THE EFFECTS OF FOREIGN COUNTRIES' STOCK MARKETS ON THE BEHAVIOUR OF TURKISH STOCK MARKET IN 2008 FINANCIAL CRISIS AND PREDICTABILITY OF RETURNS

Ridvan Zileli[a,b]
Zafer Konakli [a]

a International Burch University

b Corresponding author

ABSTRACT

In today's world, the relationship between the politics of governments and financial markets gradually increases. The process of globalization plays a supporting role in the acceleration of this relationship. The best example of this is the parallel politics politically followed by developing and developed countries and the existence of a directly proportional relationship among capital markets. The importance of stock market among capital markets is an indisputable truth. Therefore, interpretation of stock exchange values' relationship between developed and developing countries, and analysis of the tendencies of long-term stock market index profits and their relationships with each other especially in crisis periods have a great importance for economists and investors. This work's aim is to examine the effects of developed and developing countries' stock markets on Istanbul Stock Exchange. These effects are analysed in three periods using monthly index data. Stock markets belonging to developed countries such as DJI, GDAXI, N225 and stock markets belonging to developing countries such as HSI, BIST100, RTSI, BSESN, BVSP are included in this analysis. Effects of other stock markets on BIST100 are approached in three periods: pre-crisis period (2002-2007), crisis period (2007-2011) and post crisis period (2011-2015). Data are obtained using finance.yahoo.com website. VAR method is used in this work. Result of the work reveals that the interaction of BIST with BRIC countries, which are accepted as the stock markets of developing countries, was more in the pre-crisis and crisis periods while it showed an increase in post crisis period. It is deduced that BIST 100 has been a profitable but risky market in both pre and post crisis periods, and has been gradually reducing its predictability.

Keywords: BIST100, Stock Market Integration, VAR Method, Develop Stock Market.

INTRODUCTION

Important developments have been experienced in financial markets, accordingly in stock markets along with the fact of globalization in the last twenty years. Necessity of analysing financial markets not only with the factors in their own countries, but also with the factors of countries interacted with has emerged. Integration between financial markets increases the capital flow and equalizes the return on capital in every country and eliminates the possibility of arbitrage. If securities exchanges are connected in a long-term basis, two investing made in equally risky stock exchanges will return the same profit wherever the invested country is in the world. Therefore, a disintegration between capital markets in theory, in other words an existence of separation reflects a better situation. Financial integration caused structural changes in economies as well. As the integration increased, risks became varied, bigger and easily expanding and countries became more vulnerable to developments abroad. An

uncertainty or increasing risks in a market quickly reflected on other markets and price movements. (Vural, 2010)

Since the beginning of 90s, a great increase has been observed in financial markets. Easier and cheaper access to information with the help of technology provided more productive use of information. In this period, plenty of financial products were developed depending on the risk and return expectancies. In the process beginning from the end of 90s, removal of controls over capital movements, financial deregulation policies, developments in technology sector enabled finance markets to rapidly integrate all around the world. On the other hand, stock markets became the fastest integrating forms in finance market. As a result of this, country stock markets have been the most-affected forms from wide-scaled crises and capital in and outflows during crises. Fast money transfers by the advancements in technology, eliminating the barriers in front of capital flows and accordingly increase in the interaction among investors are the factors that caused stock markets heavily affected by crises.

Financial independence environment caused capital to move easily in international field and also increased the relationships between stock markets. Interaction increase between stock markets puts a spoke in invertors' wheels who want to spread the risk.

Global crises affected countries' stock markets as well as their economies. This effect shows alterations from country to country. BIST is one of the stock markets affected by global crises. With their pre and post effects, global crises' effect on the changes of relationships between BIST and other stock markets is a question that should be examined. Within this framework, this work's aim is to analyse dynamic relationships and mutual connections between BIST100 and other selected countries' stock markets before, during and after 2008 crisis. In this work, VAR analysing method is used. In order to make a comparison among pre, during and post crises periods, analyses are split into three periods as 2003-2007, 2007-2011 and 2011-2015. Country stock markets' market indices returns are used as data. Predictability of returns of BIST100 has also been investigated in 13 years period between 2003-2015.

BIST (Istanbul Stock Exchange)

Regulation of Istanbul Stock Exchange (BIST100) was enacted on October 6, 1983 in accordance with the KHK no 91. Internal regulations of stock exchange which would be made as per article 11 in the executive order of this law was made applicable with the approval of capital market. Operating principles of Istanbul Stock Exchange was determined (Civan, 2007).

