Business Management Dynamics
Vol.3, No.7, Jan 2014, pp.01-13

Testing for cointegration and causality between sectoral indices and euro exchange rate in Turkey[i]

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Abstract
In this study, the relation between the foreign exchange rate (Euro) in Turkey and 22 indices in Istanbul Stock Exchange (ISE) as well as the direction of this relation are analyzed with econometric techniques. The study is carried out for the period between 2002:01 and 2010:01. According to the study, it is detected with Johansen cointegration test that there is a cointegration relation, in other words a long-term relation between Euro and XKMYA, XSIN, XHIZ, XILTM and XULAS indices. A Granger causality test is carried out on indices with which Euro is found to have a cointegration relation and according to this test, all indices have unidirectional causality relations with Euro and that these relations are all from respective indices to Euro. In the light of obtained findings, we can say that it is possible for financial decision makers to predict changes to happen in Euro by following the indices with which Euro is found to have long-term causality relations.

Key words: Euro, exchange rate, cointegration, causality, ISE indices

Available online
www.bmdynamics.com
ISSN: 2047-7031

INTRODUCTION

For the last decade, economists have been trying to predict stock prices and returns in the area of finance, an effort which has been particularly important since 1973, when many countries around the world adopted the freely fluctuating exchange rate system. There is an unending debate on what the desired degree of flexibility is in exchange rate objectives to determine a country's monetary policy. The proponents of the freely fluctuating exchange rate system argue that exchange rates should be determined market forces, an argument that is based on the assumption that in a perfect market with no intervention by governments or monetary authorities, markets can determine nominal exchange rates through efficient allocation of resources (Kutty, 2010).

Madura (2008) maintains that stock prices are influenced by three kinds of factors; namely, the economic factor, market-related factor, and firm-specific factor. On the other hand, exchange rates are now more sensitive toward stock market movements and global portfolio investments than in the past. Evaluating the relationship between stock prices and exchange rates is of great importance since the results to be obtained from such evaluations may influence monetary and fiscal policies.

Establishing a relationship between stock prices and exchange rates is important for several reasons (Dimitrova, 2005). First of all, such relationship may affect the decisions about monetary and fiscal policy. Gavin (1989) demonstrated that an emerging stock market positively affects aggregate demand. If this effect is large enough, it will eliminate the impact of expansionary monetary policies or contractionary fiscal policies targeting interest rates and real exchange rates. Policy makers may sometimes back up cheaper currencies to boost the export industry. Nevertheless, they should be aware whether such a policy will cause stagnation in the stock market. Secondly, the connection between two markets could be used to predict the path of exchange rates. This method will help multinational companies stabilize their earnings by managing their exposure to foreign contracts and the exchange rate risk. Thirdly, currency is usually included in the portfolios of investment funds as an asset. The knowledge of the relationship

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between currency rates and other assets in the portfolio is vital for a fund's performance. According to the mean-variance approach in portfolio analysis, expected return is estimated from portfolio variance. Thus, the variance of a particular portfolio should be correctly predicted. And to do this, one needs to estimate the relationship between stock prices and exchange rates. Finally, understanding the relationship between stock prices and exchange rates could be useful in foreseeing a crisis.

There are mainly two theories that establish a relationship between stock prices and exchange rates (Kutty, 2010). The first is the traditional approach arguing that currency depreciation will cause more export and thus corporate profits, resulting in a rise in stock prices in the short term. In this approach, transmission mechanism refers to a firm's export competitiveness. As a result, change will take place in the value of the firm's assets and liabilities and profits will increase, which will be reflected in stock prices.

As an alternative to traditional approach, portfolio approach (Frankel, 1983; Branson and Henderson, 1985, for example) argues that changes in stock prices may influence exchange rate movements through portfolio adjustments (inflow/outflow of foreign currency). Foreign currency inflow will increase in the case of a sustained upward trend in stock prices. However, a decrease in stock prices will cause a reduction in the wealth of domestic investors, resulting in a decline in money demand and interest rates. And this leads to capital outflows that will result in currency depreciation. Therefore, the portfolio approach suggests that stock prices may affect exchange rates by a negative correlation (Tabak, 2006).

Using econometric techniques, the present study analyzed the relationship between a foreign exchange (Euro) in Turkey and 22 indices traded on the Istanbul Stock Exchange (ISE) in the period between 2002 and 2010, as well as the direction of this relationship. It is distinguished from other studies in the literature by the length of its analysis period and the high number of indices it analyzes and ISE designs different types of indices so as to enable investors to track ISE markets in euro area. Vantchikova (2006) indicates the presence of long-run comovements between Turkish stock market and EU stock markets between 1994-2006. The second part of the study discusses the results of other studies on the same subject in the literature, while the third part discusses the dataset used in the analysis process, and the fourth part deals with the econometric methods employed. The fifth part presents the results of the analyses, while the last part interprets the results obtained.

