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Does Equity Market Integration Exist Between Turkey and the Eurozone?

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Abstract

This research investigates the existence of stock market integration between Turkey and the Eurozone. In this study, the performance of Turkey's stock exchange is proxied by the BIST100, and the EURO STOXX50 is employed as a proxy for the Eurozone index. We hypothesize that there is a dynamic relationship between Turkey and the Eurozone. Methodologically, our research was conducted by employing monthly time series data obtained from EIKON datastream International. In order to demonstrate the extent of equity market integration between Turkey and Eurozone, a vector autoregression model (VAR) was utilized. According to the results, there is no co-integration between these two equity markets. This is in line with the output of residual matrix test, where the correlation between these two market indices was found to be low. However, a Granger causality test indicated that there was a low one-way contribution from Turkey to the Eurozone index during the observation period.

Key words : BIST100, EURO STOXX50, VAR model, Impulse response, Variance decomposition.

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INTRODUCTION

The growth rate of the Turkish economy is among the highest worldwide, and its financial market has also grown significantly (Aysan & Ermişoğlu, 2013). This has attracted much attention from prospective investors around the world, including from America and Europe.

Moreover, there has been an increase in trade and financial collaboration between Turkey and the European countries. At the same time, particularly during the period from 2011 to 2015, the Eurozone has experienced an ongoing debt crisis, which has led to financial distress for the Eurozone countries. Haidar (2012) notes that most European countries face difficulties in rolling over their government debt without help from third parties as creditors. The worst of this financial distress is reflected in the inability of Greece and Italy to manage their obligations, which since the year 2000 have reached a level of debt of greater than 100% of their total GDPs (Aysan & Ermişoğlu, 2013).

In revisiting the original study by Kasa (1992), we would like to examine whether Turkey's equity market and the Eurozone are integrated. According to Kasa (1992), a common trend, in terms of integrated markets, exists between the markets in developed countries, either in regional areas or internationally.

Take, for instance, this can be seen through the financial integration between the United States, Japan, England, Germany, and Canada. However, the statistical report as documented by Aysan and Ermişoğlu (2013) indicates that the Eurozone crisis has had a limited effect on Turkey's economy, particularly on its equity market. As noted by Papavassiliou (2014), a body of empirical literature suggests that there is a high level of equity market integration among the large industrialized countries worldwide. This limits any potential benefits that can be gained from international diversification. Nevertheless, the clear linkages among emerging and developed equity markets appear relatively weak. Karagoz and Ergun (2009) argue that the notion of financial integration means the abolition of limitations that stem capital flows in financial markets and a process by which capital mobility has increased. They assume financial and capital markets are independently liberalized and continue to open. The behavior of international price movements indicates that prices tend to co-move more closely and integrate more than previously seen.

Over the last decade, Turkey has aspired to membership of the European Union (EU). The objective of this aspiration is to integrate Turkish foreign policy with that of the EU. However, this goal is proving difficult to attain, due to various reasons, including economic, political, and social issues. According to Modebadze and Sayın (2015), Turkey has been trying to fully integrate with the EU since 1963. Certain myths held by the members of the EU have been used to suggest that Turkey is not suitable to become an EU country. These myths are documented by Modebadze and Sayın (2015), who reports them as being: (1) Turkey is too poor and will cost the EU too much; (2) Turkey is too large, and if it is admitted to the EU, Europe will be overwhelmed with Turkish migrants; and (3) Turkey is too different to Europe. Nevertheless, in terms of economic progress, Turkey has enormously increased its economic growth, particularly in the capital market, money market, and investment. Turkey is no longer '*the sick man of Europe*', as was previously considered by the EU.

This is confirmed by Turkey's success in fostering its economic growth over the recent years, particularly under the current difficult conditions pertaining to the demographic crisis and labor shortage (Modebadze & Sayın, 2015). In a specific instance, Turkey's stock exchange, which is measured by the Borsa Istanbul 100 (BIST100), has noted significant growth. This situation is different from the current performance of the European indices, which show that since the global financial crisis, the Eurozone has been burdened by debt, financial problems, and a volatile index market.

Our study is focused on Turkey's equity market and the Eurozone index. The specific aim of this study is to discover if there are any interdependence and integration between these equity market indices. More specifically, it can be proven that Turkey's equity market and the Eurozone index should be considered by prospective investors as potential markets in Western and Eastern European regions. Moreover, this paper also contributes to the existing literature in two ways. First, this study employs and compares linear and non-linear methodologies to provide robustness to the results of VAR modeling. Second, this study extends the existing literature in regard to the presence of long-run links between Turkey's equity market and the Eurozone index.

This study is further structured as follows. The introduction outlines the importance of the study to the area of equity market integration. This is followed by giving a brief description of the theories employed in this study. Next, the research method, data and sampling method are explained, along with the vector auto regression (VAR) model and its procedures.

The features of the Turkish equity market and the Eurozone index are described in the summary statistics presented in the section of results and discussion. Finally, conclusion remarks are presented at the end of the discussion.

Equity Market Integration, The issue of equity market integration in emerging economies has been extensively investigated. Previous studies have produced mixed results, depending on the methodology and the data used. Bekaert and Harvey, (1995) reported that the degree of a national capital market which is commonly integrated into world capital markets is notoriously difficult to measure accurately. They showed that the correlation between the local market returns and those of the world market could be used as a valid measure of integration. However, this is not totally accepted, due to local industry effects and the industry mix, which are different from the average value of the world mixes.

As noted by recent studies, the majority of the equity market research has focused on the emerging markets of Latin America, Western Europe, and Asia. Notable examples are the studies on international equity market linkage, which have previously concentrated on a source of risk in a single international market, such as the US or the world market, towards another stock market, as reported by Bekaert, Harvey and Ng (2005). They point out that contagion effects, which are reflected by the correlation among markets, are inclined to be influenced by the fundamentals of economic.

