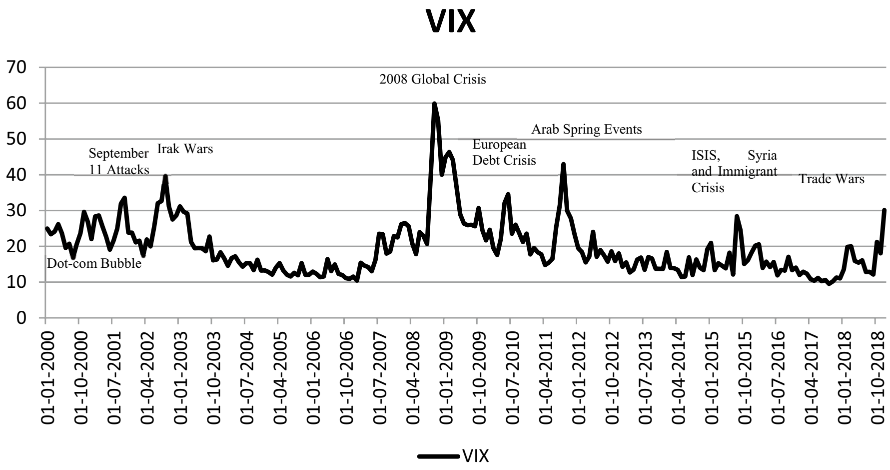

Fig. 1 The historical trend of volatility index

between the S and P500 index and VIX. Chen et al. (2017) concluded that the volatility in the markets of Germany, France, Japan, the Eurozone, Hongkong and the UK had negative effects on the Shanghai index together with the VIX index.

Huang and Wang (2017) concluded that there is a strong relationship between the VIX index and the Taiwan stock exchange. Sarwar and Khan (2017) equally maintained that the VIX index had negative impacts on the shares of Latin American countries in all time periods. Unlike the aforementioned studies, Heinonen (2013) could not find out any relationship between the VIX index and S and P500. However, it was found that investors were sensitive to any increase in VIX. It could be said that the VIX index has direct and indirect impacts on the returns of the countries' stocks.

The literature review suggests that a limited number of studies examining the relationship between the tourism indices and the VIX index are available (Beeton 2001; Sarwar 2002; Perles-Ribes et al. 2016; Bilen et al. 2017; Demir et al. 2017; Demir and Ersan 2018). In line with these available studies, this study aimed to find out the effects of the VIX index, which is also known as the global risk appetite, on the gainings of tourism indices.

Following the review of the relevant literature (Beeton 2001; Sarwar 2002, 2012; Heinonen 2013; Ozair 2014; Perles-Ribes et al. 2016; Bilen et al. 2017; Chen et al. 2017; Demir et al. 2017; Sarwar and Khan 2017; Huang and Wang 2017; Demir and Ersan 2018) the following models and hypotheses were developed for testing in the study (Fig. 2).

The countries examined within the scope of tourism indices are United States, China, Italy, Spain, Turkey, Sweden, Greece, Denmark, Sri Lanka, Sweden and the United Kingdom (Akadiri et al. 2018; Alola and Alola 2018, 2019; Saint Akadiri et al. 2019)

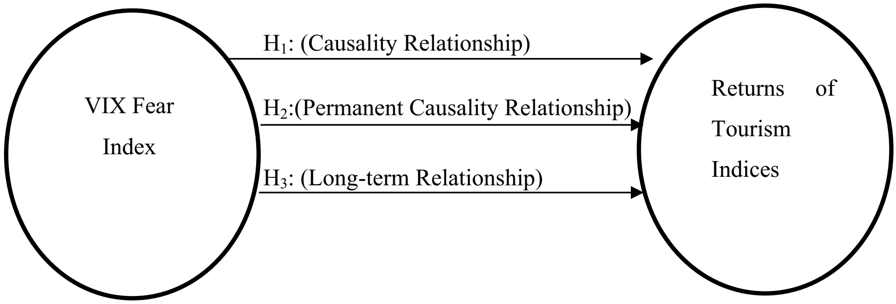

Fig. 2 Research model

H1 There is a causal relationship from the change in the VIX fear index towards the return of tourism indices.

H2 There is permanent causality from the change in the VIX fear index towards the returns of tourism indices.

H3 There is a long-term relationship between the VIX fear index and tourism indices.

The study is expected to make a valuable contribution to the relevant literature as it has revealed the effect of the VIX fear index on the tourism sector and also revealed whether the causality relationship between the variables is permanent or temporary. In this context, the study consists of five sections. In the first section, information about VIX fear index is given and the studies in the literature regarding the relationship between VIX and stock market indices are summarized. In the second section, information about the data and methodology used in the study is given, and in the third section the findings obtained from the relevant analysis are given. In the fourth and the final section, the findings of the analysis were interpreted and relevant suggestions are provided accordingly.