LITERATURE REVIEW

In the literature, theoretical relationships between stock prices and exchange rates are examined in three ways (Kollias et al., 2010). As the first approach, the goods market hypothesis assumes that there is a unidirectional causality from exchange rates to stock prices (Dornbusch and Fischer, 1980). According to this approach, changes in exchange rates affect the international competitiveness of domestic firms and hence their earnings and stock prices; however, it is not easy to foresee a sign of the effect of the fluctuations in exchange rates on stock markets. In the second approach, portfolio balance models of exchange rate determination suggest inverse causality (from stock prices to exchange rates) (Frankel, 1983). In these models, exchange rates play a role in balancing the demand and supply for assets. As the third approach, asset markets argue that there is a weak relation or any relationship between stock prices and exchange rates (Frenkel, 1976). In these models, exchange rate is considered as the price of an asset, which is mainly characterized by the fact that its current price is highly affected by expected return rate. Since there may be many different reasons behind stock price and exchange rate movements, the asset market approach argues for a lack of any connection between stock prices and exchange rates.

Ratner (1993) performed cointegration analysis to test whether the US dollar exchange rate affects US stocks by using monthly data for the period between 1973 and 1989. The results revealed that there was no link between the underlying long-term stochastic characteristics of stock index and exchange rates because the null hypothesis with no cointegration cannot be rejected when the sample is divided into sub-periods.

Abdalla and Murinde (1997) evaluated the interaction between the exchange rates and stock prices in India, Korea, Pakistan, and the Philippines, which are regarded among emerging markets, for the period between January 1985 and July 1994. The analysis results revealed a unidirectional causality from exchange rates to stock prices in Korea, Pakistan, and India and causality from stock indices to exchange rate in the Philippines. Baklaci (1997) determined the bilateral interaction between foreign investors' trading activity and returns in Turkish stock market and found a strong bilateral interaction between foreign investors' trading and stock returns.

Ajayi et al. (1998) used Granger Causality test to investigate the causal relationships between stock returns and changes in exchange rates in developed and developing countries, for the period between April 1985 and August 1991 for Canada, Germany, France, Italy, Japan, USA, and UK and for the period between December 1987 and September 1991 for Taiwan, Korea, Philippines, Malaysia, Singapore, Hong Kong, Indonesia, and Thailand. The study found a unidirectional causality relationship from stock return differential to the changes in exchange rates in all developed markets (Canada, Germany, France, Italy, Japan, USA, and UK) as well as in Indonesia and Philippines, while converse causality was found in Korea. On the other hand, no causality relationship was detected between the two markets in Malaysia, Singapore, and Hong Kong.

Similarly to Ajayi et al.'s (1998) study on developing markets, Granger et al. (2000) examined in their study Japan, Taiwan, Singapore, Hong Kong, Indonesia, South Korea, and Thailand with regard to the cointegration relationship between stock market and exchange rate in a more extensive study period between 1986 and 1998. This research obtained different results from those obtained by Ajayi et al. (1998) and reported on a bidirectional causality relationship for these variables in Hong Kong, Malaysia, Singapore, Thailand, and Taiwan. The direction of this relationship was from the exchange rate market to stock market in South Korea and from stock market to exchange rate market in Philippines, while no statistically significant relationship was detected for Indonesia and Japan. Using a similar sample, Doong et al. (2005) examined six emerging Asian countries in the period from 1989 to 2003. As a result, they failed to find a cointegration relationship between the exchange rates and stock prices in these countries, but detected a bidirectional causality relationship in Indonesia, Korea, Malaysia, and Thailand. In all countries except for Thailand, stock returns were significantly negatively correlated with the simultaneous changes in exchange rates, which meant for the authors that currency depreciations are usually accompanied by the falls in stock prices.

In addition to these studies, Pan et al. (2007) examined the cointegration relationship between stock market and exchange rate for Hong Kong, Japan, Korea, Malaysia, Singapore, Taiwan, and Thailand in the period between 1988 and 1998, with specific regard to the sub-periods of before and during the Asian financial crisis in 1997. As a result of the econometric tests performed, the causality relationships differed before and during the crisis and the analysis involving Johansen cointegration test revealed a long-term relationship between the variables before the crisis in Hong Kong, Japan, Thailand, and Taiwan, but no similar relationship was found during the crisis. Another study for Hong Kong, Indonesia, Japan, South Korea, Malaysia, Philippines, Singapore, Thailand, and Taiwan was conducted by Ramasamy and Yeung (2005) on an annual and three-month basis for the period between January 1997 and December 2000. The results of this study are inconsistent with those of the above as a unidirectional causality relationship from stock market to exchange rate was found for Indonesia, Japan, Malaysia, Singapore, Thailand, and Taiwan on an annual basis, while the same kind of relationship was found for Philippines and North Korea in an inverse direction. A bidirectional causality relationship was empirically reported for Hong Kong. In another study, Ibrahim (2000) found a bidirectional causality relationship between the same variables for Malaysia during the period between January 1979 and June 1996.

Apart from Ajayi et al. (1998), Nieh and Lee (2001) also examined G-7 countries as their sample and failed to find any long-term significant relationship between the stock prices and exchange rates in G-7 countries between October 1993 and February 1996 by using both Engle-Granger and Johansen cointegration tests. Moreover, the authors detected significant but ambiguous short-term relationships for these countries.