However, there are country-specific factors which differentiate the performance of each equity market in different regions, such as Europe, Southeast Asia, and Latin America. Therefore, regional market integration and time variation are hypothesized to be the catalysts of market integration. Moreover, a specific study of capital market integration in Southeastern European countries has been conducted, without including Greece in the consolidated sample. As pointed out by Baltzer, Cappiello, de Santis and Manganelli (2008), there are three broad categories of indicators that can be used in order to measure financial integration; namely, price, news, and quantity-based indicators. In their finding, Baltzer et al., (2008) reveal that there is little equity market integration among Southeastern European countries, while at the same time, the equity market in Southeastern Europe is dependent on Euro area shocks.

In another case, Cappiello, Engle and Sheppard (2006) utilized a specific model to identify the integration among 21 stock markets indices and 13 bond index returns in 21 countries in Australasia, Europe and North America. Their study argued that by implementing a new Generalised Auto Regressive Conditionally Heteroscedastic (GARCH) procedure and the Asymmetric Generalised Dynamic Conditional Correlation (AG-DCC) model, the correlation dynamics and asymmetry among the samples could be identified through the asset classes, unconditional correlations, and their returns. During the observation period, the international equities performances provided strong evidence of asymmetry in conditional volatility. Whilst at the same time, government bonds showed smaller conditional asymmetry volatility than international equities did. Further, their study showed that during the situations of turmoil, international equity market volatility dramatically increased.

The study of Kenourgious, Samitas and Paltalidis (2009) further provided important evidence regarding the integration of European equity and bond markets over the period from January 1997 to October 2006. They reported that by examining the time-varying correlation dynamics in the European, Central European, and Balkan financial markets using the AG-DCC model, there was an increased level of dependence between these markets during the internet bubble collapse in the year 2000. The increased dependence was also triggered by the introduction of the Euro banknotes and coins in 2002, followed by the entry of central European countries into the EU in 2004. Their findings infer that there has been a gradual integration among these economic and monetary union countries.

RESEARCH METHODS

The data in this study was obtained from Datastream International (EIKON). There are several possible sources of the specific data for the Eurozone index and Turkey's index, such as Bloomberg, Google Finance, and Yahoo Finance. However, we officially extracted our data from the EIKON (Thomson Reuters) database. From the point of view of international market integration, the dataset relies on the historical data collected from each stock exchange. Our study used the monthly indices from January 2011 to December 2015, with the data analysis comprising of 60-month time series closing prices, indexed in logs.

In this study, VAR (vector autoregression) model was employed in order to investigate whether Turkey's stock exchange and Eurozone index behave as a single market or an integrated market. The VAR model was chosen due to its ability to identify the main channels for interaction, and to simulate various responses of the market under investigation to shocks in another market. Moreover, in response to the ideas of Kenourgious and Samitas (2011), the high-frequency data incorporated here include the information on short-run market interactions that may be absent in lower-frequency data. Further, due to the fact that these markets operate in proximal time zones, Our study aimed to identify whether equity market integration exists between Turkey and the Eurozone. Therefore, we calculated the value of the index as a substitute indicator for the Turkish and Eurozone indices. The variables used in this study are listed in Table 1.

Table 1. Definition of Variables and Their Transformation

Variables	Definition of variables
LN_BIST100	Natural logarithm of the index of market value weighted average of month-end closing prices for the BIST100 listed on the Turkey Stock Exchange
LN_EURO STOXX50	Natural logarithm of the index of market value weighted average of month-end closing prices for the EURO STOXX50

Source : Primary Data

A major concern when conducting stationary tests in the analysis of VAR is determining the optimal lag. When the specific lag used in a stationary test is too short, the residuals will not be able to show the '*white noise*', and the model will not accurately estimate the error. This is due to the lag being too short for the estimation process, and hence γ and the standard errors are not well estimated. However, if more lags are inserted, this may reduce the ability to reject Ho. This happens due to an excessive increase of parameters, which reduces the degree of freedom (Harris, 1995). To determine the optimal lag, this study used several criteria, including the Akaike Information Criterion (AIC), the Schwarz Information Criterion (SIC) and the Hannan-Quinn Criterion (HQ). The smallest value among these three criteria is taken to determine the optimal lag.

Estimation using time series econometric models will generate meaningless results when the data used are not stationary. Non-stationary conditions result in a spurious regression on the outputs of the estimation. This can be identified by a high value of the coefficient of determination (R^2) and an insignificant value for the t-statistic. Spurious regression results lead to misleading interpretations (Insukindro, 1998). However, time series data can be used as a stationary dataset if the mean, variance and covariance of each lag are constant at any time (Widarjono, 2009).

Testing for stationary conditions can be conducted by implementing a correlogram test to determine the coefficients of ACF (Auto-Correlation Function) and PACF (Partial Autocorrelation Function) (Widarjono, 2009). Moreover, Gujarati (1995) notes that instead of the ACF and PACF tests, the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests can be used as a standard test when examining the null hypothesis (Ho), which conjectures that the series is not stationary. This null hypothesis is compared to the alternative hypothesis (H1) that conjectures that the series is stationary. Therefore, if Y_t is a series with a specific lag p, the equation is written as follows:

$$\Delta Y_t = \alpha_0 + \gamma Y_{t-1} + \beta_i \sum_{i=1}^{p} \Delta\ Y_{t-i+1}\ \varepsilon_t \text{..................}(1)$$