BIST100 is a public establishment with legal entity which was founded to carry out the duties stipulated in the KHK no 91, exercises its power independently under its own responsibility and is under the observation and supervision of Capital Market Board (BIST100 regulations, article 6).

The aim of Istanbul Stock Exchange is to provide the capital market to take an active role in economic development by operating the Stock Exchange in a clear, orderly and honest way and by organizing supervisions on its establishing, managing and operating principles and in this way providing a trustworthy and stable trading environment (Civan, 2007).When BIST100 was established in 1986, its daily trading volume was 3 billion liras on average, it

reached up to 3 trillion liras by 1995 and by 2008 it reached beyond 1 billion dollars (Başoğlu, Ceylan and Parasız, 2009).

Economy of Turkey

In 2015, in spite of the limited turnarounds observed in developed countries, attenuation bias in global economic activity continued along with the deceleration in developing countries. In this period, finance markets followed a fluctuating course as a result of uncertainties and growth concerns on global money policies as a basis. Financial asset prices of developing countries significantly affected by these fluctuations. During the year, decays in developing countries' risk premium indices were experienced, portfolio flows to these countries showed a weak aspect and local currencies decreased in value. Reflections of these global trends, domestic developments and geopolitical risks were seriously felt over the economy of Turkey. In this process, Central Bank of the Republic of Turkey implemented some policies in order to limit the negative effects of domestic and international uncertainties on Turkish economy and make corrections on the outlook of inflation by effectually using one-week repo interest rate, interest rate corridor, Turkish lira and foreign currencies liquidity policies and reserve requirements.

Increases in the risk premium indices of Turkey and in long-term interest rates, and decreases in the value of Turkish Lira were experienced as a result of the fluctuations in global markets that took the developing countries under its control. Especially, annual inflation of basis product class significantly increased in 2015 mostly because of the decrease in the value of Turkish Lira. While the increase rate of the load given to private sector decreased to reasonable rates, economic activity continued its domestic-demand-driven moderate growth. Central Bank of the Republic of Turkey maintained a tight monetary policy stand throughout 2015 considering the effects of these developments on inflation expectancies, pricing attitudes and other issues affecting the inflation.

LITERATURE REVIEW

Relationships between stock markets started to be considered more than before as the tendencies of globalization and territorialisation increased in the world. Determination of the direction and the amount of these relations is important for both individual and institutional investors. Different studies on this purpose are observed when we browse through the world literature. It is remarkable that these studies became more intense during and after the American financial crisis in order to reveal the effects of the crisis on stock markets.

Relationships Between Stock Markets

Cheng and Glascock (2006) investigated the connections between American stock exchange and stock exchanges of China, Hong Kong and Taiwan before and after the Asian financial crisis by using daily data between the years 1995 and 2000. They came to conclusion that after the Asian financial crisis, proceeds in these stock markets got affected by the same factors and these stock markets became more fragile to external shocks. Berument and İnce (2005) investigated the short-term relation between S&P500 and BIST100 through VAR analysing technique and came to conclusion that the effect of S&P500 index on BIST100100 index occurred in the first four days and the effect was positive. Rivas et. al (2005) split 1988-2004 period into various sub periods and investigated the reactions of Latin American

stock exchanges to the movements in European stock exchanges by using action-reaction analyses.

Erbaykal et. al (2008) investigated relations between the stock markets of Turkey, Brazil and Argentina by using monthly data from 1997 to 2007. They came to conclusion that stock exchange of Brazil had heavy effects on other two. It was also indicated that these three stock markets might have not provided the expected efficiency for international investors. Ahmed (2010) investigated long-term relations and short-term dynamic causal connections between Egypt and G-7 countries based on weekly closing values of indices between 1998 and 2007 and by splitting periods in two as before and after terror attack in the USA. They came to conclusion that the changes in Egyptian stock exchange were caused by its own internal dynamics before and after the attack. Cağıl and Okur (2010) investigated the effects of global crisis on BIST100 by using symmetric GARCH model and revealed that in case of volatility shock in a crisis period, it would take much more time for markets to get back to normal than static period.