2 Data and methodology

In this study, the daily data of the tourism indices of 11 countries were used with VIX between January 1, 2013, and December 31, 2017. A total of 1090 observations were done for the analysis. Spain, USA, China, Italy, Turkey, Britain, Sweden, Denmark, Finland, Sri Lanka and Greece were examined within the scope of the study as they were the countries whose 2017 tourism indices were available (www.turizmdatabank.com 12.12.2018). The data collection in the study was limited to these 11 countries as no data regarding the tourism index of other countries was available. In the next part of the study, the names of the countries were used instead of the index name in order to avoid confusion due to the similarity. Relevant countries and their tourism indices are given in Table 1.

Table 1 Countries and their tourism indices included in the analysis

Countries	Indices	Countries	Indices
China	FTSE China Travel and Leisure	Denmark	Kopenhag Travel and Leisure
Finland	Helsinki Travel and Leisure	Greece	FTSE Travel and Leisure
Italia	FTSE Italia Travel and Leisure	Spain	BCN 5 Spain Leisure and Tourism
Sri Lanka	Sri Lanka Hotels and Tourism	Swedish	Stockholm Travel and Leisure
Turkey	BIST Turizm	UK	FTSE All Travel and Leisure
USA	Dow Jones Travel and Tourism		

The data from 11 countries VIX were taken from the Chicago Board Options Exchange website, and the tourism index data of the countries included in the analysis were obtained from the website of CNBC-E, Bloomberg and Investing news portals (www.cboe.com, 7 April 2018; www.cnbc.com, 8 June 2018; www.bloomberght, 2 June 2018; www.investing.com, 2 June 2018).

In this study, the data were first analyzed with the use of Dickey–Fuller (ADF), Philips and Perron tests for unit root and static tests. Then, the Granger (1969) causality test and the causality test which was developed by Breitung and Candelon (2006) based on VAR model and measured based on the frequency distribution among variables, were used in the study. Thus, it was aimed to find out whether the causality between the variables that could not be revealed by Granger (1969) causality test exists in the short, medium and long term.

One of the pioneering studies using static data in the analysis conducted with the use of macroeconomic data is the study of Yule (1926). It was found that the problem of false regression may occur in the analysis of non-static data sets (Granger and Newbold 1974). Nelson and Plosser (1982) stated that standard statistical methods could not be used in non-static time series. Therefore, the data used in the analyzes to be performed by traditional methods need to static. Traditional unit root tests commonly used to find out whether the data sets are static are Dickey and Fuller (1981) developed by Dickey–Fuller (ADF), Phillips and Perron (1988) developed by Philips Perron (PP) and the Phillips, Schmidt and Shin (KPSS) test developed by Philips Perron (PP) and Kwiatkowski et al. (1992). The ADF test is based on the assumption that error terms have a constant variance and are statistically independent (Asteriou and Hall 2011: 345). The PP test has weaker assumptions than the ADF unit root test and is generally considered to be more reliable (Fabozzi et al. 2014: 197). The zero hypothesis established in the KPSS unit root test is different from the ADF and PP unit root tests. The alternative hypothesis in which null hypothesis series are static in the KPSS test reveals that the series is not static; in other words, one of the series is the root (Sevüktekin and Nargeleçekenler 2007:362).

The Granger Causality test, which could be performed on static data sets, is based on testing whether there is a two-way or one-way relationship between the two data sets. Causality in the Granger (1969) test, for predictions regarding Y, is expressed for the situation in which the past values of X are used are expressed as the measurement of the past values of X compared to the situation where the past values are not used. According to Granger (1988), if the use of past values makes more successful predictions, X, Y could be concluded to be the cause for Granger. Measurements in the relevant test are performed with F and Wald tests. According to this, four different results could be obtained with Granger Causality test. These are the results suggesting that X is the granger cause of Y or vice versa, that X is the granger cause of X, or that X and Y are bidirectional Granger causes of each other. The causality analysis developed in the Granger (1969) includes the estimation of the following VAR model for two static series (Asteriou and Hall 2011: 322).

$$y_t = a_1 + \sum_{i=1}^{n} \beta_i x_{t-i} + \sum_{j=1}^{m} \gamma_i y_{t-j} + \varepsilon_{1t} \quad (1)$$

$$x_t = a_2 + \sum_{i=1}^{n} \theta_i x_{t-i} + \sum_{j=1}^{m} \delta_i y_{t-j} + \varepsilon_{2t} \quad (2)$$

It is assumed that the error terms (ε_t) of x and y in the equation do not relate to each other. When the model is solved, four different results are obtained (Asteriou and Hall 2011: 323).

1. The delayed x_t values in Eq. (1) may be statistically different from zero in groups. However, the delayed y_t values in Eq. (2) may not be statistically different from zero. In this case, x_t is the Granger cause of x_t.
2. The delayed y_t values in Eq. (2) can be statistically different from zero in groups. However, the delayed x_t values in Eq. (1) may not be statistically different from zero. In this case, y_t is the Granger cause of x_t.
3. When x_t and y_t values in Eqs. (1) and (2) are statistically different from zero, there is bidirectional causality.
4. If the delayed x_t and y_t values in Eqs. (1) and (2) are not statistically different from zero, then there is no causality.