Johansen's method is utilized as a co-integration test. The Johansen co-integration test method is commonly analyzed through autoregressive models with order P, as indicated by the following equation:

$$yt = A1\ yt\text{-}1 + \text{.........} + Ap\ yt\text{-}p\ I + B\pi t + \varepsilon t \text{........}(2)$$

Furthermore, the equation above can be extended as follows:

$$\Delta\ Yt = \Pi\ yt\text{-}1 + \beta i \sum_{i=1}^{p-1} \Gamma i\ \Delta\ Yt\text{-}i\ + B\pi t + \varepsilon t \text{ ...}(3)$$

$$\Pi = \sum_{i=1}^{p} Ai - I,\ \Gamma i\ - \sum_{j=i+1}^{p} Aj \text{ ....}(4)$$

Granger's theory states that the coefficient matrix Π has τ <k reduced rank that has k x τ matrix α and β with rank such that $\Pi = \alpha\beta$ and $\beta' yt$ as I (0). T is the extent of co-integration (rank), while each column of vector β indicates co-integration. A is better known as the adjustment parameter in the Vector Error Correction Model (VECM).

Johansen's method can be used to estimate the matrix Π of unrestricted VAR, and is employed in order to test the acceptability of reduced rank Π outputs.

Furthermore, in the procedure of rank testing, the Johansen method uses two different statistical tests; namely, the trace test (λ_{trace}) and the maximum eigenvalue test (λ_{max}). The trace test is employed to test Ho at co-integration equation τ as an alternative co-integration of co-integration equation-k, in which k is the number of endogenous variables for τ = 0.1, ..., k-1.

Granger's causality test was used to assess the causal relation between the variables BIST100 and EURO STOXX50.

The existence of co-integration between two variables indicates the presence of a long-term relationship between those variables. In the short term, there may be disequilibrium. Disequilibrium is common in economic behavior, and denotes that the desires of economic actors are not aligned with the actual economic outcome. These differences are required for conducting specific adjustments. One model that incorporates adjustments with the goal of correcting disequilibrium is known as the error correction model.

The *Engle-Granger* error correction model was used in this study, and is written as follows:

$\Delta Y = \beta 0 + \beta 1 \Delta Xt + \beta 2 ECt + \varepsilon t$..........................(5)

$\Delta Y(LN\_BIST100) = \beta 0 + \beta 1 \Delta X(LN\_EURO\ STOXX50)t + \beta 2 ECt + \varepsilon t$................................(6)

The practical analysis framework in VAR can provide systematic information and assess the information in the equation for time series data. Additionally, the estimation of the VAR model is easily interpreted. The devices used in the VAR model consist of an impulse function and variance decomposition. The VAR model assumes that all economic variables are mutually dependent. Gujarati, (1995) states that the advantages of the VAR model include: (1) VAR is able to use more variables when analysing economic phenomena from both short and long observation periods; (2) VAR can assess whether an empirical model is consistent with econometric theory; and (3) VAR is able to find solutions to the problem of non-stationary time series variables and spurious regression in econometric analyses.

This study used two variables; namely, the LN_BIST100 and the LN_EURO STOXX50. Therefore, the specification of the research model is determined as bivariate vector autoregression. In this model, the interdependent relationship between LN_EURO STOXX50 and LN_BIST100 is specified within two equations, as follows:

$LN\_BIST100_t = \alpha_1 + \sum_{i=1}^{2} \beta_i\ LN\_EURO\ STOXX50_{t-1} + \sum_{i=1}^{2} \gamma_i\ LN\_BIST100_{t-i} + \varepsilon_{1t}$ ....(7)

LN_EURO STOXX50t = α2 + ∑_(i=1)^(2)θi LN_EURO STOXX50t-1 + ∑_(i=1)^2λi LN_BIST100t-i + ε2t ....(8)

ε1t and ε2t are the white noise of the historical behavior of LN_EURO STOXX50 and LN_BIST100. In Equation (7), the pattern of LN_BIST100 movement is influenced by the previous price movements of LN_BIST100 itself and by the previous movement patterns of LN_EURO STOXX50.

In Equation (8) the pattern is the same, but the movement of LN_EURO STOXX50 is influenced by the previous movement of LN_EURO STOXX50 and LN_BIST100. Estimation can be conducted in the VAR model by employing ordinary least squares (OLS). There is a general assumption that if the model is examined using OLS, consistent outputs of OLS can be obtained if the white noise of ε_{1t} and ε_{2t} are independent of the historical value of the observed variables.

The impulse response is utilized to trace the influence of the standard deviation of the specific shock on the changes in the current value and the future of the endogenous variable. The shocks on variable *i* will directly contribute to its value, with the impact spreading to all endogenous variables through a dynamic structure VAR (Phylaktis and Xia, 2009).

Further, Widarjono (2009) noted that the individual coefficients used in VAR models are difficult to interpret. To solve this problem, impulse response analysis is employed. Impulse response analysis is used to track the response of the endogenous variables in the VAR system to a shock or change in the variable (ε) that has experienced the disturbance. In this study, the impulse response is used to evaluate the response of the BIST100 and EURO STOXX50 when a shock exists between *shock* $u_{BIST100}$ and $u_{EUROSTOXX50.}$ In case of bivariate VAR between BIST100 and EURO STOXX50, the equations used in this research are written as follows:

$$LN\_BIST100_t = \alpha_{11}\ LN\_BIST100_{t-1} + \alpha_{12}\ LN\_EURO\ STOXX50_{t-1} + \varepsilon_{1t} \quad \text{....................}(9)$$

$$LN\_EURO\ STOXX50_t = \alpha_{21}\ LN\_BIST100_{t-1} + \alpha_{22}\ LN\_EURO\ STOXX50_{t-1} + \varepsilon_{2t} \quad \text{....................}(10)$$

Changes in ε_{1t} will immediately influence the current value of LN_BIST100. This tendency will also affect the value of subsequent periods of LN_EURO STOXX50 and LN_BIST100, which are triggered due to the lags of both LN_EURO STOXX50 and LN_BIST100, that exist as two equations. If the two innovation variables ε_{1t} and ε_{2t} in the equation are not correlated, the impulse response is categorized as direct. In this case, ε_{1t} is the innovation variable for BIST100 and ε_{2t} is determined as the innovation variable for LN_EURO STOXX50.