Lect. Şahin BULUT and Assist. Prof. Dr. Abdullah ÖZDEMİR (2010) investigated the relations between BIST and Dow Jones Industrial based on weekly index closing values between 05.01.2001 and 30.12.2010. They carried out causality relationship between series by using granger tests, short-long period and cointegration analyses, and Johansen and VEC methods. Research findings showed that DJI was the Granger casualty of BIST100 for three deferments. According to cointegration analysis results, series were moving together in the long term which means they were cointegrated. It was seen in the short-term that error correction term was working and DJI heavily affected BIST100 for three terms long. Bengü Vuran (2010) tested the long-term relationship between Istanbul Stock Exchange 100 index and some stock indices of other developing countries (FTSE 100, Dax, CAC 40, S&P500, Nikkei 225, Bovespa, Merval, Mexico IPC) by using Johansen cointegration test on daily data between January 2006 and January 2009. They came to conclusion that Istanbul Stock Exchange 100 index had a long-term relationship with FTSE 100, Dax, Bovespa, Merval and IPC between the periods of time mentioned above.

Umut EVLİMOĞLU and FUNDA ÇONDUR (2012) investigated short-term relations of BIST100 with Russian, Japanese, German and American, Brazilian, Chinese and Indian stock markets in accordance with before and after the mortgage crisis. It was revealed that the connection between BIST100 and other selected stock markets increased after the mortgage crisis.

When literature is examined, it is seen that it is important to locate short and long-term relations between stock markets. Number of workshops related to Turkey is more limited. It is observed that cointegration analyses which were carried out to designate which stock markets BIST100 was in a long-term relationships with and studies which were conducted to determine BIST100'S relations with EU stock markets densely existed. Therefore in this work, it is put emphasis on short-term relations of stock exchanges rather than long-term relations. In addition, interaction between Turkish stock market and other countries' stock market indices are tried to be revealed under three periods as before, during and after mortgage crisis. Economic crisis which started in the USA had an effect on the economic structure of the whole world. Analysing before and after of this crisis separately will make it easier to reveal Turkish stock market's changes in its interaction with other stock markets. Additionally, this method will shed light on future studies by comparing pre-crisis and post-crisis.

Share Return Predictability of Index

The proof for evidence has many aspects such as predictable share returns and it also depends on the types of variables used in order to predict returns in certain time periods. In the U.S, early tests found that the dividend to-price and earning-to-price proportions could estimate future returns (Fama and French, 1989; Hodrick, 1992). But Lamont (1998) indicated that dividend-to-price ratio has more influence on prediction when compared with earnings-to-price. Also, Ang and Bekaert (2007) and Lettau and Ludvigson (2010) confirmed the capacity of the dividend-to-price proportion to foresee abundance returns over short and long periods upon the condition of adding a short-term interest rate.

Consumption aggregate wealth ratio (CAY) was proposed by Lettau and Ludvigson (2001) in order to foresee the return of shares, as this ratio measures the temporal diversion from the long lasting relation between consumption, asset wealth and labour income. According to Lettau and Ludvigson (2001), CAY could clarify roughly 9% of the variety in one-period ahead future returns. The incorporation of customary gauging variables brought about just a negligible increment in the balanced R-squared (R^12) of the estimating relapse to 10%, with the relative Treasury charge yield significant; however it was seen that earnings-to-price ratio, dividend-to-price ratio and the term spread were not considered as important as others. The relationship between CAY and presumed future income was positive; and it was clearly stated that in case of an expectation about the decrease of incomes in the future, investors would let consumption to be reduced smoothly and move the consumption level below its relation with asset wealth and labour income, all of which would be done in order to preserve the consumption from lower incomes in the future. Contrary of that was also possible in case of any increase expectations of incomes (Lettau and Ludvigson, 2001).

The anticipating force of CAY over longer time periods was indicated by Lettau and Ludvigson (2010). On the other hand, Hodrick and Zhang (2001) have indicated that the anticipating power of CAY was beyond the average macroeconomic indicators such as GNP and production capacity of industry. This power of CAY was also demonstrated by examples from other countries. Some studies related with such examples can be stated as the work of Ioannidis et.al. (2006) which is related with Australia, Canada and the UK; then Gao and Huang (2008) and Sousa (2012) have confirmed the UK case, whereas the study of Gao and Huang (2008) has also indicated that CAY was not as successful as in other countries in order to foresee the incomes in Japan.