When this process is considered, the Granger Causality test may give some conclusions about the causality between the series, but the Wald and F tests used in the method and the content may ignore short-term relationships while revealing the long-term relationship. In order to solve this problem, Geweke (1982), Hosoya (1991) and Yao and Hosoya (2000) have suggested the causality measurement of frequencies based on the separation of spectral density functions. Frequency causality is preferred because Granger causation is an easily applicable model because it allows evaluation at different frequencies and is based on linear constraints (Yanfeng 2013: 58). The spectral density function, which is the basis of frequency causality, can be expressed by the following equation (Kratschell and Schmidt 2012: 10).

$$f_x(\omega) = \frac{1}{2\pi} \left\{ \left| \Psi_{11}\left(e^{-i\omega}\right) \right|^2 + \left| \Psi_{12}\left(e^{-i\omega}\right) \right|^2 \right\} \quad (3)$$

However, the problem of using the F-test in the application of the relevant tests was solved by the application of the proposed linear limitations as suggested by Breitung and Candelon (2006). While Granger Causality test examines a single test statistic for the variables included in the analysis, nonlinear causality analysis is performed with Frequency Causality test. Granger causality at different frequencies is expressed by the following equation by Geweke (1982) and Hosoya (1991):

$$M_{y\to x}(\omega) = log\left[\frac{2\pi f_x(\omega)}{\left|\Psi_{11}\left(e^{-i\omega}\right)\right|^2}\right] = log\left[1 + \frac{\left|\Psi_{12}\left(e^{-i\omega}\right)\right|^2}{\left|\Psi_{11}\left(e^{-i\omega}\right)\right|^2}\right] \tag{4}$$

According to the equation, if $\left|\Psi_{12}(e^{-i\omega})\right|=0$, there will be no causality from y variable to x variable at any ω frequency (Ciner 2011, 500). Breitung and Candelon (2006) suggest a new method to test the null hypothesis suggesting that there is no causality in the study. If $M_{y\to x}(\omega) = 0$, $\left|\Psi_{12}(e^{-i\omega})\right| = 0$,the following equation is used;

$$\Psi(L) = \Theta(L)^{-1}G^{-1} \text{ ve } \Psi_{12}(L) = -\frac{g^{22}\Theta_{12}(L)}{|\Theta(L)|} \tag{5}$$

g^{22} refers to the lower diagonal elements of the matrix G^{-1}, $|\Theta(L)|$ is the determinant of $\Theta(L)$. In this case, the hypothesis that “y” is not the cause of “x” at “ω” could be tested by the following equation (Bodart and Candelon 2009: 143).

$$\left|\Theta_{12}\left(e^{-i\omega}\right)\right| = \left|\sum_{k=1}^{p}\Theta_{12,k}\cos(k\omega) - \sum_{k=1}^{p}\Theta_{12,k}\sin(k\omega)i\right| = 0 \tag{6}$$

As $\Theta_{12,k}$ and Θ_k’nin (1,2) elements are indicated, $\left|\Theta_{12}\left(e^{-i\omega}\right)\right| = 0$ is the sufficient condition as it indicates “y” is the cause of “x” at “ω” frequency. The model proposed by Breitung and Candelon (2006) is based on the following linear constraints.

$$\sum_{k=1}^{p}\Theta_{12,k}\cos(k\omega) = 0 \tag{7}$$

$$\sum_{k=1}^{p}\Theta_{12,k}\sin(\text{k}\omega) = 0 \tag{8}$$

If the notations under these constraints are simplified as $\alpha_j = \Theta_{11,j}$ and $\beta_j = \Theta_{12,j}$, then the equality of VAR for x_t could be written as follows:

$$x_t = \alpha_1 x_{t-1} + \cdots + \alpha_p x_{t-p} + \beta_1 y_{t-1} + \cdots + \beta_p y_{t-p} + \varepsilon_{1t} \tag{9}$$

Thus, since the hypothesis $M_{y\to x}(\omega) = 0$ is equivalent to linear constraints, the hypothesis H0 could be established as follows.

H_0:$R(\omega)\beta = 0$ $(\beta = [\beta_1, \dots, \beta_p]')$ $R(\omega)$ could be calculated by the following equation.

$$R(\omega) = \begin{bmatrix} \cos(\omega) & \cos(2\omega) & \dots & \cos(p\omega) \\ \sin(\omega) & \sin(2\omega) & \dots & \sin(p\omega) \end{bmatrix} \tag{10}$$

As $\omega \in (0, \pi)$ is the test method (2, T − 2p), is the degree of freedom, and as it has F- distribution H_0:$R(\omega)\beta = 0$, the causality could be tested by standard F test.

Cointegration analyzes are used to determine if at least two variables are in long-term equilibrium or not (Gujarati and Porter 2012: 762). In order to carry out cointegration analysis, series should not be static and should be integrated in the same degree. Cointegration analysis is not performed in the non-static series. The error terms must be static for the cointegration between the two series. If there is a cointegration relationship between the two series, there will be no false regression relationship between the series (Dikmen 2012: 321).

