 doi:10.20944/preprints201911.0106.v1

Article

Relationship of Causality Between Spot And Futures Markets of Borsa Istanbul Index 30 and Dow Jones Industrial Average

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Abstract: Futures markets are mainly used as a tool for price discovery and for risk management on the spot markets and enable diversification for international portfolio investments. With this study we aim (1) to investigate the causality relationship between futures markets and spot market and (2) to examine the causality relationship between futures markets and spot markets in different countries. We are interested in both the futures markets - spot market relations and the interactions between the markets at international level. For variables we used the the BIST30 spot index and BIST30 futures contract representing the Borsa Istanbul market and the Dow-Jones 30 index and Dow-Jones 30 futures contract, which are the most important indices representing the US markets. Daily closing price data for the period between 2nd January, 2009 and 18th June, 2018 were analyzed using correlation, unit root test, causality test and regression equations. The results of the study show that the futures markets continue their price discovery role for both the spot markets and futures markets and are influential on other futures and spot markets at international level. These findings are important for investors wanting to invest in Turkey and in similarly considered emerging market economies. It will help investors take informed decisions by providing them with a more efficient price estimations utilizing the futures markets.

Keywords: Causality, Dow Jones 30, Borsa Istanbul, BIST30, Emerging Market Economies

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1. Introduction

Futures are mainly used for hedging, speculation and arbitrage and their use is increasing daily. Futures have the leading and price discovery roles for spot markets because of their characteristics. This characteristic of the futures favours the prospective transaction decisions of the investors trading in spot markets.

The mechanism that futures prices influence spot prices happens in different way and this determins the information flow in the markets (Powers, 1970: 464). It is possible to trade in spot and futures markets when news is received. However, in order to trade in futures markets, it is enough to pay a lower amount of margin as compared to the spot markets. When transaction costs are reduced, less time will be spent to choose stocks in the futures market then in the spot market. As a consequence, it is expected that stocks are priced faster in the futures markets than in spot markets. For that reason, futures prices are expected to affect the spot prices in markets with sufficient depth (Çevik and Pekkaya, 2007).

However, according to Madura (1992), futures prices and spot prices have important behavioral differences. Corporate investors regard futures as a portfolio insurance rather than instruments to balance their profits by selling them off. The fact that corporate investors trade in futures markets instead of selling off their assets such as stocks in spot markets prevents the stock prices in spot markets to decrease remarkably.

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Markowitz (1952) suggests diversification to achieve portfolios with an optimal risk-return relationship. Diversification in securities can yield favorable results, when the choice includes stocks in sectors or markets having low correlation with each other. However, international portfolio diversification can also be performed with the help of spot and futures markets.

When carrying out portfolio diversification, an investor who trades in the spot and futures markets in one country can simultaneously trade in the spot and futures markets in another country. For that reason, it is necessary to determine the relationships between spot and futures markets in both countries. It is stated that international price spillovers will also be more efficient through futures rather than through spot markets due to a causality relationship generally between futures and spot prices. The individuals trading in international markets tend to analyze the international futures stock market as an indicator of future spot stock market changes (Sim and Zurbreugg, 1999).

The purpose of this study is to investigate the causality relationship between futures and spot stock markets and to examine the causality relationship between futures and spot markets in different countries. We use the BIST30 index and BIST30 Futures Contract to represent the Borsa Istanbul markets and the Dow-Jones 30 Index and Dow-Jones 30 Futures Contract which is one of the most important indices representing US markets for this study. We will be using the Granger causality test using daily closing price data between the 2nd January, 2009 and 18th June, 2018 for analysing the causality relationship between the variables.

Literature summerised in the next section of this article shows that the relationships among futures markets within emerging market economies such as Turkey, which can be the best example of an economy that straddles the fine line between developed and developing economies, has not be sufficiently addressed. Therefore this study adds to the literature on such economies and prepares the way for further analysis of similar markets. It wll help investors take informed decisions by providing them with a more efficient price estimations within similar economies.

2. Literature Review

In this section we will summarise literature on the investigation of causality relationships between futures and spot markets and the investigation of causality relations between the markets of different countries.

Most academic studies indicate that futures prices in stock markets are determined from their respective spot prices and the futures markets are in turn determined using spot market prices (Kawaller et al.,1987; Harris,1989; Tse, 1995; Ramasamy and Shanmugan, 2004; Sangyoo, 2012). Kawaller et al.,(1987) investigated the relationship between S&P 500 spot index and S&P futures index in the USA. A correlation test was performed for one-minute data of 1984 and 1985. in this study a strong relationship was found between futures prices and spot prices. While the prices in the futures market affect the spot prices for up to forty five minutes, the prices in spot prices usually affect the futures prices for up to one minute. This result indicates that futures prices play a price discovery tool role for spot prices. Harris (1989) investigated the relationship between S&P 500 spot index and S&P futures index for the October 1997 stock market collapse. Harris (1989) used five-minute data in his study and revealed that futures market affected spot market. Tse (1995) found that there was a similar one-directional causality relationship for Nikkei stock futures and spot market. Ramasamy & Shanmugan (2004) suggested to purchase in spot market as soon as there is an increase in the futures market since they found a one-directional causality relationship from futures market to spot market. Sangyoo (2012) tried to explain the relationship between TFEX futures and spot prices using ten minute day prices. As a result of the Error Correction (VEC) Model, a one-directional causality was found from futures prices to spot prices.