DATA AND METHODOLOGY

The analysis conducted in order to reveal the dynamic relations between stock exchanges in pre-crisis, crisis and post-crisis periods paid attention for market variety and world recognition when selecting stock exchanges with the exception of BIST100. Stock exchanges of developed and developing countries except for Turkey stock market are markets with high values in the world. The fact that the selected stock exchanges are from different continents shows the global aspect of stock market relations.

In this work, Stock Market Returns between the years 2003 and 2015 was analysed and monthly data was taken into consideration.

In this work, the effects of the mortgage crisis of 2008 on the relations of stock exchanges were primarily examined. The performance of BIST100 was compared to national stock exchanges under two branches as stock exchanges developed and developing countries.

Crisis periods were split in three different periods in order to make proper comparisons. Periods were examined in about four years processes. The first period ranges from 2002-12-02 to 2007-08-01. The second period ranges from 03.09.2007 to 01.07.2011. The third period ranges from 2011.08.01 to 5.10.2015. Monthly data were used for every three periods. As moving from yearly series to daily series, in other words, as the time interval narrows down, reliability of the analysis increases. However, since the number of variables was so high, monthly data was preferred in order to block confusion. Time series used in the study consists of monthly closing values of national stock exchange indices. All series were sourced from (http:// http://finance.yahoo.com) website.

Below are the national stock markets, their indices and abbreviations:

Turkey BIST100 Index (XU100.IS)

Stock Markets of Developed Countries:	USA Dow Jones Index (DJI), Germany Index (GDAXI), Japan Index (N225)
Stock Markets of Developing Countries:	Brazilian Bovespa Index(BVSP), Russia RTSI Index (RTSI), China HSI-Hang Seng Index (HSI) India Bombay SENSEX Index (BSESN)

In the study, data that will be used in VAR analysis was analyzed on steadiness and unit root, and it was revealed the series are stable. VAR analysis was performed on these stable series. In VAR analysis, suitable Lag Length was selected by performing the relevant tests for suitable Lag Length determination.

After that, Granger Causality Test, Variance Decomposition and Descriptive Statistics were applied to the VAR model and these reviews were made based on these analyses when comparing stock exchanges. Trials for determining the effects of volatilities and shocks on the next terms were performed by determining ARCH and GARCH values of Istanbul Stock Exchange.

Finally, trials for determining the change predictability of index returns made by the effects of 2008 crisis in the selected periods were performed again by using the values of Istanbul Stock Exchange.

Vector Autoregression

There is another econometric pattern utilized to understand the interdependencies among different time arrangements and it is named as vector auto regression (VAR). VAR models sum up the univariate autoregressive model (AR model) by taking into consideration more than one advancing variable. There is a symmetrical dealing for all the variables in VAR but the assumed quantitative factors may not be same always. Variables have their own

statements mentioning the development depending on the lags of itself and other model variables.

Dickey–Fuller Test

This test was developed by Dickey & Fuller (1979) to test the presence of a unit root in an AR model. As the presence of unit root is a null hypothesis, there is also an alternative hypothesis that is based on the type of test used, which is usually stationary or trend-stationary.

Descriptive Statistics

It is the discipline of quantitatively portraying the principle components of a gathering of data (Mann, 1995), and sometimes the quantitative definition. They are different from inferential statistics (inductive statistics) as descriptive statistics does not use any data to learn about the population such data is representing, but it aims to outline any given sample. So, it is not based on the theory of probability (Dodge, 2003). In cases where data analysis uses inferential statistics to reach conclusions, we still see descriptive statistics. For instance, there is a general characteristic in any paper report in which human subjects are involved of having a table with general sample size, sample sizes of significant subgroups and other specific features (demographic/clinical) such as gender rates, average age and the rate of subjects with relevant comorbidity.

Autoregressive Conditional Heteroscedasticity

Autoregressive conditional heteroscedasticity (ARCH) models are utilized in econometrics in order to represent and model the time series. They are utilized anytime as a part of an arrangement where the mistake terms are thought to have a trademark size or change. ARHC models presumes that the variance of existing error term or innovation is a function of actual size of former period error terms. The change is frequently identified with the past alterations' squares.