The Johansen cointegration test developed by Johansen (1988) and Johansen and Juselius (1990) is based on the VAR analysis in which series are at equal static level and a delay value (Tari and Yildirim 2009: 100). The model developed by Johansen (1988) is largely based on the relationship between the degree of a matrix and the characteristic roots of this matrix (Enders 2015: 374). The VAR model, on which the Johansen cointegration test is based, could be expressed as follows (Greene 2012: 1006).

$$y_t = \Gamma_1 y_{t-1} + \Gamma_2 y_{t-2} + \cdots + \Gamma_p y_{t-p} + \varepsilon_t \tag{11}$$

The existence of cointegration is tested by "trace statistics". In the trace test, the null hypothesis suggesting that the cointegration vector is as much as "r" is tested. The trace statistics could be expressed as follows (Greene 2012: 1007).

$$\gamma_{tr} = -T \sum_{i=r+1}^{M} ln\left[1 - \left(r_i^*\right)^2\right] \tag{12}$$

3 Findings

The causality between the daily data of the tourism indices of the countries included in the analysis was tested with both Granger causality and Breitung and Candelon Frequency causality analyzes with the VIX index, which is an indicator of global risk appetite. Then, the Johansen cointegration test was used to see if the variables were co-integrated. Finally, FMOLS and DOLS analyzes were conducted to find out what effects the VIX index had on tourism indices. In this context, the descriptive statistics of both the logarithmic base data and the data on logarithmic change are given in Table 2.

When Table 2 is examined, it is seen that the highest volatility is VIX index, Spain and Greece tourism indexes respectively. When the average daily returns of the indices are evaluated, it is seen that the highest daily average returns are Finland, Sweden and US tourism indices respectively. In order to determine whether the VIX

Table 2 Descriptive statistics

Variables	Mean	Maximum	Minimum	Standard deviation
logVIX	1.144276	1.610021	0.960946	0.095516
ΔlogVIX	0.0001	0.174157	−0.148118	0.034204
logChina	3.870378	4.191974	3.671677	0.113618
ΔlogChina	0.000202	0.033514	−0.079034	0.008858
logDenmark	3.030766	3.193425	2.872197	0.080697
ΔlogDenmark	0.000264	0.021974	−0.036097	0.005070
logFinland	2.967819	3.364669	2.778260	0.140970
ΔlogFinland	0.000480	0.029326	−0.032678	0.006286
logGreece	3.177077	3.361465	3.015532	0.076837
ΔlogGreece	0.000213	0.052852	−0.069223	0.011621
logItalia	4.484148	4.657035	4.336921	0.073870
ΔlogItalia	0.000284	0.033481	−0.028958	0.006149
logSpain	3.037070	3.234188	2.638679	0.077521
ΔlogSpain	0.000096	0.468375	−0.457939	0.022397
logSri Lanka	3.506428	3.562739	3.447879	0.027737
ΔlogSri Lanka	0.000098	0.012058	−0.011419	0.001930
logSwedish	3.266231	3.455962	2.985790	0.141872
ΔlogSwedish	0.000398	0.067483	−0.030528	0.005521
logTurkey	3.787303	3.976397	3.633948	0.076202
ΔlogTurkey	0.000143	0.038199	−0.063948	0.007995
logUK	3.891846	3.998922	3.718927	0.062167
ΔlogUK	0.000252	0.016072	−0.032140	0.004335
logUSA	2.929214	3.070197	2.739904	0.077930
ΔlogUSA	0.000299	0.021158	−0.023345	0.004402

and tourism indices are static, ADF, PP and KPSS unit root tests were used. The test results are given in Table 3.

Table 3 presents the ADF, PP and KPSS unit root test results. Unlike the ADF and PP unit root tests, the null hypothesis of the KPSS test is established assuming that the relevant series are static. When the KPSS test results are evaluated, it is seen that all the variables in the fixed model contain unit root at the basic level. In the difference series, the null hypothesis suggesting that the unit root is present in the ADF and PP unit root tests was rejected at the significance level of 1%. The KPSS test results for the difference series were accepted as the null hypothesis suggesting that the series supported the ADF and PP tests. Therefore, the series were found not to have a unit root and the series were static. In this context, it could be stated that the related series have a tendency to return to the average. The tendency to return to mean reveals that the series could be estimated. Accordingly, the variance and average of the series are constant over time and causality analyzes could be performed on the respective series. Table 4 presents the Granger causality test results from the change in the VIX index to the change in tourism indices.