In a study, Wu (2000) used weekly data from the period between 1990 and 2000 to examine the cointegration relationship between stock market and exchange rate in USA and Singapore. The results of the study, in which Johansen cointegration test was performed, demonstrated a long-term relation between the variables. In parallel to this study, Kim (2003) found a similar relationship for USA in the period extending from January 1974 to December 1998; however, Bahmai-Oskooee and Sohrabian (1992) detected a bidirectional causality relationship between the variables of the US stock index (S&P 500) and

effective exchange rate between July 1973 and December 1988, but found no long-term relation, in contrast to the results of the two studies.
Hatemi and Irandoust (2002) examined the causality relationship between exchange rate and stock prices in Sweden by using Granger causality test. Their results demonstrated that the Granger causality was unidirectional and from the stock market to the foreign exchange market. The study also showed that an increase in Sweden's stock prices caused a decline in the exchange rate in the country.
In another study, Smyth and Nandha (2003) investigated the relationship between stock market and exchange rate in Bangladesh, India, Pakistan, and Sri-Lanka between 1995 and 2001. Based on daily data and Engle-Granger and Johansen cointegration tests, the analysis showed no cointegration relationship between the variables. More recently, Bangladesh, India, and Pakistan have been studied by for the period between January 2003 and June 2008. Rahman and Uddin (2009), who similarly to Smyth and Nandha's (2003) study, failed to find a long-term relation and a causality relationship between nominal exchange rates and stock indices in these countries in the sample using monthly data.
Erbaykal and Okuyan (2007) examined the relations between exchange rate and stock price in 13 developing economies by using different periods for each country. The obtained results provide evidence for the existence of causality relationships for eight economies. A unidirectional causality relationship was found in five of these countries from stock price to exchange rates, while the causality relationship was bidirectional in the remaining three countries. In another study, Vardar, Aksoy and Can (2008) investigated the impact of interested rate and exchange rate on the composite and sector price indices and used sector data over the 2001-2008 period in Istanbul Stock Exchange and they suggested that when there become changes in interest rates and exchange rates, investor should revisit the composition of their portfolios or shift the share of the sector index in the portfolio.
Aydemir and Demirhan (2009) used the Toda Yamamoto method under Granger Causality Test to investigate the causal relationship between stock prices and exchange rates (TL/USD) for Turkey by using the data from the period between February 2001 and January 2008. The results of this empirical research demonstrate that there is a bidirectional causal relationship between exchange rate and all stock indices. While negative causality was detected from national 100, services, financials and industrials indices to exchange rate, there was a positive causal relationship from technology indices to exchange rate. On the other hand, the researchers found a negative causal relationship from exchange rate to all stock market indices. Presenting different results from those of this study, Kasman (2003) examined the relationship between the National 100 index (the period between January 1990 and November 2002), financial sector index (the period between January 1991 and November 2002), industrial sector index (the period between January 1991 and November 2002), and service sector index (the period between January 1997 and November 2002) and exchange rate (TL/USD) using standard Granger test and reported a long-run relation between all the sector indices and exchange rate, but found a causality relation only between the industrial sector index and exchange rate running from exchange rate to industry sector.
In the recent studies, Zhao (2010) investigated the relation between stock market and exchange rate in China between January 1991 and June 2009, but did not empirically find a long-term balance relation. The other study, Subayyal and Shah (2011) examined the existence and direction of causality between stock market index (Karachi Stock Exchange) and exchange rate in Pakistan for the period between January 1998 and December 2009 and found that bidirectional causality exists between the variables.

DATA SET AND METHODOLOGY

The dataset used in this study consists of 2006 daily data from 22 indices traded on the Istanbul Stock Exchange (ISE) and Euro exchange rate in the period between 2002:01 and 2010:01. The data on the exchange rates and the indices were obtained from the Electronic Data Distribution System (http://evds.tcmb.gov.tr/) of the Central Bank of the Republic of Turkey and the Istanbul Stock Exchange (ISE). The indices included in the analysis are XTAST (Stone-Soil), XKMYA (Chemisty-Oil), XKAGT (Forestry-Paper-Printing), XTEKS (Textile-Leather), XGIDA (Food-Beverages), XSIN (Industrial), XUTUM (National All), XU030 (National 30), XU050 (National 50), XU100 (National 100), XMESY (Metal Goods-Machinery), XUHIZ (Services), XSVNM (Defense), XUTEK (Technology), XSGRT (Insurance), XBANK (Banking), XUMAL (Financial), XILTM (Communication), XTRZM (Tourism) and XULAS (Transportation). Eviews 6.0 software pack was employed to carry out the economic analyses.

Before proceeding with the analysis process, first the natural logarithms of the data were taken. Next, stationary analysis was performed for the data concerning the variables used in the study. Among the parametric tests, the most commonly used ones are the Augmented Dickey-Fuller (ADF-1979) test and Philips-Perron (PP-1988) test, which considers the possible structural breaks and trends in time series. By using the cointegration test developed by Johansen and Juselius (1990), the presence of a long-run relationship was investigated between the time series. Finally, the direction of the intervariable relationship was investigated through Granger (1969) causality analysis.