In fact, the innovation variables ε_{1t} and ε_{2t} are usually correlated. Thus, both of these innovation variables make the same contribution to the endogenous variables and their impact cannot be separated.

By virtue of their mutual correlation, the response of these innovation variables cannot be identified. Therefore, variance decomposition is necessary to separate the effects of each innovation variable on the response of another variable (Kurnia, 2005).

In addition to the impulse response, VAR model also provides a specific analysis to forecast the error decomposition of variance (variance decomposition).

This analysis illustrates the relative importance of each variable in the VAR model due to the existence of shocks.

Variance decomposition is useful for predicting the percentage of the contribution resulting from the changes of each variable in the VAR model. In this study, variance decomposition is intended to determine the proportion of the variance of $\sigma_{EURO\ STOXX50}$ and $\sigma_{BIST100}$ due to the shock resulting from $u_{EURO\ STOXX50}$ and u_{BIST10}

RESULTS AND DISCUSSION

The basis of this study is the assumption that the Borsa Istanbul (LN_BIST100) and the

Eurozone (LN_EURO STOXX50) indices have specific characteristics. In particular, this study also tries to determine the probability.

Characteristics in creating the possibilities concerning portfolio Diversification, especially to allow prospective investors improving the risk-return basis of their investment activity.

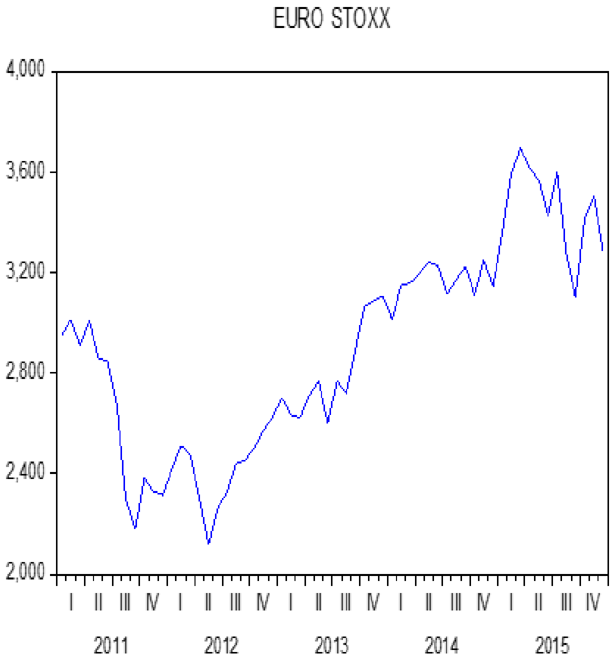

Figure 1. LN_BST100 Index Movement
Source: Data processed

All data were transformed to LN value prior to the analysis. To examine the linkages between the LN_BIST100 and LN_EURO STOXX50, monthly values of the index prices

Were utilized, Figures 1 and 2 display the price movements of Turkey's equity market and the As can be seen in Figure 1 and Figure 2, the index of BIST100 has experienced greater price movements than the EURO STOXX50 (here, we show the LN of each index The LN_BIST100 also shows more volatile price movements than the LN_EUROSTOXX50.

Summary statistics of the actual value and natural logarithm (LN) of the BIST100 and EURO STOXX50 from January 2011 to December 2015 are presented in Table 2. Eurozone index. Here, Turkey's equity market is proxied by the Borsa 100 Istanbul (BIST100) and the Eurozone index by EURO STOXX50.

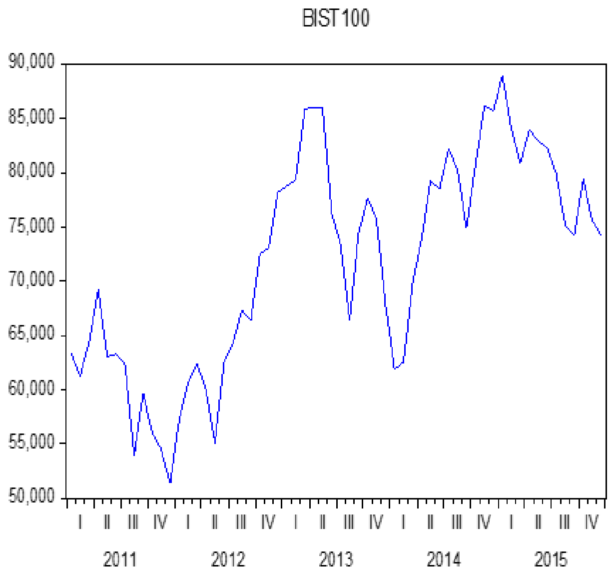

Figure 2. LN_EURO STOXX50 Index Movement
Source: Data processed

However, the market value of the LN_BIST100 is higher than that of the LN_EUROSTOXX. To investigate the relationship between these indices, we performed a correlation analysis.

Table 2 shows that the sample indices are normally distributed, as verified by the Jarque-Bera statistic outputs, either for the actual prices indices or the natural logarithm prices indices. The BIST100 shows a greater standard deviation (9963.245) than that of the EURO STOXX50 (418.120). However, after completing the LN procedure, the values of the standard deviations for both of these indices were almost equal.