Table 3 Unit root test results

Variables	ADF		PP		KPSS	
	Constant	Constant and trend	Constant	Constant and trend	Constant	Constant and trend
logVIX	– 5.9505*	– 6.2791*	– 5.5088*	– 5.8883*	0.9638*	0.5755*
ΔlogVIX	– 34.8279*	– 34.8124*	– 38.5596*	– 38.5496*	0.0274	0.0229
logChina	– 1.1376	– 1.8515	– 1.2246	– 1.9626	2.4607*	0.4576*
ΔlogChina	– 31.0438*	– 31.0307*	– 31.0132*	– 30.9997*	0.0868	0.0896
logDenmark	– 1.3551	– 2.5160	– 1.3369	– 2.5160	3.6654*	0.4646
ΔlogDenmark	– 33.9029*	– 33.8905*	– 33.9092*	– 33.8967*	0.0607	0.0629
logFinland	1.5515	– 0.3619	1.6478	– 0.2939	3.1287*	0.6094*
ΔlogFinland	– 33.7640*	– 33.9153*	– 33.7798*	– 33.9369*	0.6009	0.0999
logGreece	– 2.7454	– 2.7332	– 2.5181	– 2.5033	0.4175*	0.4452*
ΔlogGreece	– 20.0633*	– 20.0582*	– 33.7330*	– 33.7272*	0.1049	0.0833
logItalia	– 1.0694	– 1.6168	– 1.0838	– 1.6168	1.7811*	0.4528*
Δlogİtalia	– 32.4909*	– 32.4772*	– 32.4886*	– 32.4748*	0.1167	0.1075
logSpain	– 2.2876	– 2.2744	– 3.1941	– 3.2006	0.5309**	0.3475*
ΔlogSpain	– 43.5323*	– 43.5506*	– 44.6360*	– 44.7108*	0.2096	0.1015
logSri Lanka	– 1.0539	– 1.7160	– 1.2789	– 2.0605	2.7522*	0.5553*
ΔlogSri Lanka	– 33.5857*	– 33.5716*	– 33.9977*	– 33.9839*	0.0772	0.0725
logSwedish	– 1.7151	– 1.5115	– 1.6991	– 1.5754	3.8159*	0.7501
ΔlogSwedish	– 32.5526*	– 32.5802*	– 32.5819*	– 32.6071*	0.2015	0.0504
logTurkey	– 1.3463	– 2.4811	– 1.2738	– 2.4170	2.2261*	0.3493*
ΔlogTurkey	– 35.7187*	– 35.7165*	– 35.6692*	– 35.6681*	0.0870	0.0375
logUK	– 2.0913	– 3.6372**	– 2.0846	– 3.4578**	3.6822*	0.4738*
ΔlogUK	– 25.1464*	– 25.1583*	– 32.2056*	– 32.2363*	0.1358	0.0610
logUSA	– 1.6675	– 3.1653	– 1.6562	– 3.0043	3.6914*	0.4791*
ΔlogUSA	– 32.3822*	– 32.3784*	– 32.6682*	– 32.6746*	0.1108	0.0633

Significant at, *%1, **% 5 significance level

Table 4 shows that there is causality from the change in VIX index at 5% significance level according to Granger causality test results from the change in tourism indices of other countries except for the USA and Sri Lanka. In line with these findings, H1 was accepted for all countries except the US and Sri Lanka. According to the test results, the change in the VIX index is the Granger cause of the tourism index returns. In Table 5, Breitung and Candelon (2006) frequency causality test results are given.

According to the Breitung and Candelon (2006) casuality test results in Table 5, it was found that the cauality of the change in VIX index was permanent towards the changes in the tourism indices of Turkey, China, Denmark, England, Spain, Sweden, Italy and Greece, but the causality change towards the tourism index of Finland was temporary. Similar to the results of Granger causality analysis, no causal relationship between the changes in the VIX index and the change in the tourism indices of

Table 4 Granger causality results

Direction of causality	F statistics	Probability value	Lags	Result
ΔlogVIX → ΔlogChina	5.3946*	0.0011	3	Granger causality exists
ΔlogVIX → ΔlogDenmark	5.8014*	0.0006	3	Granger causality exists
ΔlogVIX → ΔlogFinland	3.0532**	0.0476	2	Granger causality exists
ΔlogVIX → ΔlogGreece	4.3565*	0.0006	5	Granger causality exists
ΔlogVIX → ΔlogItalia	2.5023**	0.0409	4	Granger causality exists
ΔlogVIX → ΔlogSpain	7.1096*	0.0000	4	Granger causality exists
ΔlogVIX → ΔlogSri Lanka H&T	0.9129	0.5129	9	Granger causality does not exist
ΔlogVIX → ΔlogSwedish	7.6921*	0.0000	3	Granger causality exists
ΔlogVIX → ΔlogTurkey	3.2058**	0.0225	5	Granger causality exists
ΔlogVIX → ΔlogUK	8.8529*	0.0000	4	Granger causality exists
ΔlogVIX → ΔlogUSA	0.9983	0.3928	3	Granger causality does not exist