Abhyankar (1995) using the 1-hour return of FTSE 100 spot and futures stock indices data revealed that the futures market affected the spot market returns especially in the period of high volatility in the 1986-1990 period. Bi-directional causality between futures and spot markets was reveled in studies such as those by Turkington and Walse (1999) and Pizzi et al. (1998). Turkington and Walse (1999) investigated the high frequency causality relationship between Australian SPI futures index and AOI spot index. Transport Cost Model, ARMA (p,q), bi-directional VEC and VAR models and Action and reaction functions were used in the study. It was revealed that two indices were cointegrated and there was a bi-directional causality relationship between the series and the action-reaction functions favoured the results obtained. The bi-directional causality relationship between futures and spot prices was also revealed in Pizzi et al.'s (1998) studies. Pizzi et al. (1998) studies used the one-minute data for the 3 and 6 month futures stock markets data from S&P 500 futures and spot stock markets and revealed a bi-directional causality relationship. According to the study, futures prices affect the spot prices for up to 20 minutes and spot prices affect the futures prices for up to 4 minutes.

Özen et al.(2009) investigated the causality relationship between daily future prices and spot stock index prices between 2005 and 2009 and found a causality relationship between the futures markets and the spot markets in long term. However, in short term it was found that the spot index was determined the futures markets. Çelik (2012) identified a long term relationship among the markets. Ersoy and Bayrakdaroğlu (2013) performed a causality analysis using daily closing prices of the IMKB30 index spot and futures contracts in order to investigate the presence of a led-lag relationship between the spot and futures markets. As a result of the study, they identified that two markets were cointegrated and there was a bi-directional causality relationship between the spot and the futures markets, but not a led-lag relationship.

Kaur and Singh (2017) analyzed the price discovery effect of futures in the Indian stock market over a 16-year period between 2001 and 2017. The authors found a bi-directional causality relationship between the futures and spot prices using the Vector Error Correction Model (VECM). According to the study, new information is firstly priced in the futures markets and then spread to the spot markets. Yao and Lin (2017) investigated the relationship between spot and futures stock markets using granger causality and conditional granger tests in China. According to the study results, the information flow from the futures markets to spot markets is higher than than flows in the opposite direction. However, it was identified that direct information flow from the spot markets to the futures markets was higher than flows in the opposite direction. Özdemir (2017) analyzed the relationship between the BIST30 spot and futures prices using the daily closing prices. As a result of the study conducted using granger causality test, a bi-directional causality was found between the two markets.

However, we also find studies investigating the relationship between the futures prices based on stocks instead of index and the spot stocks. Pradhan and Bhat (2018) in their study investigated the causality relationship between the spot asset prices and the transactions based on stocks trading in the NSE futures markets in India. The authors identified a causality between futures prices and spot prices for 9 stocks between 2001 and 2005 and future prices played a price discovery role. A bi-directional causality for 9 stocks and a one-directional causality from spot prices to futures prices for 7 stocks were revealed in the study.

Futures markets should be an active market for them to be used for price discovery in the spot markets. Zakaria and Shamsuddin (2012) found a one-directional causality between spot prices and futures prices. They investigated the causality relationship between the futures stock market and the spot stock market in Malaysia and identified that the futures market could not fulfill the task of price discovery due to low trading volumes.

A few studies investigated the causality relationship between spot-spot and/or futures-futures market data belonging to more than one country. Sim and Zurbreugg (1999), Wahab and Lashgari (1993), Lien and Shrestha (2009), Innocenti et al's (2010) studies are examples of such. These studies should be considered as portfolio management tools in different countries. Sim and Zurbreugg (1999) analyzed the minute price information between 24th July, 1997 and 24th October, 1997 in futures and spot stock markets of Australia and Japan by using ARCH models. The study findings indicate that the Japanese market affects Australian markets and the effect of the Australian stock market on the Japan market is weak. For Australian investors the Japanese futures market is more successful than the Australian futures market in fulfilling the task of price discovery. The Japanese futures market primarily affects the Australian futures market and in turn the Australian futures market affects the Australian spot market. It is possible to say that this result is due to the fact that the Japanese economy

 doi:10.20944/preprints201911.0106.v1

and the respective stock markets are larger than those in Australia. Wahab and Lashgari (1993) investigated the spot and futures markets of the US S&P 500 index and the UK FTSE 100 index. The authors found a bi-directional relationship between futures and spot markets of the two countries. Lien and Shrestha (2009) studied the spot and futures markets of the S&P 500, the FTSE 100, the TOPIX indices in USA and the Japan and UK markets. It was identified in all of the three markets that price discovery was revealed by the markets. Similarly, Yarovaya et al. (2016) in their study using market data of 10 developed and 11 developing countries revealed that futures markets are more successful in conveying information than spot markets.

Ren et al. (2019) investigated the relationship among futures, options and spot markets in Chinese Mainland, Hong Kong and USA. The analysis results reported that other two futures and option markets except for Chinese Mainland had an effect on the spot market and the futures markets was used for price discovery. This result is due to the maturity of their derivatives markets. However, immature derivative markets are not mechanisms for price discovery in Chinese Mainland and this role is carried out by the spot market.

Innocenti et al. (2010) in their study investigated the relationship between the USA S&P 500 futures market and three important European spot stock markets (CAC40, DAX-100 and FTSE 100). The authors analyzed the one minute data. According to the analyses, there is a positive correlation between the USA futures market and the European spot markets. However, the degree of the relationship increases during the opening and closing hours of the European stock markets and weakens in the middle of the day.