Table 2. Summary Statistics of the Indices

	ACTUAL BIST100	ACTUAL EURO_STOXX	LN_BIST100	LN_EURO_STOXX
Mean	71790.27	2899.336	11.171	7.961
Median	74038.50	2932.270	11.212	7.983
Maximum	88945.80	3697.380	11.395	8.215
Minimum	51345.00	2118.940	10.846	7.658
Std. Dev.	9963.245	418.120	0.142	0.146
Skewness	-0.215	-0.000	-0.406	-0.210
Kurtosis	1.913	1.984	2.089	2.002
Jarque-Bera	3.394	2.577	3.720	2.930
Probability	0.183	0.275	0.155	0.231

Source: Data processed

Table 3. Residual Matrix between Turkey's Equity Market and the Eurozone Index

	LN_BIST 100	LN_EURO_STOXX
LN_BIST100	1	0.452***
LN_EURO_STOXX	0.452***	1

Note: *** Denotes significance at 10% level.
Source : Data Processed

Table 3 presents the correlations of the residuals of the monthly prices for the LN_BIST100 and LN_EURO STOXX50 for a VAR model with five lags. The correlation coefficients between both of these indices are low. Both LN_BIST100 and LN_EURO STOXX50 have equal correlation coefficients, at 0.452, which are significant at the 10% level ($p < 0.1$). This finding indicates weak contemporaneous interactions between these two equity markets. However, this can also be observed as a potential benefit for emerging stock markets involved in global diversification. As Turkey's equity market gradually opens up, there are strong opportunities for it to be engaged in broader market interactions. We continue our testing with the unit root test. Table 4 shows that for both indices the null hypothesis of the existence of unit roots was not rejected at the level of the data, but that Ho was accepted at the first difference form after employing the Augmented Dickey-Fuller test statistic (ADF) with five lags. Therefore, it can be inferred that each data series is stationary and integrated with an order of 1 or 1(1).

The results support the hypothesis that LN_BIST100 and LN_EURO STOXX50 are first-order integrated I(1). Therefore, the Granger causality test was used (Granger, 1969) to assess the co-movements between Turkey's equity market and the Eurozone equity market. We continue our testing with the unit root test. Table 4 shows that for both indices the null hypothesis of the existence of unit roots was not rejected at the level of the data, but that Ho was accepted at the first difference form after employing the Augmented Dickey-Fuller test statistic (ADF) with five lags.

Table 4. Unit Root Tests on the Levels and First Differences of the Stock Market Indices

Test critical values:	ADF test statistic			
	Level		1st Difference	
	LN_BIST100	LN_EURO_STOXX	LN_BIST100	LN_EURO_STOXX
t-Statistic	-1.814	-1.095	-7.557*	-7.096*
1% level	-3.546	-3.546	-3.548	-3.548
5% level	-2.911	-2.911	-2.912	-2.912
10% level	-2.593	-2.593	-2.594	-2.594

Source: Data processed

Therefore, it can be inferred that each data series is stationary and integrated with an order of 1 or 1. The results support the hypothesis that LN_BIST100 and LN_EURO STOXX50 are first-order integrated I(1). Therefore, the Granger causality test was used (Granger, 1969) to assess the co-movements between Turkey's equity market and the Eurozone equity market.

Table 5. Lag Determination

Lag	LogL	LR	FPE	AIC	SC	HQ
0	74.096	NA	0.002	-2.621	-2.548	-2.593
1	**171.365**	**183.926***	**8.396***	**-6.013***	**-5.794***	**-5.928***
2	172.555	2.163	9.306	-5.911	-5.546	-5.769
3	175.996	6.006	9.506	-5.890	-5.379	-5.693
4	179.261	5.461	9.796	-5.864	-5.207	-5.610
5	179.845	0.934	1.115	-5.739	-4.936	-5.429

Note: * Indicates lag order selected by the criterion

Source: Data processed

Several studies have found that information from one nation's equity market will spill over to other national markets over time (Roca, Selvanathan & Shepherd, 1998). Thus, this study searches for the most appropriate lag. Lags of 1 versus 2 are first tested (HQ: p = 1 vs. H1: p = 2). If the null hypothesis is rejected, the test continues by testing the next higher lags (3, 4, 5). The outputs of the lag test results are presented in Table 5. These show that lag testing using LR

Therefore, it is assumed that the variable data is meaningful and does not contain spurious indications. (a sequential modified LR test statistic at the level of 5%, final prediction error [FPE], AIC, SIC, and HQ) determine Lag 1 as the optimal lag for the VAR model. After determining the optimal lag, we continued with a co-integration test, as shown in Table 6.

Co-integration may exist between the Turkish and Eurozone indices. This indicates that a linear combination of two time-series can be stationary and that there is a long-run equilibrium between Turkey's index and the Eurozone index. The data from both of these markets are stationary at the first difference.

Table 6. Co-Integration Output Panel A. Unrestricted Co-integration Rank Test (Trace)

Hypothesised No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.115	8.552	15.494	0.408
At most 1	0.024	1.409	3.841	0.235

Panel B. Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Hypothesised No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.115	7.142	14.264	0.472
At most 1	0.024	1.409	3.841	0.235

Note: Trace test indicates no co-integration at the 0.05 level
Max-eigenvalue test indicates no co-integration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
Source: Data processed

Thus, as suggested by Johansen (1988) and Johansen and Juselius (1990), the number of significant co-integrating vectors was tested by using the maximum likelihood-based l-max and l-trace statistics. Co-integration may exist between the Turkish and Eurozone indices.