Variance Decomposition of Forecast Errors

In order to provide support for the interpretation of VAR model, forecast error variance decomposition (FEVD) is used in econometrics and other multivariate time series analysis applications (Lütkepohl, 2007). Variance decomposition shows the information contributed by each variable to other variables in autoregression process. It sets the amount of the forecast error variance of each of the variables can be disclosed by exogenous shocks to alternate variables. (Wikipedia, 2016)

Granger Causality Test

This test was proposed in 1969 (Granger, 1969) as a statistical hypothesis test to determine whether one time series is useful in predicting other. Clive Granger claimed that causality in economics can be tested by using the previous values of other time series in order to forecast the future values. As the concept of "true causality" is a profound one and as the assumption of one item preceding another can be utilized for causation; according to econometricians, Granger test only finds "predictive causality" (Diebold, 2001).

Least Squares Method

Least squares method is used in regression analysis in order to find an estimate solution to over determined systems such as sets of equations that contain more equations than unknown ones. In “least square”, general solution minimizes the risk of making square errors for equations.

Data fitting is the most important application. Least squares best minimize the difference between an observed and a fitted value of a model, namely the squared residual. If the problem has problems of uncertainties in independent variable (x variable), so does simple regression and least squares methods. In such cases, fitting errors-in-variables models methodology should be used instead.

EMPIRICAL FINDINGS
Results of VAR Analysis

There are two reasons for choosing VAR model for examining short-term dynamic relations between BIST100 and other stock exchanges. These reasons are:

- ·0 Determining how other variables will react to a shock given to an internal variable's error term by impulse response function,
- ·1 Researching the variance decomposition way and the source of change in the internal variable variance (standard deviation)

Determination of Suitable Lag Length for VAR Analysis

Determination of suitable Lag Length for VAR analysis is very important. Below are some tests used for the determination of lag length:

LR Test Statistic (LR), Final Prediction Error (FPE), The Akaike information criterion (AIC), Schwarz Information Criterion (SC) and Hannan-Quinn Informatin Criterion (HQ) In the work, Final Prediction Error (FPE), Akaike (AIC) and Hannan Quinn (HQ) were used for the determination of optimal lag length.

A VAR model from the return levels of stock exchange indices was created for the determination of suitable Lag Length that will be used in VAR analysis, and on this model, the most suitable Lag Length was determined.

Lag Length Test

It was observed that AIC, HQ and FPE values assigned minimum value for 1 lag, SC assigned minimum value for 0 lag and LR criterion submitted 4 lags. Suitable Lag Length that will be used in VAR analyses was selected as 1 for both pre and post crisis periods as a result of the tests conducted with the aim of determining Lag Length suited for the series belonging to pre and post crisis periods.

Unitroot Test Results

Whether the variables that will be used in VAR analysis were stable or not was investigated by Augmented Dickey-Fuller (ADF) unit root tests. Tests results for ADF were shown on

Table 4-1. Variables that will be used in pre-crisis analysis were taken under review in accordance with ADF test with stable and stable+trend statistics. Since series happened to be lower than 5% and 1% MacKinnon critical values, Ho hypothesis was understood to be rejected and it was understood that the series were stable.

ADF Test Results of Variables Belonging to Pre-crisis, Crisis, Post-crisis Periods in Accordance with Level Values and First Differences

Each series on the level of I(0) is stable in pre-crisis period. Therefore, there is no need to examine values on the level of I(1) which is obtained by performing stability test after taking first differences. In crisis period It is observed that all the series which are not stable on I(0) level turn into stable status on I(1) level when they are put into stability test after taking first differences. Each series on the level of I(0) is stable in post-crisis period. Therefore, there is no need to examine values on the level of I(1) which is obtained by performing stability test after taking first differences.

Prediction of Stock Returns in Pre-crisis, Crisis and Post-Crisis Periods with the Assistance of VAR Model

In the study, VAR(1) model with the first degree lag belonging to an eight-variate VAR model which involves series of different nations' stock exchanges for last thirteen years governments were predicted in order to reveal short-term dynamic relations between BIST100 and other stock exchanges of developed and developing countries after selecting suitable lag length.

However, coefficients of VAR model are hard to interpret. Researchers prefer interpreting the results obtained by performing action and reaction analyses and variance decomposition rather than interpreting the coefficients of the VAR model. Therefore, results obtained by VAR(1) model have been interpreted by performing action and reaction analyses and variance decomposition.