Following Sim and Zurbreugg's (1999) study, the relationship between the futures markets of different countries were investigated in few other studies such as that by Kang and Lee's (2019). Kang and Lee (2019) used daily price data for twelve market index futures (Australia, Brazil, France, Germany, Hong Kong, India, Japan, Korea, Singapore, Spain, UK, and US) in their study. The study covers the period between 2002 and 2018. They indicate that European zone futures markets have a strong connection with each other and the correlation between the global futures markets increased between the global crisis period (2008 to 2009) and the European debt crisis period (2010-2012). They identify the FTSE 100 as the most significant spillover contributor, while the KOSPI 200 being the largest net receiver of market shocks. The obtained results show that more mature futures markets have more effects on the weaker ones. Ozdemir (2018) examined the relationship between the BRICS-T futures markets (Bovespa (Brazil), MICEX (Russia), BSE100 (India), CSI (China) FTSE / JSE40 (South Africa) and BIST30 (Turkey)) using daily data between the period 1st August, 2012 and 29th June, 2018. The findings show that there is a bi-directional nonlinear causality relationship between Brazil and India-South Africa; Russia and India-China; India and Brazil-Russia-China-South Africa-Turkey; China and Russia-India-South Africa; South Africa and Brazil-India-China; as well as Turkey and India stock index futures markets.

Özen et al. (2014) analyzed the daily data from the stock index futures markets of Turkey (BIST30) and four Eurozone countries - Italy (MIB30), France (CAC40), Spain (IBEX), Greece (ASE20). It is stated that there is a bidirectional causality relationship between futures markets in the Euro regions. This result provides empirical evidence that the Eurozone stock futures markets are highly integrated.

3. Data, Method and Findings

The purpose of this study is to determine how the Borsa Istanbul spot and futures market as an emerging market is affected by the USA spot and futures market and to determine the causality relationship between these markets. In this analysis we used data from the BIST30 index and BIST30 Futures Contract representing the Borsa Istanbul stock markets and Dow-Jones 30 index and Dow-Jones 30 Futures contract representing USA markets.

Logarithmic return of the daily closing data between the 2nd January, 2009 and 18th June, 2018 was calculated and used in the analyses. The data was obtained from the following online source: https://tr.investing.com and the Borsa Istanbul data distribution center. The variables and abbreviations included in the study are shown in Table 1.

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Table 1. Variables and Abbreviations Included in the Study

Variable	Abbreviation
BİST 30 Spot Stock Index	BIST
BİST 30 Futures Stock Index	BISTV
Dow-Jones 30 Spot Stock Index	DOW
Dow-Jones 30 Futures Stock Index	DOWV

Source: Authors' Compilation

Descriptive statistics for the futures and spot return series belonging to the DOW and the BIST indices were included in the study. We analysed the data using the statistics values obtained through descriptive statistics notwithstanding if the series was normally distributed or not.

Table 2. Descriptive Statistics Belonging to Return

	BIST	BISTV	DOW	DOWV
Mean	0,000512	0,000510	0,000445	0,000446
Median	0,000800	0,000534	0,000565	0,000691
Max.	0,069652	0,083699	0,066116	0,053535
Min.	-0,109019	-0,119418	-0,057065	-0,061118
Standart Deviation	0,015739	0,016070	0,009753	0,009557
Skewness	-0,319394	-0,303780	-0,304265	-0,474300
Kurtosis	5,724021	6,934921	7,707833	7,423427
Jarque-Bera	750,8681	1520,541	2161,386	1963,083
Probability	0,000000	0,000000	0,000000	0,000000
N	2302	2302	2302	2302

Source: Authors' Compilation

From the return series in Table 2, we can see that skewness values have negative values for all the return series and the distribution is skewed to the left. When the kurtosis values are analyzed, we can see that the DOW and DOWV series has greater kurtoses when compared to BIST and BISTV series. According to skewness and kurtosis statistics, it is observed that the series do not comply with the normal distribution. This was investigated using Jarque-Bera test statistics. According to the test statistics, it is observed that the series are not normally distributed at 1% of significance level.

Correlation analysis was performed in order to determine the direction and degree of the relationship between the return series. The purpose of the correlation analysis is to indicate the relationship between variables. As the correlation coefficient approaches 1 and -1, it means the relationship between the variables is strong; however, as it approaches 0, it means that the relationship is weak. The correlation coefficients for the return series are presented in Table 3. When we analyze Table 3, we can see that there is a positive correlation between the markets.

Table 3. Correlation Between Return Series

	BIST	BISTV	DOW	DOWV
BIST	1,00			
BISTV	0,948562	1,00		
DOW	0,297607	0,289353	1,00	
DOWV	0,349963	0,341523	0,764750	1,00

Source: Authors' Compilation

It is primarily necessary to determine whether the series are stable or not in order to analyze the relationship between the return series. For the stationarity analysis ADF (Augmented Dickey-Fuller) unit root test and PP (Phillips-Perron) unit root test were used. The unit root test results for the regression models with fixed term and trend terms for return series are presented in Table 4.