Unit Root Test

Prior to the analysis with time series data, one first needs to investigate whether the series are stationary. Stationary analysis is also termed as unit root test. A series without any unit root problems is designated as a stationary series. When working with non-stationary time series, one can face with the spurious regression problem, in which case the result obtained by regression analysis does not reveal the actual relationship (Gujarati, 1999). Certain problems occur in models constructed by using non-stationary time series and a relation that does not exist between the variables is misinterpreted and evaluated as actually existing. Various parametric and non-parametric tests have been developed to investigate whether a series is stationary or contains a unit root. Augmented Dickey-Fuller (ADF-1979) and Phillips-Perron (PP-1988) test methods were employed to identify whether the series used contain unit roots. By comparing the t statistics obtained as a result of the test with the critical value, it is decided whether to reject or accept H_0 hypothesis (Enders, 1995). H_0 hypothesis indicates that the series is non-stationary and has a unit root, while the alternative hypothesis shows the stationarity of the series. If the computed value is higher than the critical value, then H_0 hypothesis is rejected and the series is decided to be stationary.

Johansen Cointegration Test

The cointegration method was developed by Granger as a new method to investigate the long-term inter-variable balance relationships. Later, the theory was elaborated through a joint study by Engle and Granger, and thus, long-term balance relationship and short-term dynamic relations could now be analyzed under the same framework. Thanks to Engle and Granger cointegration test developed by Engle and Granger, and Johansen cointegration test later developed by Johansen and Juselius (1990), it is now possible to show whether level-non-stationary series move together in the long run.

The number of cointegrated vectors is calculated by trace statistics, which is based on the log likelihood test statistics using eigenvalues, and maximum eigenvalue statistics which is based on testing r number of cointegration vectors against r+1 number of its alternatives. Thus, if the values of trace statistics and maximum eigenvalue statistics are higher than the critical value, then the null hypothesis (H_0) is rejected (Johansen, 1988; Johansen and Juselius, 1990).

Granger Causality Test

After the cointegration relationship (cointegration vector) showing the existence of a long-term intervariable relationship is identified, causality relations need to be analyzed by the error correction model (Vector Error Correction Model, VECM). Granger (1969) causality was defined as follows: "If past information contained in a variable X improves forecasts of another variable Y, variable X is said to cause variable Y" After validating this statement, the relationship is expressed from X to Y. The analyses reveal whether two variables lag affect each other, and if they do, whether the causality is unidirectional (from X to Y, or from Y to X) or bidirectional (both from X to Y, and Y from X).

EMPIRICAL RESULTS

Unit Root Test Results

For the time series stationarity analysis of the variables, two different unit root tests were used: Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) tests. For the ADF and PP tests, the null hypothesis indicates the existence of a unit root or non-stationarity of the series, while the alternative hypothesis indicates the absence of a unit root or stationarity of the series. In both tests, a higher t statistics than critical values results in the rejection of H_0 hypothesis (non-stationarity of the series).

Unit root test was carried out to examine the stationarity of the data. The first step involved investigating the level I(0) stationarity of the variables. For this purpose, both ADF and PP tests were performed for 3 different models including with constant, with constant-with trend and none. PP test is carried out to confirm the ADF test. The lag numbers used in ADF unit root test are the lag length determined by Akaike Information Criterion (AIC). In the PP test, on the other hand, dependent variables enough to eliminate autocorrelation are not included in the lag model.

Table 1: Unit Root Test Results (Level)

	Augmented Dickey Fuller (ADF)-I(0)			**Philips Perron (PP)-I(0)**		
	Constant	**Constant and Trend**	**None**	**Constant**	**Constant and Trend**	**None**
EURO	-2.259 (0.185)	-2.790 (0.201)	0.584 (0.842)	-2.262 (0.184)	-2.832 (0.185)	0.587 (0.843)
XTAST	-0.873 (0.797)	-1.046 (0.935)	1.773 (0.982)	-0.955 (0.770)	-1.147 (0.919)	1.650 (0.976)
XKMYA	-0.666 (0.853)	-2.078 (0.557)	1.022 (0.919)	-0.661 (0.854)	-2.084 (0.553)	1.028 (0.920)
XKAGT	-1.780 (0.390)	-1.746 (0.729)	1.199 (0.941)	-1.790 (0.385)	-1.774 (0.716)	1.180 (0.939)
XTEKS	-1.118 (0.710)	-1.498 (0.830)	0.654 (0.857)	-1.182 (0.684)	-1.557 (0.809)	0.638 (0.854)
XGIDA	-0.887 (0.792)	-2.331 (0.416)	1.319 (0.953)	-0.765 (0.827)	-2.113 (0.537)	1.521 (0.968)
XSIN	-0.842 (0.806)	-1.511 (0.825)	1.515 (0.968)	-0.864 (0.799)	-1.557 (0.809)	1.478 (0.966)
XUTUM	-0.680 (0.849)	-1.656 (0.770)	1.467 (0.965)	-0.686 (0.848)	-1.673 (0.762)	1.455 (0.964)
XU030	-0.787 (0.822)	-1.771 (0.718)	1.266 (0.948)	-0.790 (0.821)	-1.780 (0.714)	1.266 (0.948)
XU050	-0.744 (0.833)	-1.705 (0.749)	1.334 (0.954)	-0.749 (0.832)	-1.710 (0.746)	1.331 (0.954)
XU100	-0.720 (0.839)	-1.685 (0.757)	1.363 (0.957)	-0.722 (0.839)	-1.692 (0.754)	1.355 (0.956)
XMESY	-1.298 (0.632)	-1.386 (0.864)	0.958 (0.910)	-1.408 (0.579)	-1.533 (0.818)	0.868 (0.896)
XUHIZT	-0.243 (0.930)	-2.915 (0.157)	1.623 (0.975)	-0.166 (0.940)	-2.855 (0.177)	1.731 (0.980)
XSVNM	-0.968 (0.766)	-1.555 (0.810)	1.306 (0.952)	-1.015 (0.749)	-1.599 (0.793)	1.263 (0.948)
XUTEK	-0.944 (0.774)	-1.216 (0.906)	0.501 (0.823)	-1.132 (0.705)	-1.384 (0.865)	0.454 (0.812)
XSGRT	-0.810 (0.815)	-1.604 (0.791)	1.370 (0.957)	-0.788 (0.821)	-1.576 (0.802)	1.483 (0.966)
XBANK	-0.679 (0.849)	-1.668 (0.764)	1.347 (0.955)	-0.685 (0.843)	-1.679 (-0.760)	1.341 (0.955)
XUMAL	-0.770 (0.826)	-1.614 (0.787)	1.269 (0.948)	-0.781 (0.823)	-1.635 (0.778)	1.256 (0.947)
XILTM	-1.047 (0.738)	-2.708 (0.233)	1.009 (0.918)	-0.886 (0.793)	-2.466 (0.344)	1.216 (0.943)
XTRZM	-1.101 (0.717)	-1.598 (0.793)	0.602 (0.846)	-1.126 (0.707)	-1.524 (0.821)	0.704 (0.867)
XULAS	0.341 (0.980)	-1.239 (0.901)	1.223 (0.944)	0.378 (0.982)	-1.276 (0.893)	1.200 (0.941)