Effects of Japanese and Russian stock exchanges on Istanbul Stock Exchanges in the second lag of pre-crisis period are significant. While the effect of Japanese stock exchange was positive, the effect of Russian stock exchange was negative. In the third lag, effects of Brazilian and Russian stock markets on Istanbul stock exchange are significant. While the effect of Brazilian stock exchange was positive, the effect of Russian stock exchange was negative. In pre-crisis period, no effect of Istanbul Stock Exchange on other stock exchanges was observed.

Effects of American stock exchange on Istanbul Stock Exchanges in the second lag of crisis period are significant and negative. In this period, effects of Istanbul stock exchange on Indian stock exchange are significant and positive in the first lag.

At the end of the crisis period, effects of Japanese stock exchange in the second lag and American stock exchange in the third lag on Istanbul stock exchange are significant. While the effect of Japanese stock market was negative, the effect of American stock market was positive. No significant effect of Istanbul stock exchange on other stock exchanges was observed in this period.

Descriptive Statistics Results

Descriptive statistics belonging to the returns of stock indices are shown on Table 4.3.1 for pre-crisis period, Table 4.3.2 for crisis period and on Table 4.3.3 for post-crisis period.

According to results, the highest rate of return related to pre-crisis period belongs to Russian stock market and the lowest rate of return for the same period belongs to British stock market. Istanbul stock exchange, on the other hand, has the highest rate of return after Russia. When standard drift rate is observed, it is seen that volatility in developing markets is higher than developed markets. This situation is caused by the sensitivity that developing markets have to external shocks more than developed markets. Therefore, risk and return rates of developing markets are higher than developed markets. Investors who invest on these countries should take this into consideration. Among national stock markets, Istanbul stock exchange is the one with the highest volatility (0.087) while the one with the lowest volatility is Dow Jones Index in American stock market. (0.025). Since values apart from the test values in German stock market, monthly return normality of which was tested by Jarque-Bera Test, are lower than the critical value(12.567), it has a statistically normal distribution with the level of 1%. Since probability values except for German stock market are higher than 0.05, we can again came to conclusion that other stock market values also have the normal distributions.

Fratzscher (2002) stated in his work that negative skewness values are indicators of negative shocks and high kurtosis rates are indicators of full-scaled shocks. According to this, it is observed that in pre-crisis period developing BRIC countries had negative shocks and developed countries including BIST has positive shocks. High kurtosis rates show that returns had a leptokurtic distributions (Mutan,2008: 10). While half of the countries analyzed performed leptokurtic distributions, other half performed kurtosis distribution. Istanbul stock exchange has a leptokurtic distribution since its kurtosis rate is higher than 3.

The highest return in a month based on index in pre-crisis period belongs to Istanbul stock exchange with 0.27%. The highest decline belongs again to Istanbul stock exchange with 0.18%. In crisis period, while Brazil, India, Turkey and Russia had positive return averages, Germany, The United States, Japan, England and China had negative return averages. When standard drift rate is examined, volatility in developing markets is observed to be more than developed markets in crisis period just as pre-crisis period. However, in crisis period, a great increase occurred in volatility levels of developed countries. When these rates were compared to pre-crisis period, this increase doubled in the United States and Japan. An increase in BIST was observed parallel to these developments. However, this increase remained around 17% - 18%.

During the crisis, an increase in the number of negative skewness values and a further rise in kurtosis rates were observed. Skewness value remained positive only in India while other nations' stock markets had negative skewness values. This is an indication that many national stock markets including Istanbul stock market experienced negative shocks. When kurtosis rates are examined, it is observed that every stock market except for Istanbul and American stock markets had leptokurtic distributions.

Granger Causality Test Results

When we observed the pre-crisis period, American and Russian stock markets are the cause

for BIST100 since probability values in Table 4.4.1 are lower than 0.05. It is observed that the crisis period, Brazilian stock market is the cause for BIST100 since probability values in Table 4.4.2 are lower than 0.05. When we observed the post-crisis period, none of the stock markets are the cause for BIST100 since probability values in Table 4.4.3 are higher than 0.05.

Variance Decomposition of BIST

As a result of the variance research performed for BIST100, changes in BIST100 in pre-crisis period are explained by the changes in the following stock markets: Indian stock market (3.16%), Brazilian stock market (11.4%), American stock market (4.3%), German stock market (11.2%), Chinese stock market (4.59%), Japanese stock market (5.63%) and Russian stock market (18.1%).