This indicates that a linear combination of two time-series can be stationary and that there is a long-run equilibrium between Turkey's index and the Eurozone index. The data from both of these markets are stationary at the first difference. Therefore, it is assumed that the variable data is meaningful and does not contain spurious indications. Thus, as suggested by Johansen (1988) and Johansen and Juselius (1990), the number of significant co-integrating vectors was tested by using the maximum likelihood-based l-max and l-trace statistics. However, as can be observed in Table 6 the output of the co-integration test indicates that there is no co-integration between Turkey and the Eurozone. The result from the unrestricted co-integration rank test (trace) shows a lower trace statistic value than the 0.05 critical value. Moreover, the output of

The unrestricted co-integration rank test (maximum eigenvalue) is similar, in that the maximum eigenvalue statistic value is lower than the 0.05 critical value. Therefore, we continued our analysis with a Granger causality test to determine the causal relationship that possibly exists between the Turkish and Eurozone equity markets. The results of the Granger test output are shown in Table 7 According to the result of the Granger causality test, F-statistic values are calculated to test the null hypothesis that X does not affect Y (HQ: b = 0), against the alternative hypothesis that X does affect Y (HQ: b ^ 0). The null hypothesis that Y does not affect X (HQ: b* = 0), versus the alternative hypothesis that Y does affect X (HA: b* *0) is also tested.

Based on the Granger output, the causality relationship between Turkey and Eurozone can be identified in the first lag (Lag 1), in which the probability of the first lag model reflects that the alternative hypothesis is supported at a significant level of 10%. The calculated F-statistics for the consecutive lags are presented in Table 7. Considering the output of Granger test, which determined Lag 1 as the chosen lag, we further continued our test to the VAR model, as shown in

Table 7. Granger Causality Test Results

Null Hypothesis:	Lag 1		Lag 2		Lag 3		Lag 4		Lag 5	
	F-Stat	Prob.	F-Stat	Prob.	F-Stat	Prob.	F-Stat	Prob.	F-Stat	Prob.
LN_BIST100 does not Granger Cause LN_EURO_STOXX	2.828	**0.098*****	0.473	0.625	0.529	0.664	1.113	0.361	0.901	0.488
LN_EURO_STOXX does not Granger Cause LN_BIST100	0.001	0.970	2.033	0.140	2.297	0.088***	1.955	0.116	1.513	0.205

Note: * denotes significance at 1%, ** denotes significance at 5%, *** denotes significance at 10%

Source: Data processed

Table 8. According to the output of VAR model, as can be seen in Table 8, Turkey's equity market and the Eurozone index tend to behave as a single market. This can be seen in the result of the co-integration test, which showed no co-integration between the Turkish and the Eurozone indices, and is supported by the weak correlation (0.452) shown by the residual matrix test in Table 8.

Table 8. VAR Estimation Results

	LN_BIST100	LN_EURO_STOXX
LN_BIST100(-1)	0.897***	0.102***
	(0.079)	(0.059)
	[11.315]	[1.681]
LN_EURO_STOXX(-1)	-0.002***	0.885***
	(0.077)	(0.058)
	[-0.036]	[15.121]
C	1.165	-0.203
	(0.646)	(0.485)
	[1.803]	[-0.419]
R-squared	0.810	0.899
Adj. R-squared	0.803	0.895
Sum sq. resids	0.225	0.127
S.E. equation	0.063	0.047
F-statistic	119.871	250.419
Log-likelihood	80.468	97.353
AIC	-2.626	-3.1984
SIC	-2.520	-3.092
Mean dependent	11.173	7.961
S.D. dependent	0.1433	0.147
Determinant resid covariance (dof adj.)		7.306
Determinant resid covariance		6.576
Log-likelihood		184.574
AIC		-6.053
SIC		-5.842

Note: * denotes significance at 1%, ** denotes significance at 5%, *** significance at 10.