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Table 4. Unit Root Test Results

Series		Augmented Dickey-Fuller (ADF) Test		Philips-Perron (PP) Test	
		Intercept	**Intercept and Trend**	**Intercept**	**Intercept and Trend**
BIST	Level	-14,09592***	-14,19189***	-49,06558***	-49,09633***
BISTV	Level	-14,08141***	-14,14896***	-49,11031***	-49,14378***
DOW	Level	-22,79243***	-22,78695***	-51,18752***	-51,17714***
DOWV	Level	-22,76738***	-22,76163***	-49,40007***	-49,38967***
Critical Values					
%1		-3,433009	-3,962051	-3,432996	-3,962034
%5		-2,862600	-3,411770	-2,862595	-3,411761
%10		-2,567380	-3,127770	-2,567377	-3,127765

*** indicates 1%, ** indicates 5%, * indicates 10% of significance level.

Source: Authors' Compilation

It is seen that return series do not have unit roots i.e. the series are stable at their level values since 1%, 5% and 10% significance levels of t values obtained for ADF test statistics are higher than the absolute values of their critical values. The Phillips Perron test statistic also supports the ADF test statistic.

Granger causality analysis was performed in order to determine the relationship between spot and futures return variables of DOW and BIST indices to determine that they are stationary. Causality analysis shows whether the delayed values of a variable can be used for explaining another variable. For instance, if the delayed values of X variable has a significant effect on Y variable, X is the granger cause of Y (Granger, 1988). There are four possibilities in causality analyses to determine the cause and effect relationship between two variables such as X and Y. X variable may affect Y variable, Y variable may affect X variable, X and Y variables may affect each other mutually or both of the variables do not affect each other.

Granger causality test which is used for determining whether there is a causal relationship or not and determines the direction of the relationship, if any, is performed with the help of the following equation (Gujarati, 2001).

$$Y_t=\alpha_0+\sum_{i=1}^{m}\alpha_i\,Y_{t-i}+\sum_{j=1}^{m}\beta_j\,X_{t-j}+u_{1t} \qquad (1)$$

$$X_t=\alpha_0+\sum_{i=1}^{m}\lambda_i\,X_{t-i}+\sum_{j=1}^{m}\delta_j\,Y_{t-j}+u_{2t} \qquad (2)$$

Here m indicates the length of the lag and u1t and u2t error terms are supposed to be white noise which is distributed with null average and constant variance and whose common variance is null. Equation (1) indicates the causality from X to Y, Equation (2) indicates the causality from Y to X. In Equation (1) if the null hypothesis (H0) is $\beta_j = 0$, X is not the cause of Y; if hypothesis 1 (H1) is $\beta_j \neq 0$, X is the cause of Y. In Equation (2) if the null hypothesis (H0) is $\delta_j= 0$, Y is not the cause of X; if hypothesis 1 (H1) is $\delta_j \neq 0$, Y is the cause of X.

In order to perform the Granger Causality test it is primarily necessary to determine the suitable delay value for the test. In order to determine the relationship between the spot and futures return variables of the DOW and the BIST indices that were identified to be stable, the delay length to be used in the VAR model was determined first. For this purpose, the maximum delay length was selected as 12 and the delay length which makes the critical values the least such as Likelihood Ratio

(LR), Final Prediction Error (FPE), Akaike (AIC), Schwarz (SC) and Hannan Quinn (HQ) was determined. The number of delays to be used in dual VAR model are presented in Table 5.

Table 5. Suitable Delay Lengths for VAR Model

VAR Variables	Lag Lenght
BIST Spot – BIST Futures	7
BIST Spot – DOW Spot	5
BİST Spot – DOW Futures	1
BİST Futures – DOW Spot	5
BİST Futures – DOW Futures	6
DOW Spot – DOW Futures	8

Source: Authors' Compilation

The position of the inverse roots of the AR characteristic polynomial in the unit circle was controlled to identify whether the dual VAR models estimated by considering the delay lengths include the unit root. It is understood from the following figures 1 to 6, that all of the inverse roots of the AR characteristic polynomial are in the unit circle. The fact that the inverse roots are in the unit circle presents that the estimated models are stable.

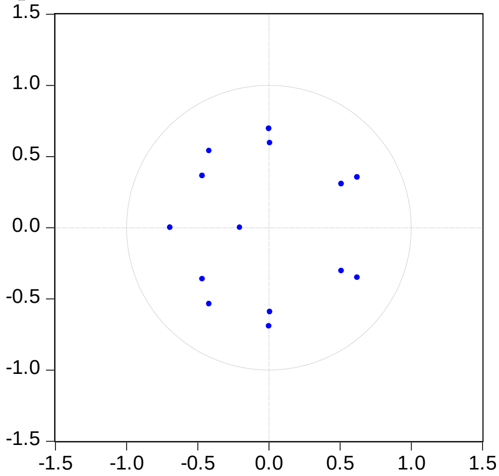

Figure 1. Inverse Roots of AR Characteristic Polynomial of BIST–BISTV Model
Source: Authors' Compilation

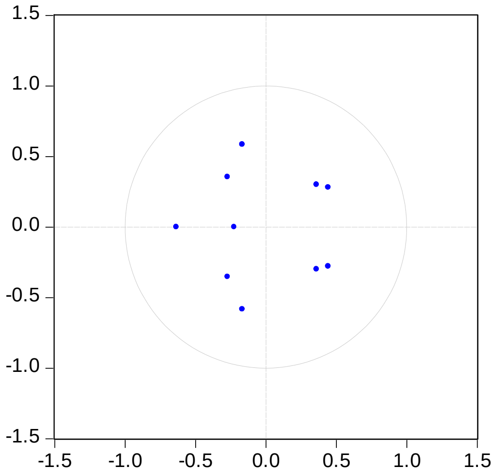

Figure 2. Inverse Roots of AR Characteristic Polynomial of BIST–DOW
Source: Authors' Compilation