According to these results, we can say that the highest influence on BIST100 was received from Russian stock market while the lowest influence on BIST100 was received from Indian stock market in pre-crisis period.

Changes in BIST100 in crisis period are explained by the changes in the following stock markets: Indian stock market (2.2%), Brazilian stock market (28%), American stock market (11%), German stock market (16.9%), Chinese stock market (5.2%), Japanese stock market (12.4%) and Russian stock market (4.1%).

According to these results, we can say that the highest influence on BIST100 was received from Brazilian stock market while the lowest influence on BIST100 was received from Russian stock market in crisis period.

Changes in BIST100 in post-crisis period are explained by the changes in the following stock markets: Indian stock market (5.42%), Brazilian stock market (5.7%), American stock market (9.29%), German stock market (17.8%), Chinese stock market (2.76%), Japanese stock market (1.2%) and Russian stock market (5.3%).

According to these results, we can say that the highest influence on BIST100 was received from German stock market while the lowest influence on BIST100 was received from Japanese stock market in post-crisis period.

In Turkish stock market, while 41.39% of prediction error variance in pre-crisis period was caused by the movements in its own returns, this rate declined to 19.7% during the crisis. This situation shows that the influence of external markets on BIST100 increased. After the crisis, this rate increased to 52.4%. Another situation connected to this result is the increasing of the total effect of other stock markets in the analysis on Turkish stock market from 58.6% to 80.3% in the period after the beginning of the crisis. After the crisis, this rate dropped to 47.6%. This situation indicates that Turkish stock market became more dependent to the developments in external markets and to external stock exchanges. It was observed that this dependence decreased after the crisis.

Predictability of Returns

When coefficient values from the data obtained by Least Squares method were examined, it was observed that the predictability of index returns in pre-crisis period was 0.85, in crisis

period it notably dropped to 0.28. We can say that the reason for the value of predictability's dropping to 0.08 in the post-crisis period was the on-going effect of the crisis. These results also indicate that markets gained more fragility and turned into a more sensitive structure.

Volatility of Returns

Financial market volatility has a significant role in investment decisions especially in recent years. Volatility, in the simplest term, means sudden movements occurring in prices.

Volatility in capital markets means volatility in prices occurring in any security or index in a specific time period. Unexpected incidents continuously affect the prices of equity shares. Investors try to predict the change on equity shares price volatility. Increase of volatility in the prices of equity shares makes equity share investments and equity share market risky. High volatility in the price of an equity share shows that the price of the same equity share can raise or decline in a big scale. Here, risk means that investors under high profit expectancy might take a bath.

Previous volatility does not have any effect on the index returns in all periods since p-value in higher than 0.05 in the row that shows ARCH (RESID(-1^2) values. Previous shocks a have significant effect on index returns since p-value is lower than 0.05 in the row that shows GARCH values in both pre-crisis and post-crisis. Previous shocks does not have an effect on index returns since p-value is higher than 0.05 in the row that shows GARCH values in crisis period.

CONCLUSION

When the results of descriptive statistics were examined, it was observed that BIST was the stock market with one of the highest return rates in pre and crisis periods, however it dropped behind to the stock markets of developing countries in the post-crisis period. The fact the there was no negativity on return averages in these periods is an important indicator which would attract investors. Additionally, BIST100's having the highest volatility value along with Russian stock market in the same periods reveals that BIST100 is a risky but profitable stock market. In addition to these, BIST100 is a stock market that experienced positive shocks except for crisis periods. According to the results of causality test, American and Russian stock markets were the cause of BIST100 in pre-crisis period, while Brazil became the cause of BIST100 in crisis period. In post-crisis period, none of the stock markets were the cause of BIST100.

According to the GARCH (1,1) model which was conducted to determine whether previous volatility and shocks affected the following values or not, previous volatility did not have any effect on the next returns of index in any period. In pre and post-crisis periods, while the previous shocks had significant impact on the returns of index, after the crisis it did not have any impact. This result is parallel to the predictability measurement. In crisis period, BIST100 was affected by external shocks more than internal shocks. Because according to the predictability test, dependence of BIST100 on the stock markets of foreign countries increased in this period.