Source: Data processed denotes

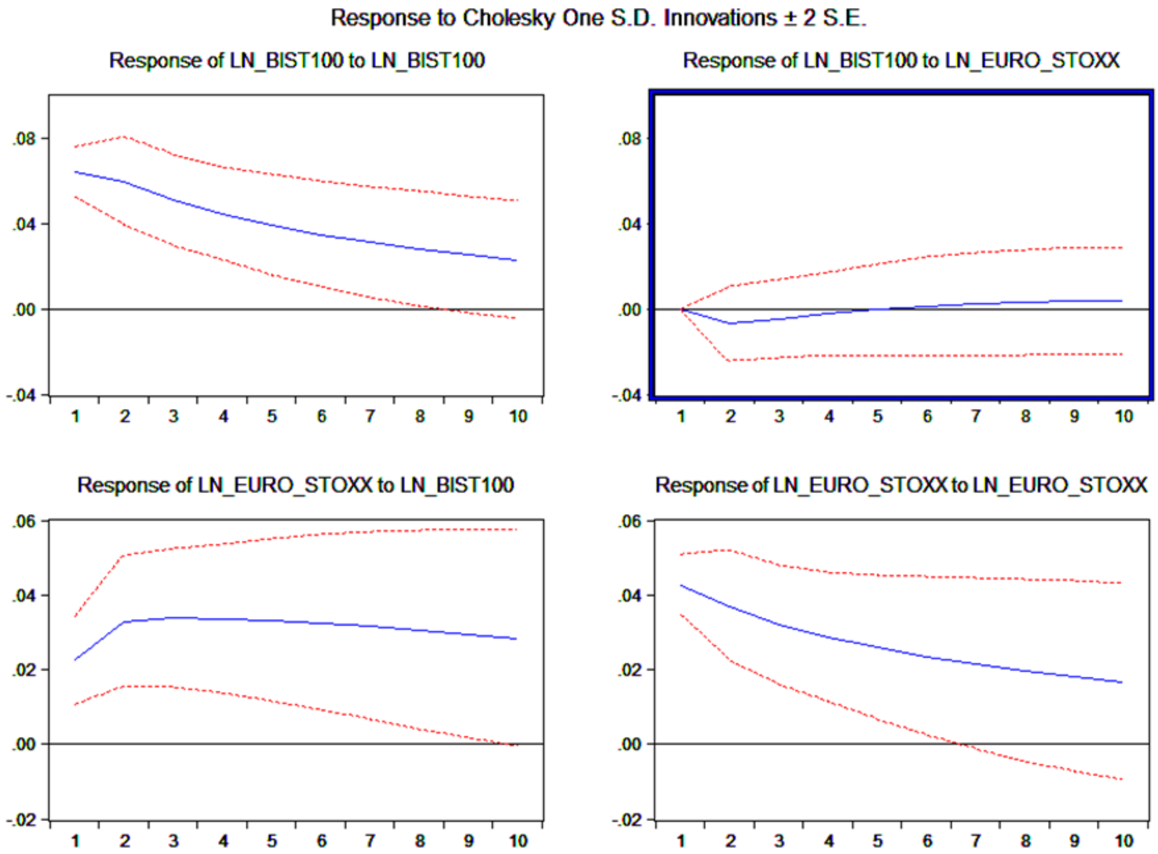

Figure 3. Impulse Response Output Results
Source: Data processed

However, the results of the Granger test showed that the output runs one way, from LN_BIST100 to LN_EURO_STOXX50, and not in the other direction. This result implies that even though these two markets are located in nearby regions, their performances during the observed period tend to show very different patterns. Hence, we argue that there is significant conditional heteroscedasticity in the Turkish and Eurozone equity markets. Figure 3 presents the trend of the monthly conditional equity market correlations. Analysis of the figure shows that the LN_BIST100 and LN_EUROSTOXX50 manifest slightly different responses. In line with the findings of prior studies, the equity market correlation between LN_BIST100 and LN_EURO STOXX50 appears to be more stable than the individual market performance. There is still a tendency for these markets to be correlated, although the evidence is mixed, in that there is no co-integration between the two markets. Not surprisingly, given the international nature of their activities, during the observation period, Turkey showed significantly more economic growth than the Eurozone.

Moreover, as the completion of the impulse response output, the results with regards to the forecast of the variance decomposition analysis are provided. Table 9 displays the proportion of changes occurring in the index prices. In a particular equity market arising out of random shocks between Turkey and the Eurozone index, this can be associated with random shocks coming from each equity market. e short-run dynamics

Table 9. Variance Decomposition Outputs Variance Decomposition of LN_BIST100

Period	S.E.	LN_BIST100	LN_EURO STOXX
1	0.064	100.000	0.000
2	0.088	99.346	0.653
3	0.101	99.268	0.731
4	0.111	99.339	0.660
5	0.117	99.411	0.588
6	0.123	99.452	0.547
7	0.126	99.458	0.541
8	0.130	99.434	0.565
9	0.132	99.386	0.613
10	0.134	99.320	0.679
Mean		99.844	0.556

Source: Data processed

Table 10. Variance Decomposition of LN_EURO_STOXX

Period	S.E.	LN_BIST100	LN_EURO _STOXX
1	0.048	21.652	78.347
2	0.069	33.197	66.802
3	0.083	39.311	60.688
4	0.094	43.368	56.631
5	0.103	46.461	53.538
6	0.110	48.956	51.043
7	0.117	51.020	48.979
8	0.122	52.752	47.247
9	0.127	54.219	45.780
10	0.131	55.469	44.530
Mean		44.472	55.458

Source: Data processed

that have been previously captured are useful in describing the phenomena occurring between the LN_BIST100 and the LN_EURO STOXX50.

To understand more about the short-run dynamic relationship between these two indices, variance decomposition techniques were employed.

The table shows the variance decomposition results for the 10-month-ahead forecast error variance. The ordering of the index price series in the VECM follows the trading time of the markets.

The column labeled S.E. contains the forecast error of the variable at the given forecast horizon. The columns labeled LN_BIST100 and LN_EURO STOXX50 depict the percentage of variation that is explained by the shock to these equity markets.

Furthermore, the results of the impulse function and variance show that the response of the LN_BIST100 is largely caused by shocks to the LN_BIST100 itself, at 98.84%, while 0.557% is caused by the LN_EURO STOXX50. Meanwhile, the response of the LN_EURO STOXX50 is predominantly caused by shocks to the LN_EURO STOXX50 itself, at 53.10%, with the remaining 44.47% caused by shocks to the LN_BIST100.

The short-run dynamics that have been previously captured are useful in describing the phenomena occurring between the LN_BIST100 and the LN_EURO STOXX50.

To understand more about the short-run dynamic relationship between these two indices, variance decomposition techniques were employed. Variance decomposition gives the proportion of the movements in the dependent variables that are caused by their shocks, against shocks to the other employed variables. The value of the variance decomposition is calculated by ordering the variables. Regarding the existence of the strong contemporaneous correlation between the shocks, the ordering variables are obviously necessary.

The results from the variance decompositions are presented in Table 9 as 10-month-ahead forecast error variance. It is evident that the ability of the markets to explain their own variation is high. However, the co-integration test showed that there is no integration between Turkey and Eurozone. This investigation was continued with a Granger causality test, using five lags in order to determine the probability of a one-way or two-way contribution from each index.

The results showed a weak one-way contribution from Turkey's equity market to the Eurozone index. However, the output of the Granger test was statistically significant at the 10% level, in line with the result of the residual matrix correlation shown in Table 3.