The lag lengths are determined according to Akaike information criteria

Significant at, *%1, **% 5 significance level

Table 5 Causality results of Breitung Candelon frequency

Direction of causality	Permanent w = 0.5	Temporary w = 2.5
ΔlogVIX → ΔlogChina	17.1306* (0.0001)	1.3557 (0.5076)
ΔlogVIX → ΔlogDenmark	11.5153* (0.0031)	10.9763* (0.0041)
ΔlogVIX → ΔlogFinland	3.7467 (0.1536)	6.8510** (0.0325)
ΔlogVIX → ΔlogGreece	20.6343* (0.0000)	6.6419** (0.0361)
ΔlogVIX → ΔlogItalia	6.6672** (0.0356)	8.4534** (0.0146)
ΔlogVIX → ΔlogSpain	10.7181* (0.0047)	5.0485 (0.0801)
ΔlogVIX → ΔlogSri Lanka	2.4731 (0.2903)	2.2033 (0.3323)
ΔlogVIX → ΔlogSwedish	16.9008* (0.0002)	19.5104* (0.0001)
ΔlogVIX → ΔlogTurkey	8.6493** (0.0132)	9.2034* (0.0100)
ΔlogVIX → ΔlogUK	23.6778* (0.0000)	22.7285* (0.0000)
ΔlogVIX → ΔlogUSA	2.4542 (0.2931)	0.4125 (0.8136)

The lag lengths are determined according to Akaike information criteria

Significant at, *%1, **% 5 significance level

the US and Sri Lanka was found. The graphs of Breitung and Candelon frequency causality results are given in the "Appendix". Hypothesis 2 was accepted for Turkey, China, Denmark, England, Spain, Sweden, Italy and Greece, but rejected for the other countries.

The dependent variable VIX index was used as an independent variable in Table 6, and the results of FMOLS and DOLS analysis performed to determine the direction of the cointegration relationship between variables with Johansen cointegration test was given.

Table 6 Johansen cointegration, FMOLS and DOLS test results

Variables	Hypothesized no. of CE(s)	Trace statistic	Max-Eigen statistic	FMOLS	DOLS
logVIX → logChina	H_0: r = 0	30.1482* (0.0002)	28.4790* (0.0002)	− 0.0049 (0.9581)	− 0.0105 (0.9161)
	H_0: r ≤ 1	1.6691 (0.1964)	1.6691 (0.1964)		
logVIX → logDenmark	H_0: r = 0	29.2167* (0.0002)	27.9089* (0.0002)	− 0.0909* (0.0019)	− 0.0874* (0.0045)
	H_0: r ≤ 1	1.3078 (0.2528)	1.3078 (0.2528)		
logVIX → logFinland	H_0: r = 0	36.8899* (0.0014)	29.7297* (0.0011)	− 0.2867* (0.0000)	− 0.2665* (0.0001)
	H_0: r ≤ 1	7.1601 (0.3281)	7.1601 (0.3281)		
logVIX → logGreece	H_0: r = 0	37.1693* (0.0013)	32.8436* (0.0013)	− 0.3726* (0.0000)	− 0.3566* (0.0000)
	H_0: r ≤ 1	4.3257 (0.6946)	4.3257 (0.6946)		
logVIX → logItalia	H_0: r = 0	35.2662* (0.0025)	32.7326* (0.0003)	− 0.2862* (0.0000)	− 0.2708* (0.0000)
	H_0: r ≤ 1	2.5335 (0.9267)	2.5335 (0.9267)		
logVIX → logSpain	H_0: r = 0	34.9721* (0.0028)	30.4590* (0.0008)	− 0.2502* (0.0001)	− 0.2409* (0.0003)
	H_0: r ≤ 1	4.5130 (0.6672)	4.5130 (0.6672)		
logVIX → logSri Lanka	H_0: r = 0	45.3142* (0.0001)	41.4733* (0.0000)	0.0022 (0.8812)	0.0009 (0.9567)
	H_0: r ≤ 1	3.8408 (0.7650)	3.8408 (0.7650)		
logVIX → logSwedish	H_0: r = 0	60.2222* (0.0000)	57.1307* (0.0000)	− 0.0863 (0.4663)	− 0.0844 (0.4959)
	H_0: r ≤ 1	3.0914 (0.8655)	3.0914 (0.8655)		
logVIX → logTurkey	H_0: r = 0	31.3197* (0.0001)	29.7629* (0.0001)	− 0.2203* (0.0000)	− 0.2076* (0.0000)
	H_0: r ≤ 1	1.5567 (0.2121)	1.5567 (0.2121)		
logVIX → logUK	H_0: r = 0	46.2873* (0.0000)	33.9742* (0.0002)	− 0.1641* (0.0011)	− 0.1572* (0.0028)
	H_0: r ≤ 1	12.3130 (0.0541)	12.3130 (0.0541)		
logVIX → logUSA	H_0: r = 0	39.0330* (0.0007)	30.3558* (0.0009)	− 0.0525* (0.0000)	− 0.0575** (0.0172)
	H_0: r ≤ 1	8.6771 (0.2012)	8.6771 (0.2012)		

Significant at, *%1, **% 5 significance level

When the Johansen cointegration test results in Table 6 were evaluated, it was found that there was a long-term relationship between the change in VIX and the change in tourism indices; in other words, they are cointegrated. In line with this information, H3 was accepted for all country indices. As a result of the FMOLS and DOLS analysis conducted to find out the direction of the relationship between the variables, it was seen that there was an inverse relationship between the change in VIX and the change in the tourism indices of other countries except for China and Sweden tourism indices. In other words, it was seen that the increase in VIX caused a decrease in tourism indices which is in line with the expectations. As a matter of fact, the increase in the VIX index indicates that fear increases in global markets and investors' risk appetite decreases. Increasing fear in this context will reduce the appetite of investors for investing in stock markets. The results of FMOLS and DOLS conducted to find out the relationship between China, Sweden and Sri Lanka tourism indices and VIX were insignificant at 5% significance level. In addition, the tourism indices which were affected by VIX were found to be respectively the tourism indices of Greece, Finland, Italy, Spain, Turkey, United Kingdom, Denmark and the United States.