( ) MacKinnon (1996) one-sided p values.

Table 1 presents the results of the unit root tests performed for the variables at their levels. From Table 1, it is clear that all the variables were non-stationary and had unit roots both in the ADF and PP tests and for 3 different models (with constant, with constant-with trend and none). If all variables are not found to be stationary as a result of unit root tests performed for the levels-I(0) of all variables, they are made stationary by taking first differences-I(1) and the results of which are presented in Table 2.

Table 2: Unit Root Test Results (First Difference)

	Augmented Dickey Fuller (ADF)-I(1)			**Philips Perron (PP)-I(1)**		
	Constant	**Constant and Trend**	**None**	**Constant**	**Constant and Trend**	**None**
EURO	-44.576*** (0.0001)	-44.572*** (0.000)	-44.561*** (0.0001)	-44.576*** (0.0001)	-44.571*** (0.000)	-44.562*** (0.0001)
XTAST	-40.997*** (0.000)	-40.988*** (0.000)	-40.933*** (0.000)	-41.421*** (0.000)	-41.412*** (0.000)	-41.397*** (0.000)
XKMYA	-43.835*** (0.0001)	-43.834*** (0.000)	-43.820*** (0.0001)	-43.826*** (0.0001)	-43.825*** (0.000)	-43.814*** (0.0001)
XKAGT	-43.029*** (0.000)	-43.026*** (0.000)	-43.007*** (0.0001)	-43.002*** (0.000)	-42.998*** (0.000)	-42.983*** (0.0001)
XTEKS	-42.769*** (0.000)	-42.787*** (0.000)	-42.771*** (0.0001)	-42.777*** (0.000)	-42.792*** (0.000)	-42.784*** (0.0001)
XGIDA	-44.745*** (0.0001)	-44.734*** (0.000)	-44.718*** (0.0001)	-45.080*** (0.0001)	-45.069*** (0.000)	-45.016*** (0.0001)
XSIN	-42.985*** (0.000)	-42.974*** (0.000)	-42.948*** (0.0001)	-42.965*** (0.000)	-42.954*** (0.000)	-42.935*** (0.0001)
XUTUM	-43.750*** (0.0001)	-43.741*** (0.000)	-43.714*** (0.0001)	-43.741*** (0.0001)	-43.732*** (0.000)	-43.705*** (0.000)
XU030	-43.967*** (0.0001)	-43.957*** (0.000)	-43.942*** (0.0001)	-43.960*** (0.0001)	-43.950*** (0.000)	-43.936*** (0.0001)
XU050	-43.836*** (0.0001)	-43.826*** (0.000)	-43.807*** (0.0001)	-43.827*** (0.0001)	-43.817*** (0.000)	-43.797*** (0.0001)
XU100	-43.769*** (0.0001)	-43.759*** (0.000)	-43.739*** (0.0001)	-43.759*** (0.0001)	-43.750*** (0.000)	-43.729*** (0.0001)
XMESY	-43.033*** (0.000)	-43.022*** (0.000)	-43.023*** (0.0001)	-43.149*** (0.000)	-43.139*** (0.000)	-43.179*** (0.0001)
XUHIZT	-45.164*** (0.0001)	-45.165*** (0.000)	-45.115*** (0.0001)	-45.241*** (0.0001)	-45.250*** (0.000)	-45.157*** (0.0001)
XSVNM	-43.452*** (0.000)	-43.445*** (0.000)	-43.425*** (0.0001)	-43.463*** (0.000)	-43.456*** (0.000)	-43.435*** (0.0001)
XUTEK	-43.279*** (0.000)	-43.306*** (0.000)	-43.284*** (0.0001)	-43.377*** (0.000)	-43.369*** (0.000)	-43.382*** (0.0001)
XSGRT	-41.806*** (0.000)	-41.795*** (0.000)	-41.770*** (0.000)	-41.828*** (0.000)	-41.818*** (0.000)	-41.791*** (0.000)
XBANK	-43.388*** (0.000)	-43.378*** (0.000)	-43.358*** (0.0001)	-43.368*** (0.000)	-43.358*** (0.000)	-43.339*** (0.0001)
XUMAL	-43.312*** (0.000)	-43.301*** (0.000)	-43.286*** (0.0001)	-43.296*** (0.000)	-43.286*** (0.000)	-43.268*** (0.0001)
XILTM	-46.203*** (0.0001)	-46.192*** (0.000)	-46.186*** (0.0001)	-46.815*** (0.0001)	-46.802*** (0.000)	-46.717*** (0.0001)
XTRZM	-41.472*** (0.000)	-41.462*** (0.000)	-41.472*** (0.000)	-41.461*** (0.000)	-41.452*** (0.000)	-41.461*** (0.000)
XULAS	-42.041***	-42.101***	-42.019***	-42.041***	-42.133***	-42.016***