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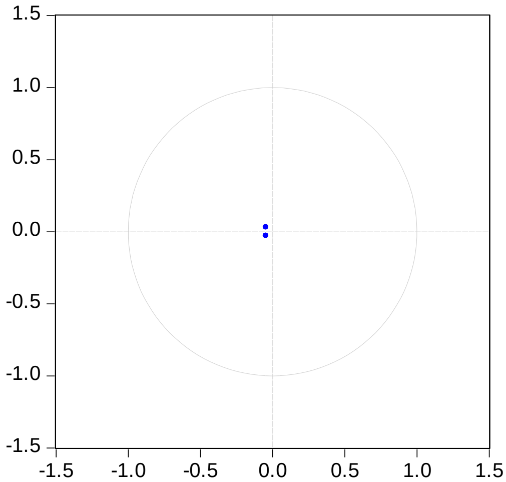

Figure 3. Inverse Roots of AR Characteristic Polynomial of BIST–DOWV Model
Source: Authors' Compilation

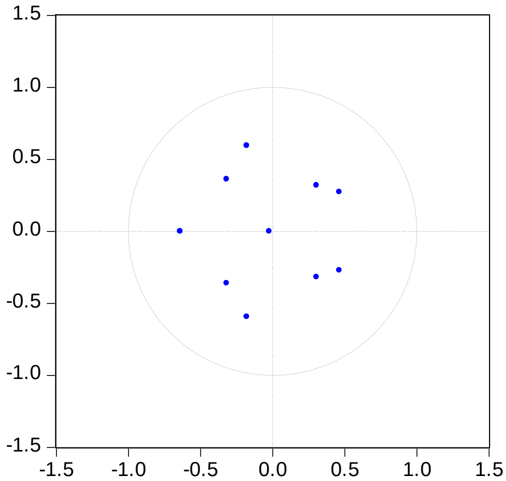

Figure 4. Inverse Roots of AR Characteristic Polynomial of BISTV–DOW Model
Source: Authors' Compilation

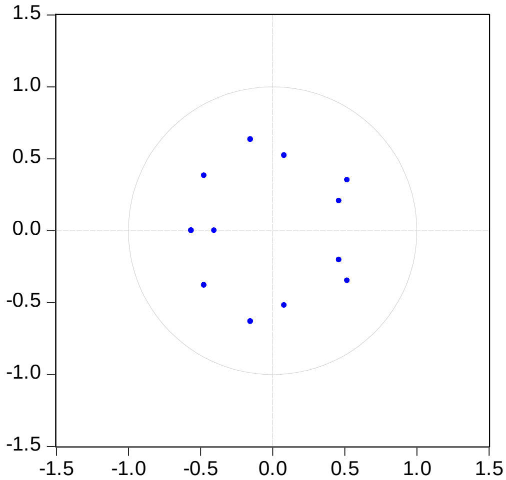

Figure 5. Inverse Roots of AR Characteristic Polynomial of BISTV–DOWV Model
Source: Authors' Compilation

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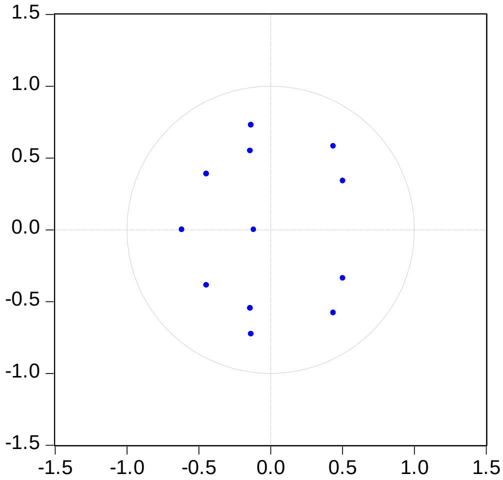

Figure 6. Inverse Roots of AR Characteristic Polynomial of DOW–DOWV Model

Source: Authors' Compilation

Granger causality test was performed in order to determine the causality relationship between the spot and futures return variables of the DOW and BIST indices. VAR model established for causality test are presented as follows.

The models for the causality between the BIST spot and the BIST futures variables are shown below:

$$BIST_t = \alpha_1 + \sum_{i=1}^{n} \beta_{1i} \, BIST_{t-i} + \sum_{i=1}^{n} \gamma_{1i} \, BISTV_{t-i} + u_{1t} \tag{3}$$

$$BISTV_t = \alpha_2 + \sum_{i=1}^{n} \beta_{2i} \, BISTV_{t-i} + \sum_{i=1}^{n} \gamma_{2i} \, BIST_{t-i} + u_{2t} \tag{4}$$

The models for the causality between DOW spot and DOW futures variables;

$$DOW_t = \alpha_1 + \sum_{i=1}^{n} \beta_{1i} \, DOW_{t-i} + \sum_{i=1}^{n} \gamma_{1i} \, DOWV_{t-i} + u_{1t} \tag{5}$$

$$DOWV_t = \alpha_2 + \sum_{i=1}^{n} \beta_{2i} \, DOWV_{t-i} + \sum_{i=1}^{n} \gamma_{2i} \, DOV_{t-i} + u_{2t} \tag{6}$$

The models for the causality between BIST spot and DOW spot variables;

$$BIST_t = \alpha_1 + \sum_{i=1}^{n} \beta_{1i} \, BIST_{t-i} + \sum_{i=1}^{n} \gamma_{1i} \, DOW_{t-i} + u_{1t} \tag{7}$$

$$DOW_t = \alpha_2 + \sum_{i=1}^{n} \beta_{2i} \, DOW_{t-i} + \sum_{i=1}^{n} \gamma_{2i} \, BIST_{t-i} + u_{2t} \tag{8}$$