4 Discussion and suggestions

In recent time, increasing globalization, financial markets have started to integrate rapidly into one another. As a result of this integration, the volatility arising in any of the financial markets have the potential of affecting the other financial markets. This relationship, which is called as financial contagion, generally occurs and mostly spread from the developed countries to the developing countries. In this context, the volatility in the markets of the developed countries should be closely monitored.

The VIX is accepted as the most followed volatility indicator in financial markets. The VIX which is also named as the fear index, affects the global financial indicators of many countries. In this context, the aim of this study is to find out whether the VIX fear index affects the returns of the firms operating in the tourism sector. The study considered the VIX fear index and the monthly data regarding the tourism indices of 11 countries. By using the Granger (1969) causality, Breitung and Candelon frequency causality, Johansen cointegration and DOLS and FMOLS techniques, tests were used to test the relationship between the variables

As a result of the Granger (1969) causality analysis, the change in VIX index was found to have casual relationship towards the changes in the stock exchange indices of China, Denmark, Finland, Greece, Italia, Spain, Swedish, Turkey and UK. For Sri Lanka and the United States, there is no significant evidence of causal relationship found. The lack of casual relationship for Sri Lanka could be because that it is a relatively underdeveloped country with the characteristic and unusual domestic stock market. The lack of casual relationship for the USA could be related to the methodology used since the calculation of VIX fear index was based on S&P 500 US options. According to the results of frequency causality analysis, it was found that the change in VIX index had permanent casual relationship towards the changes in the tourism indices of China, Denmark, Greece, Italia, Spain, Swedish, Turkey and UK, but the casuality towards the changes in the index of Finland was found to be temporary.

Similar to the results of Granger causality analysis, there was no causal relationship between the changes in the VIX index and the change in tourism indices of Sri Lanka and USA. According to the results of the cointegration analysis, there is a long-term relationship between the VIX fear index and the tourism indices of the countries, and this relationship was found to be inverse according to the DOLS and FMOLS test. In other words, the increase in the VIX index results decreases the return in the tourism indices.

When the results were evaluated together, the fact that the VIX fear index affects the tourism stock indexes of the countries is in line with the market expectations. As a matter of fact, the increase in VIX means there has been an increase in the fear of global markets, and this increase affects both the investment decisions of the investors and the consumption preferences of the consumers. When the volatility in the market increases, investors avoid investing in stocks, which is one of the most affected investment tools in such volatilities (Whaley 2000: 17).

On the other hand, due to the volatility in the financial markets, consumers will be able to assess the possibility of the crisis and limit their consumption expenditures. In this context, the first cut in consumption expenditures will occur in holiday expenditures which has high demand elasticity (Song et al. 2010: 378). The best example of this is that the 2008 global crisis, which caused high volatility in the markets, caused great reductions in tourism revenues (Papatheodorou et al. 2010: 39).

The behaviour of the investors, as well as the behaviour of the consumers, will cause a decrease in the value of tourism stocks. In line with this information, it could be said that the VIX fear index had general effects on the stocks of tourism companies. Under the light of all this information, it could be said that the VIX fear index has a general effect on the stocks of tourism companies.

As a result of the study, investors are suggested to follow the VIX fear index along with micro and macroeconomic factors in their investment decisions before they make any investment in tourism companies. For the tourism companies, it is advisable to follow the changes in the VIX fear index along with macroeconomic factors in their future projections and plans. The analysis in this study was conducted on a limited number of countries. It is thought that involving data from more countries and employing more sophisticated methods will contribute to the relevant literature in terms of the generalization of the results.

Appendix

See Fig. 3.