(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

***** represent the statistical significance level of 1%.**
( ) MacKinnon (1996) one-sided p values.

An examination of the results of the ADF and PP unit root tests performed by taking the first difference of the series shows that although none of the variables was stationary at their levels I(0), they were made stationary by taking their first differences I(1). The results obtained from the ADF unit root tests were also confirmed by the results of the PP test in Table 2. Since all variables are integrated in the first order I(1), it was concluded that there might be a cointegration relationship between the variables. Therefore, as these twenty-three variables are integrated in the same order, we can continue with investigating the existence of a long-run relationship (cointegration).

Johansen Cointegration Test Results

Johansen cointegration test was carried out to investigate the presence of a long-term relationship in the analyses, and the results are given in Tables 3 and 4 below. The lag number to be considered in the cointegration test was computed to be 3 (three) in line with Akaike Information Criterion (AIC), and included in the model.

An examination of the results about the variables with regard to trace statistics revealed the following: The Johansen trace statistics value (16.836) between the variables of EURO and XKMYA was higher than the critical value (15.494) at a statistical significance level of 5% with a single cointegration vector (cointegration relationship); the Johansen trace statistics value (13.919) between the variables of EURO and XSIN was higher than the critical value (13.428) at a statistical significance level of 10% with a single cointegration vector (cointegration relationship), the Johansen trace statistics value (16.215) between the variables of EURO and XHIZ was higher than the critical value (15.494) at a statistical significance level of 5% with a single cointegration vector (cointegration relationship); the Johansen trace statistics value (13.547) between the variables of EURO and XILTM was higher than the critical value (13.428) at a statistical significance level of 10% with a single cointegration vector (cointegration relationship); and the Johansen trace statistics value (15.912) between the variables of EURO and XULAS was higher than the critical value (13.428) at a statistical significance level of 10% with a single cointegration vector (cointegration relationship). Therefore, the null hypothesis indicating the absence of a cointegration relationship can be rejected.

Table 3: Johansen Cointegration Test Results-Trace Statistics

	H_0	H_n	Eigenvalue	Trace Statistics	1% Critical Value	5% Critical Value	10% Critical Value
EURO-XTAST	r=0	r>0	0.004	11.549	19.937	15.494	13.428
	r≤1	r>1	0.001	2.731*	6.634	3.841	2.705
EURO-XKMYA	r=0	r>0	0.007	16.836**	19.937	15.494	13.428
	r≤1	r>1	0.001	2.231	6.634	3.841	2.705
EURO-XKAGT	r=0	r>0	0.003	10.904	19.937	15.494	13.428
	r≤1	r>1	0.002	4.824**	6.634	3.841	2.705
EURO-XTEKS	r=0	r>0	0.004	9.357	19.937	15.494	13.428
	r≤1	r>1	0.0006	1.231	6.634	3.841	2.705
EURO-XGIDA	r=0	r>0	0.004	10.878	19.937	15.494	13.428
	r≤1	r>1	0.0006	1.352	6.634	3.841	2.705
EURO-XSIN	r=0	r>0	0.005	13.919*	19.937	15.494	13.428
	r≤1	r>1	0.001	2.591	6.634	3.841	2.705
EURO-XUTUM	r=0	r>0	0.005	12.872	19.937	15.494	13.428
	r≤1	r>1	0.0009	1.852	6.634	3.841	2.705
EURO-XU030	r=0	r>0	0.005	12.574	19.937	15.494	13.428
	r≤1	r>1	0.0009	1.995	6.634	3.841	2.705
EURO-XU050	r=0	r>0	0.005	12.691	19.937	15.494	13.428
	r≤1	r>1	0.0009	1.942	6.634	3.841	2.705