The models for the causality between BIST spot and DOW futures variables;

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$$BIST_t = \alpha_1 + \sum_{i=1}^{n} \beta_{1i}\, BIST_{t-i} + \sum_{i=1}^{n} \gamma_{1i}\, DOWV_{t-i} + u_{1t} \tag{9}$$

$$DOWV_t = \alpha_2 + \sum_{i=1}^{n} \beta_{2i}\, DOWV_{t-i} + \sum_{i=1}^{n} \gamma_{2i}\, BIST_{t-i} + u_{2t} \tag{10}$$

The models for the causality between BIST Futures and DOW spot variables;

$$BISTV_t = \alpha_1 + \sum_{i=1}^{n} \beta_{1i}\, BISTV_{t-i} + \sum_{i=1}^{n} \gamma_{1i}\, DOW_{t-i} + u_{1t} \tag{11}$$

$$DOW_t = \alpha_2 + \sum_{i=1}^{n} \beta_{2i}\, DOW_{t-i} + \sum_{i=1}^{n} \gamma_{2i}\, BISTV_{t-i} + u_{2t} \tag{12}$$

The models for the causality between BIST futures and BIST futures variables;

$$BISTV_t = \alpha_1 + \sum_{i=1}^{n} \beta_{1i}\, BISTV_{t-i} + \sum_{i=1}^{n} \gamma_{1i}\, DOWV_{t-i} + u_{1t} \tag{13}$$

$$DOWV_t = \alpha_2 + \sum_{i=1}^{n} \beta_{2i}\, DOWV_{t-i} + \sum_{i=1}^{n} \gamma_{2i}\, BISTV_{t-i} + u_{2t} \tag{14}$$

Table 6. Granger Causality Test Results

Hypotheses	**F Value**	**Probability**	**Direction of Causality**
BISTV does not Granger Cause BIST BIST does not Granger Cause BISTV	1,97458 5,07924	0,0549* 1,E-05***	BIST ⟷ BISTV
DOWV does not Granger Cause DOW DOW does not Granger Cause DOWV	42,5259 1,37592	8,E-64*** 0,2020	DOW ← DOWV
DOW does not Granger Cause BIST BIST does not Granger Cause DOW	4,42287 1,38397	0,0005*** 0,2271	BIST ← DOW
DOWV does not Granger Cause BIST BIST does not Granger Cause DOWV	28,9339 0,21541	8,E-08*** 0,6426	BIST ← DOWV
DOW does not Granger Cause BISTV BISTV does not Granger Cause DOW	3,86661 1,83637	0,0017*** 0,1025	BISTV ← DOW
DOWV does not Granger Cause BISTV BISTV does not Granger Cause DOWV	3,95603 0,94150	0,0006*** 0,4639	BISTV ← DOWV

 doi:10.20944/preprints201911.0106.v1

* indicates 10% of significance level, **indicates 5% of significance level, *** indicates 1% of significance level.

← means a one-directional causality relationship.

↔ means a bi-directional causality relationship.

Source: Authors' Compilation

According to Granger causality test results, a bi-directional causality was determined between the BIST spot return and the BIS Futures variables and a one-directional causality was determined from the DOW Futures variable to the DOW spot variable. In addition, a one-directional causality was determined from the DOW spot and the DOW Futures variables to the BIST spot variable and from the DOW spot and the DOW futures variables to the BIST futures. According to these results, it is concluded that a change in the values of the BIST futures, the DOW spot and the DOW Futures varaibles will affect the BIST spot variable and a change in the BIST spot, the DOW spot and the DOW futures variables will affect the BIST Futures variable.

After investigating whether there is a mutual relationship among the variables, a regression analysis was performed using the least square method in order to determine the direction and the influence rate of the DOW and the DOW futures variables to BIST and BIST futures variables. Regression models were established as stated in the following and the results are presented in Table 7 and Table 8.

$$\text{BIST} = b_0 + b_1 \text{ DOW} + b_2 \text{ DOWV} \tag{15}$$

$$\text{BISTV} = a_0 + a_1 \text{ DOW} + a_2 \text{ DOWV} \tag{16}$$

Table 7. Regression Analysis Results

Dependent Variable: BIST				
Independent Variables	**Coefficient**	**Standart Error**	**T Statistics**	**Probability**
DOW	0.116507	0.048871	2.383977	0.0172
DOWV	0.485430	0.049876	9.732762	0.0000
c	0.000244	0.000307	0.792846	0.4279
R^2: 0.124638 Adjusted R^2: 0.123876		F Statistics: 163.6708 Prop (F Statistics) :0.000000		

Source: Authors' Compilation

According to the regression estimation results through the Least Squares Method, it is seen that the DOW return affects the BIST return at 5% significance, the DOW Futures contract affects it at a 1% significance level. According to the parameters obtained from the model, it was determined that 1 unit of increase in the DOW return would cause a 0.12 of increase in the BIST return and 1 unit of increase in the DOW futures contract return would cause a 0.49 unit of increase in the BIST return.

F statistics expresses whether the model is significant as a whole or not. When we looked at the F statistics of the model, it was understood that the model was significant at 1% of significance. R2 indicates what percentage independent variables explain on the changes in the dependent variables. Therefore, the variables in this model explain 12% of the change in BIST return. From this point of view, it can be said that the rest of the change in the BIST return is affected by the different factors.