Our study examines the relationship between Turkey's equity market, proxied by the Borsa Istanbul 100 (BIST100), and the Eurozone index, represented by the EUROSTOXX50. Our findings reveal that there is no co-integration between these two markets since their indices movement patterns are different to each other. We also find that the Turkish and European equity markets show different performances; Turkey has experienced strong economic growth, identified by its impressive capital market development. On the other hand, the European market has suffered as a result of the European financial crisis.

Even though our tests show that there is no market integration between Turkey and the Eurozone, our results imply a one-way contribution from Turkey to the Eurozone equity market. This was shown by the Granger causality test. We determined Lag 1 as the most appropriate to explain the variation in equity market performance. However, the one-way contribution is only significant at the 10% level. This is driven by specific macroeconomic factors, in which each index is affected by different factors. As noted by Maysami, Howe and Hamzah (2004), macroeconomic factors lead to the possibility of superior returns based on specific stock performances. Further, the study of Nurazi and Usman (2016) found that different firms have differing abilities to respond to macroeconomic variables, and these authors report that the banking sector is more volatile when facing economic shocks.

Information relating to specific firms in any index must be considered when explaining the returns of the index (Usman & Tandelilin, 2014). The amount of information entering the market will drive the co-movement of the index itself. Most investors will carefully consider their investment portfolio, which is associated with their investment performance (Usman, 2012). In line with this notion, the study of Nurazi, Kananlua and Usman (2015), Nurazi, Usman and Kananlua (2016) argue that there is information asymmetry between informed and uninformed investors. Thus, the value of the index movement is eventually influenced by the level of incoming information. In this study, information with respect to the issues of debt and the financial crisis faced by the Eurozone countries contributes to investors' decision-making processes.

Both institutional and individual investors decide their investment strategy with reference to the information available in the market (Nurazi & Usman, 2015). Turkey has created positive growth in its index. This implies that Turkey is no longer 'the sick man of Europe', while at the same time, the Eurozone index shows a contrasting pattern in its movements over the observed period.

As per the idea proposed by Aysan and Ermişoğlu (2013), a factor responsible for the Eurozone crisis is related to errors in the structure of the monetary union. The optimum currency area (OCA) theory was conjectured to be one of the leading errors. According to the argument of Anand, Gupta and Dash (2012), the creation and implementation of the Eurozone were subject to an inherent contradiction, in that it was a monetary union, but not a fiscal union in terms of taxation, pensions and treasury functions. This notion is supported by the study of Subacchi and Pickford (2012), who point out that a system of monetary union that is not established simultaneously with fiscal union can be only robust under a government with strong rules. These authors claim that the common rules within the Eurozone have been disregarded and driven by the political situation, which changes unpredictably. This affects the performance of the European market index, which creates uncertainty in the market information to investors wishing to invest in the European area.

During the observation period, the Turkish equity market showed a different pattern to the Eurozone index, in that for the last five years Turkey has shown a positive economic performance. Tracking back to the previous seasonal economic cycle, Turkey has emerged from the global financial crisis (Rodrik, 2012). In 2008–2009, Turkey was hardly hit by the global financial crisis. Due to the experience of facing this global crisis, Turkey has recovered its economic activity and currently performs well as an advanced economy. Moreover, Turkey's economy can be considered as a functioning market. Also, the current condition of its bearish and bullish pattern on its equity market has dramatically contributed to the entire performance of its Economy. This is in line with the notion of Usman, (2016) in which the strong performance of equity market inclines to significantly reflect the economic performance within a certain time period of related-economy situation.

Our findings contrast with those of Kasa (1992). Kasa notes that after testing the stochastic trends from five equity market in the US, Japan, England, Germany and Canada, a single common trend drove these countries' stock markets. However, testing the relationship between the equity markets of Turkey and the Eurozone gives the opposite result. Our findings show that any co-integration between these two indices is dubious, as directly testing for co-integration showed that this was absent, while on the other hand, the Granger causality test indicates a one-way contribution from Turkey to the Eurozone index over the observed period. This is a result of the instability of the Eurozone index, while the performance of the Turkish index has significantly increased over recent years.

As noted by Granger (1988), VECM (Vector Error Correction Model) provides two channels of causality between the variables tested. The first is through the lag value of the explanatory variable, and the second is through the error correction terms (EC_{t-1}). Here, the joint hypothesis of the lags for each variable can be examined by using the value of the F-statistic and the value of the coefficient of the lagged error terms, which is tested by the t-statistic (Karagoz & Ergun, 2009). However, our result differs from the a priori expectation, in that we found no cointegration between the variables examined. However, we note the presence of a weak one-way contribution from Turkey's equity market towards the Eurozone index. This result implies that there is no pair-wise relationship during the observation period. Further, the impact of macroeconomic variables strongly influences the volatility and co-movement of the samples employed.

Further empirical research in the area of equity market integration is needed to extend the existing literature in this area. The potential factors associated with equity market integration can be investigated and extended by exploring these empirical findings. Further, for prospective investors, the benefits of diversification and investment across the Turkish and Eurozone markets could be considered as a strategy for increasing the performance of their portfolios. Integration is thought to exist in the long-run equilibrium. However, in the short-run equilibrium, the opposite relationship may be found. Therefore, there is still an opportunity for Turkey and the Eurozone markets to increase the performance of their indices in the future.

CONCLUSION

The short-run dynamics that have been previously captured are useful in describing the phenomena occurring between the LN_BIST100 and the LN_EURO STOXX50. To understand more about the short-run dynamic relationship between these two indices, variance decomposition techniques were employed. Variance decomposition gives the proportion of the movements in the dependent variables that are caused by their shocks, against shocks to the other employed variables. The value of the variance decomposition is calculated by ordering the variables. Regarding the existence of the strong contemporaneous correlation between the shocks, the ordering variables are obviously necessary.

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