EURO-XU100	r=0	r>0	0.005	12.827	19.937	15.494	13.428
	r≤1	r>1	0.0009	1.921	6.634	3.841	2.705
EURO-XMESY	r=0	r>0	0.003	12.047	19.937	15.494	13.428
	r≤1	r>1	0.002	4.587**	6.634	3.841	2.705
EURO-XHIZ	r=0	r>0	0.007	16.215**	19.937	15.494	13.428
	r≤1	r>1	0.0004	0.962	6.634	3.841	2.705
EURO-XSVNM	r=0	r>0	0.003	9.460	19.937	15.494	13.428
	r≤1	r>1	0.001	2.496	6.634	3.841	2.705
EURO-XUTEK	r=0	r>0	0.005	13.173	19.937	15.494	13.428
	r≤1	r>1	0.001	2.261	6.634	3.841	2.705
EURO-XSGRT	r=0	r>0	0.004	10.022	19.937	15.494	13.428
	r≤1	r>1	0.0008	1.718	6.634	3.841	2.705
EURO-XBANK	r=0	r>0	0.004	11.192	19.937	15.494	13.428
	r≤1	r>1	0.0007	1.485	6.634	3.841	2.705
EURO-XMAL	r=0	r>0	0.004	11.379	19.937	15.494	13.428
	r≤1	r>1	0.0009	1.833	6.634	3.841	2.705
EURO-XILTM	r=0	r>0	0.005	13.547*	19.937	15.494	13.428
	r≤1	r>1	0.001	2.436	6.634	3.841	2.705
EURO-XTRZM	r=0	r>0	0.004	11.216	19.937	15.494	13.428
	r≤1	r>1	0.001	2.814*	6.634	3.841	2.705
EURO-XULAS	r=0	r>0	0.007	15.912**	19.937	15.494	13.428
	r≤1	r>1	0.0003	0.741	6.634	3.841	2.705

***,** represent the statistical significance levels of 10% and 5% respectively.**

An examination of the results about the variables with regard to maximum eigenvalue statistics revealed the following: The Johansen maximum eigenvalue statistic value (14.605) between the variables of EURO and XKMYA was higher than the critical value (12.296) at a statistical significance level of 10% with a single cointegration vector (cointegration relationship); the Johansen maximum eigenvalue statistic value (15.253) between the variables of EURO and XHIZ was higher than the critical value (14.264) at a statistical significance level of 5% with a single cointegration vector (cointegration relationship); and the Johansen maximum eigenvalue statistic value (15.171) between the variables of EURO and XULAS was higher than the critical value (14.264) at a statistical significance level of 5% with a single cointegration vector (cointegration relationship). Therefore, the null hypothesis indicating the absence of a cointegration relationship can be rejected.

Table 4: Johansen Cointegration Test Results-Maximum Eigenvalue Statistics

	H_0	H_n	Eigenvalue	Maximum Eigenvalue Statistics	1% Critical Value	5% Critical Value	10% Critical Value
EURO-XTAST	r=0	r=1	0.004	8.818	18.520	14.264	12.296
	r≤1	r=2	0.001	2.731*	6.634	3.841	2.705
EURO-XKMYA	r=0	r=1	0.007	14.605*	18.520	14.264	12.296
	r≤1	r=2	0.001	2.231	6.634	3.841	2.705
EURO-XKAGT	r=0	r=1	0.003	6.079	18.520	14.264	12.296
	r≤1	r=2	0.002	4.824**	6.634	3.841	2.705
EURO-XTEKS	r=0	r=1	0.004	8.126	18.520	14.264	12.296
	r≤1	r=2	0.0006	1.231	6.634	3.841	2.705
EURO-XGIDA	r=0	r=1	0.004	9.525	18.520	14.264	12.296
	r≤1	r=2	0.0006	1.352	6.634	3.841	2.705
EURO-XSIN	r=0	r=1	0.005	11.327	18.520	14.264	12.296
	r≤1	r=2	0.001	2.591	6.634	3.841	2.705
EURO-	r=0	r=1	0.005	11.019	18.520	14.264	12.296