Table 8. Regression Analysis Results

Dependent Variable: BİST Vadeli				
Independent Variables	**Coefficient**	**Standart Error**	**T Statistics**	**Probability**
DOWV	0.487007	0.051100	9.530525	0.0000
DOW	0.111808	0.050070	2.233025	0.0256
c	0.000242	0.000315	0.769823	0.4415

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R2: 0.118550 Adjusted R2: 0.117783	F statistics: 154.6013 Prop (F statistics) :0.000000

Source: Authors' Compilation

The regression anaysis results in Table 8 indicate how and to what extent the DOW and DOW futures variables affect the BIST futures variables. According to these results, it was determined that the DOW return affected the BIST Futures return at a 5% significance and the DOW Futures contract return affected it at a 1% of significance.

According to the parameters obtained from the model, it was determined that 1 unit of increase in the DOW return will cause a 0.11 unit of increase in the BIST Futures contract return and a 1 unit of increase in the DOW Futures contract return will cause 0.49 unit of increase in the BIST Futures contract return. R2 value of our model was found as 12 %. This indicates that independent variables explain 12 % of the change in the BIST Futures return. F statistics value of the model is significant at a 1% significance indicating that the model is significant.

5. Conclusions and Evaluation

As noted above the futures markets are used for price discovery and risk management in spot markets and offer diversification opportunity for internatioınal portfolio investments. The ability of one futures market to influence other futures or spot markets is related to the volume of transactions in the relevant market. Moreover, it is seen that markets of economically large countries also have an effect on other markets and lead the relevant markets.

For that reason, both futures and spot market relationships and between-market interaction are investigated at an international level. The purpose of this study is to reveal the causality relationship between futures and spot markets and the causality relationships between the Borsa Istanbul spot and the futures markets and the USA spot and futures markets. The data of the BIST30 index and the BIST30 Futures Contract representing the Borsa Istanbul markets and the Dow-Jones 30 index, one of the important indices, and the Dow-Jones 30 Futures Contract representing US markets were used in the analyses.

For these purposes, daily return rates for the period between 2009 and 2018 of the four markets were analyzed by establishing correlation, unit root, causality and regression equations. According to the analysis results, the highest correlation is seen between the BIST30 spot and futures returns. The correlation between ths BIST30 spot - futures returns and the DOW futures returns is higher than DOW spot returns.

Stability of all series was primarily tested by using the ADF and PP unit root tests in order to determine the causality relationship between the return series and it was determined that all series were stable at the level values. As a result of the Granger causality test, we find that while there is a bi-directional causality between the BIST30 spot and the futures returns, there is a one-directional causality between the DOW spot and the futures returns. The DOW futures return influences the DOW spot return. According to the causality results between Turkey and the USA markets, a one-directional causality was found between the DOW spot and futures return and the BIST spot and the futures return.

Regression analysis was performed in order to determine to what extent the BIST spot and the futures returns were affected by the DOW and the DOW futures returns. According to the results of the regression analysis, the power of the DOW futures return to explain the BIST30 futures and the BIST30 returns is much higher than the power of the DOW spot returns. Accordingly, the developments in markets are firstly priced by the USA futures market and then transferred to Turkish futures market and at the same time the Turkish spot market is also affected from these movements. The obtained regression analysis results supports the correlation analysis results.

This study findings are similar to the studies in the literature review. According to the study, the direction of causality in markets is from futures markets to spot markets. A bi-directional causality relationship is observed between the futures market and the spot market determined by the power of these markets. In addition, futures markets of large economies influence smaller markets.

 doi:10.20944/preprints201911.0106.v1

This result cooroborates to Sim and Zurbreugg (1999) and Ren et al.'s (2019) findings. Sim and Zurbreugg (1999) revealed that Japanese futures transactions, an economically larger stock market, had a dominant effect on the Australian futures market. Ren et al. (2019) determined that USA derivative markets had an effect on the Chinese mainland and the Hong Kong derivative markets.

The results indicate that the futures markets continue to determine price discovery for spot markets and futures markets and have an effect on other international futures and spot markets.

For the investors who want to invest in Turkey and in similar emerging economies with similar characteristics, this study findings provides decision makers with more information to enable them to make more effective and efficient price estimations when utilizing futures markets.

6. Limitation of the Study

Although, the study utilizes and generalises using only data relating to the Dow Jones and the BIST 30 futures and spot stock index, these are one of the most important influencing indexes in the markets and therefore are indicative results. However, one can use this study as a base for further studies that can include further indexes.

Author Contributions: All authors have contributed equally to this paper

Funding: This research received no external funding

Acknowledgments: Not Applicable

Conflicts of Interest: The authors declare no conflict of interest

References

(Abhyankar, 1995) Abhyankar, A.H. (1995). Return and Volatility Dynamics in the FT-SE 100 Stock Index and Stock Index Futures Markets. Journal of Futures Markets. 15 (4), 457-488.

(Celik, 2012) Çelik, İ. (2012). Price Discovery in the Futures Market An Empirical Application on the Izmir Futures and Options Exchange (in Turkish).The Banks Association of Turkey. Nr:283, İstanbul.

(Çevik, et al. 2007) Çevik, E. İ. & Pekkaya, M. (2007). The Causalıty Test Between The Variances of Spot and Future Market Prices(in Turkish), Dokuz Eylül University, Journal of Faculty of Economics and Administrative Sciences, 22(2), 49-66.