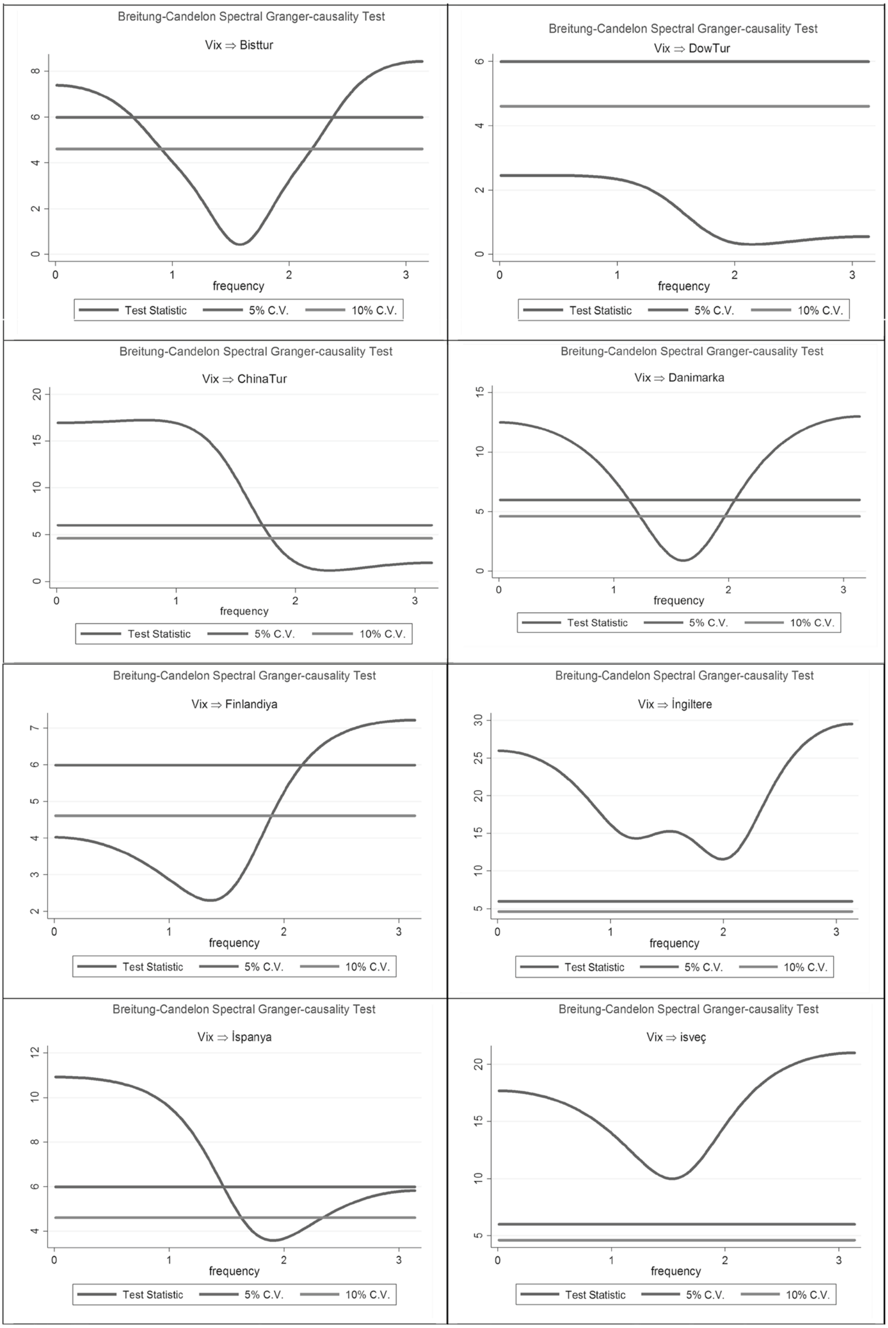

Fig. 3 Graphs of Breitung and Candelon frequency causality analysis

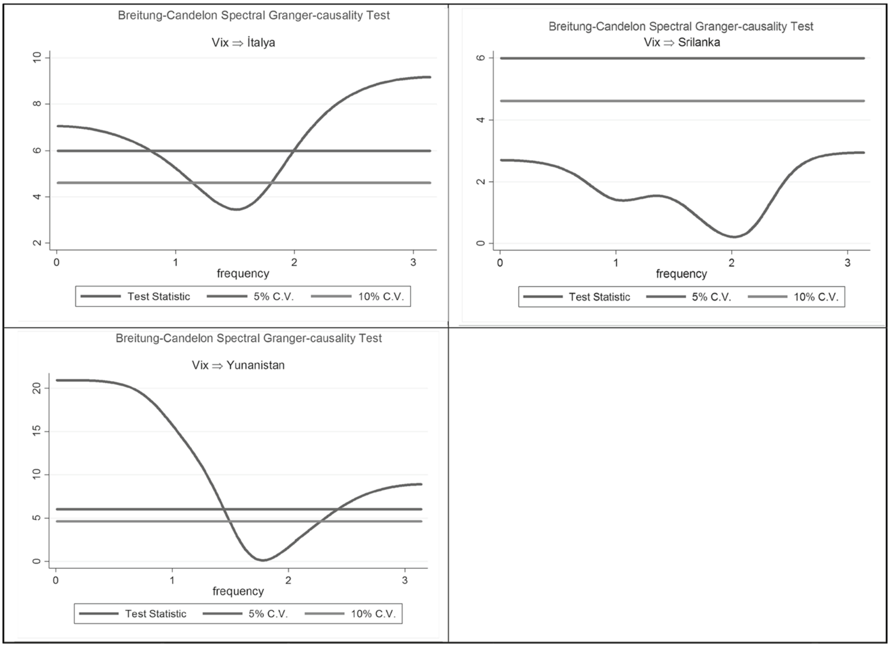

Fig. 3 (continued)

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