XUTUM	r≤1	r=2	0.0009	1.852	6.634	3.841	2.705
EURO-XU030	r=0	r=1	0.005	10.579	18.520	14.264	12.296
	r≤1	r=2	0.0009	1.995	6.634	3.841	2.705
EURO-XU050	r=0	r=1	0.005	10.749	18.520	14.264	12.296
	r≤1	r=2	0.0009	1.942	6.634	3.841	2.705
EURO-XU100	r=0	r=1	0.005	10.906	18.520	14.264	12.296
	r≤1	r=2	0.0009	1.921	6.634	3.841	2.705
EURO-XMESY	r=0	r=1	0.003	7.460	18.520	14.264	12.296
	r≤1	r=2	0.002	4.587**	6.634	3.841	2.705
EURO-XHIZ	r=0	r=1	0.007	15.253**	18.520	14.264	12.296
	r≤1	r=2	0.0004	0.962	6.634	3.841	2.705
EURO-XSVNM	r=0	r=1	0.003	6.964	18.520	14.264	12.296
	r≤1	r=2	0.001	2.496	6.634	3.841	2.705
EURO-XUTEK	r=0	r=1	0.005	10.912	18.520	14.264	12.296
	r≤1	r=2	0.001	2.261	6.634	3.841	2.705
EURO-XSGRT	r=0	r=1	0.004	8.304	18.520	14.264	12.296
	r≤1	r=2	0.0008	1.718	6.634	3.841	2.705
EURO-XBANK	r=0	r=1	0.004	9.706	18.520	14.264	12.296
	r≤1	r=2	0.0007	1.485	6.634	3.841	2.705
EURO-XMAL	r=0	r=1	0.004	9.545	18.520	14.264	12.296
	r≤1	r=2	0.0009	1.833	6.634	3.841	2.705
EURO-XILTM	r=0	r=1	0.005	11.111	18.520	14.264	12.296
	r≤1	r=2	0.001	2.436	6.634	3.841	2.705
EURO-XTRZM	r=0	r=1	0.004	8.402	18.520	14.264	12.296
	r≤1	r=2	0.001	2.814*	6.634	3.841	2.705
EURO-XULAS	r=0	r=1	0.007	15.171**	18.520	14.264	12.296
	r≤1	r=2	0.0003	0.741	6.634	3.841	2.705

***,** represent the statistical significance levels of 10% and 5% respectively.**

An examination of the obtained results in the light of both trace and maximum eigenvalue statistic values demonstrates that there is a long-term relationship (cointegration) between the variable pairs of EURO-XKMYA, EURO-XSIN, EURO-XHIZ, EURO-XILTM and EURO-XULAS.

Granger Causality Test Results

After identifying the presence of a long-term relationship (cointegration relationship) between the variables pairs of EURO-XKMYA, EURO-XSIN, EURO-XHIZ, EURO-XILTM and EURO-XULAS. Granger Causality Test based on the VECM model was performed to reveal whether there was any causality relationship between them, and the results are presented in Table 5 below.

Table 5: Granger Causality Test Results

Variables	Hypothesis (H_0 and H_n)	df	Chi-Square	Prob.
EURO-XKMYA	XKMYA does not Granger cause EURO.	3	298.805***	0.000
	EURO does not Granger cause XKMYA.	3	2.8458	0.416
EURO-XSIN	XSIN does not Granger cause EURO.	3	439.579***	0.000
	EURO does not Granger cause XSIN.	3	3.392	0.335
EURO-XUHIZ	XUHIZ does not Granger cause EURO.	3	323.188***	0.000
	EURO does not Granger cause XUHIZ.	3	2.650	0.448
EURO-XILTM	XILTM does not Granger cause EURO.	3	172.758***	0.000
	EURO does not Granger cause XILTM.	3	3.103	0.376
EURO-XULAS	XULAS does not Granger cause EURO.	3	239.411***	0.000
	EURO does not Granger cause XULAS.	3	3.481	0.323

***** represent the statistical significance level of 1%.**

Table 5 shows that the variables of XKMYA, XSIN, XUHIZ, XILTM and XULAS Granger-caused at a statistical significance level of 1% of EURO, and a unidirectional causality relationship was found to run from these variables to EURO. The EURO variable, on the other hand, was found to be a Granger cause for none of the other variables.

CONCLUSION

The present study analyzed the short- and long-term relationships between Euro exchange rate and 22 indices traded on the Istanbul Stock Exchange (ISE) in the period between 2002 and 2010. Thus, for analysis, cointegration test and Granger causality test based on vector error correction model were carried out. The analyses demonstrated the presence of a cointegration relationship (long-run) between Euro exchange rate (Euro/TL) and the indices of XKMYA, XSIN, XUHIZ, XILTM and XULAS (Wu, 2000; Pan et al., 2007), and no cointegration relationship was found with the other indices (Ratner, 1993; Granger et al., 2000; Nieh and Lee, 2001; Smyth and Nandha, 2003; Doong et al., 2005; Zhao, 2010). Performed on the basis of the VEC model for the indices with a long-term relationship with Euro exchange rate, the Granger causality test revealed the presence of a unidirectional causality relationship running from the indices to Euro exchange rate (Ajayi et al., 1998; Hatemi and Irandoust, 2002; Erbaykal and Okuyan, 2007; Aydemir and Demirhan, 2009), while Euro exchange rate was not a causality for any of the indices. In the light of the obtained results, it was shown that the changes in EURO were explained by the indices of XKMYA, XSIN, XUHIZ, XILTM and XULAS; in other words, the portfolio approach (Frankel, 1983; Branson and Henderson, 1985) arguing that exchange rate is affected by the changes in the stock market with regard to the indices involved (causality relationship from stock market to exchange rate) is valid. Our findings emphasize that when making short-term investment decisions and managing their portfolios, investors can make predictions about the probable changes in EURO by an analysis and examination of the indices and can manage their investments accordingly. If the stock prices in certain types of sectors such as XKMYA, XSIN or the others increase (decrease), the currency appreciation (depreciation) may occur.

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[i] *This study was presented at The First International Conference on Banking and Finance Perspectives, North Cyprus, held between 13-15th April 2011 and only the abstract was published in the conference proceedings CD.*