(Ersoy, et al., 2013) Ersoy, E. & Bayrakdaroglu, A. (2013). The lead-lag relationship between ISE 30 index and the TURKDEX-ISE 30 index futures contracts (in Turkish). Istanbul University Journal of the School of Business, 42(1), 26-40.

(Granger, 1998) Granger, C.W.J. (1988). Some Recent Developments in a Concept of Causality. Journal of Econometrics. 39(1-2), 199-211.

(Gujarati , 2001) Gujarati, D.N. (2001). Basic Econometrics (U. Senesen & G.G. Senesen Translated). Istanbul: Literatür Publishing.

(Harris, 1989) Harris, C. (1989). The October 1987 S&P 500 Stock-Futures Basis. The Journal of Finance. XLIV(1), 77-99.

(Innocenti, 2010) Innocenti, A. vd. (2010). Intra-Day Anomalies in The Relationship Between U.S. Futures and European Stock Indexes. DEPFID Working Papers - 12 . http://ssrn.com/abstract=1743608.

(Kang et al., 2019) Kang, S. H., & Lee, J. W. (2019). The Network Connectedness of Volatility Spillovers Across Global Futures Markets. Physica A: Statistical Mechanics and its Applications, 526, 120756.

(Kawaller, 1987) Kawaller, I.G. vd. (1987). The Temporal Price Relationship Between S&P Futures and the S&P500 Index. The Journal of Finance. XLII(5), 1309-1329.

(Lien et al., 2009) Lien, D. ve Shrestha, K. (2009). A New Information Share Measure. The Journal of Futures Markets. 29(4), 377–395.

(Madura, 1992) Madura, J. (1992). Financial Markets and Institutions. Second Editon. West Company. USA.

(Markowitz,1952) Markowitz, H. (1952). Portfolio Selection. The Journal of Finance. 7 (1), 77-91.

(Ozdemir, 2017) Ozdemir, L. (2017). The Relationship Between Futures Market and Stock Market Volatility: An Application on Izmir Futures and Options Exchange. The Journal of Academic Social. 5(44), 171-189.

(Ozdemir, 2018) Ozdemir, L. (2018). Relationship Between BRICS-T Stock Index Futures Markets: Evidence From Nonlinear Granger Causality. Current Studies Over Social Sciences, IKSAD Publications. 166-185.

doi:10.20944/preprints201911.0106.v1

(Ozen, et al., 2009) Ozen, E. Bozdoğan T. & Zugül M. (2009). The Relationship Of Causality Between The Price Of Futures Transactions Underlying Stock Exchange And Price Of Cash Market: The Case Of Turkey. Middle Eastern Finance And Economics. 4, 28-37.

(Ozen, et al., 2014) Ozen, E. Ozdemir L. Grima S. and Bezzina F. (2014). Investigating Causality Effects in Return Volatility Among Five Major Futures Markets in European Countries with a Mediterranean Connection. Journal of Financial Management Markets and Institutions, 2(2), 207-220.

(Power, 1970) Powers, M.J. (1970). Does Futures Trading Reduce Price Fluctuations in the Cash Markets?. The American Economic Review. 60(3), 460-464.

(Pradhan et al., 2018)Pradhan, Kailash. Chandra and Bhat, K. Sham., 2018. Price Discovery and Causality in the NSE Futures Market. http://www.igidr.ac.in/conf/money/mfc_08/Price_Discovery_and_Causality_in_the_NSE...Pradhan&%20 Bhat.pdf. (Accessed:23.05.2018).

(Ren et al., 2019) Ren, F., Ji, S. D., Cai, M. L., Li, S. P., & Jiang, X. F. (2019). Dynamic Lead–Lag Relationship Between Stock Indices and Their Derivatives: A Comparative Study Between Chinese Mainland, Hong Kong And US Stock Markets. Physica A: Statistical mechanics and Its applications, 513, 709-723.

(Sangyoo, 2012) Sangyoo, K. (2012). Optimal Pasitioning in Thailand's Spot and Futures Market. Procedia. Social and Behavioral SCiences. 40, 741-745.

(Sim, et al., 1999) Sim, A.B. and Zurbreugg, R. (1999). Intertemporal Volatility and Price Interactions Between Australian and Japanese Spot and Futures Stock Index Markets. The Journal of Futures Markets. 19, 523-540.

(Turkington, et al., 1999)Turkington, J. and Walsh, D. (1999). Price discovery and Causality in the Australian Share Price index Futures Market. Australian Journal of Management. 24(2), 97-113.

(Wahab et al., 1993) Wahab, M. and Lashgari, M. (1993). Price Dynamics and Error Correction in Stock Index and Stock Index Futures Markets: A Cointegration Approach. The Journal of Futures Markets. 13(7), 711-742.

(Yao, et al., 2017) Yao, C. Z. and Lin, Q. W. (2017). The Mutual Causality Analysis Between The Stock And Futures Markets. Physica A: Statistical Mechanics and its Applications. 478, 188-204.

(Yarovaya, et al., 2016) Yarovaya, L., Brzeszczyński, J., & Lau, C. K. M. (2016). Intra-and inter-regional return and volatility spillovers across emerging and developed markets: Evidence from stock indices and stock index futures. International Review of Financial Analysis, 43, 96-114.

(Zakaria, et al., 2012) Zakaria, Z. and Shamsuddin, S. (2012). Relationship between Stock Futures Index and Cash Prices Index: Empirical Evidence Based on Malaysia Data. Journal of Business Studies Quarterly. 4(2), 103-112.