According to the results obtained by Variance Decomposition Test, it can be said that impact was received from Russian stock market in pre-crisis period, Brazil in crisis period, Germany and the USA in post-crisis periods. This is the result of increased influence of developed

stock markets on BIST100. While 41.39% of the prediction error variance in BIST100 in pre-crisis period was caused by its own return movements, this rate dropped to 19.7% in crisis period. This situation shows that the impact of external markets on BIST100 increased in crisis period. It raised up to 52.4% after the crisis. Another situation connected to this result is the increasing of the total effect of other stock markets in the analysis on Turkish stock market from 58.6% to 80.3% in the period after the beginning of the crisis. These two situations indicate that Turkish stock market became more dependent to the developments in external markets after the beginning of the crisis. However, this rate's dropping to 47.6% between the years 2011 and 2015 when the impact of the crisis started to decline indicates that this dependence declined as well.

REFERENCES

Akman, C. (2010), *2008 Küresel Ekonomik Krizine Tarihsel ve Teorik Açıdan Bir Yaklaşım*, İstanbul Üniversitesi Sosyal Bilimler Enstitüsü, İstanbul, p.185

Aktan, C.C.; Şen,H.(2002). *Ekonomik Kriz: Nedenler ve Çözümler,*Yeni Türkiye Dergisi, p. 6

Aldrich, J. (1998). Doing Least Squares: Perspectives from Gauss and Yule. International Statistical Review 66 (1): 61–81.

Al-fayoumi, N.; Basheer, K. & Ali, A. (2009), *Information Transmission among Stock Return Indexes:Evidence from the Jordanian Stock Marke*t, International Research Journal of Finance and Economics, p. 194-208

Babbie, E. R. (2009), The Practice of Social Research (12th ed.). Wadsworth. pp. 436–440.

Baily, M. N. & Douglas J. E. (2009), *The US Financial and Economic Crisis: Where Does It Standand Where Do We Go From Here?"*, http://www.brookings.edu/research/papers/2009/06/15-econo mic -crisis-baily-elliott, 17.04.2012

Bali, S. & Ahmet, B. (2011), *Finansal Krizler Tarihi*, Çatı Kitapları, İstanbul, pp.16-17,199

Başoğlu, U. , Ceylan, A. , & Parasiz, İ. (2009). *Finans (Teori, Kurum, Uygulama)* Bursa: Ekin Yayınları

Beine, M., Gunther, B., & Helena R. (2008), *Nonlinear Causality between Stock Markets*, The European Journal of Finance International, pp. 299-312

Bretscher, O. (1995). Linear Algebra With Applications (3rd ed.). Upper Saddle River, NJ: Prentice Hall.

Brooks, C. (2014). *Introductory Econometrics for Finance* (3rd ed.). Cambridge: Cambridge University Press. p. 461.

Ceylan, A. & Korkmaz, T. (2008). İşletmelerde Finansal Yönetim. Bursa: Ekin Basım Yayın Dağıtım, p.446.

Charnes, A.; Frome, E. L.; & Yu, P. L. (1976). The Equivalence of Generalized Least Squares and Maximum Likelihood Estimates in the Exponential Family.Journal of the American Statistical Association 71 (353): 169–171

Civan, M. (2007). *Sermaye Piyasası Analizleri ve Portföy Yönetimi,* Ankara: Gazi Kitapevi p. 189

Coşkun, M. (2008) .*Sermaye Piyasaları*, Eskişehir: Genç Copy Center, s.427

Darrat, Ali F. & Omar M., B.; (2003), *Interdependence and Volatility Spillovers Under Market Liberalization: The Case of Istanbul Stock Exchange*, Journal of Business Finance & Accounting, pp. 1089-1114.

Delice, G. (2003), *Finansal Krizler: Teorik Ve Tarihsel Bir Perspektif* , Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, Sayı 20, Kayseri, p.57-81

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the Estimators for Autoregressive Time Series with a Unit Root. Journal of the American Statistical Association *, 74(366), 427–431.*

Diebold, Francis X. (2001). Elements of Forecasting (2nd ed.). Cincinnati: South Western. p. 254.

Dodge, Y. (2003). The Oxford Dictionary of Statistical Terms. OUP.

Duhigg, C. (2008), "Depression, You Say? Check Those Safety Nets", http://www.nytimes.com/2008/03/23/weekinreview/23duhigg. html, 10.04.2012.

Eğilmez, M. (2012*), Küresel Kriz Önlemleri ve Türkiye,* http://www.cnbce.com/business/yazarlar/mahfiegilmez/konuid=27.asp 04.03. 2012.

Eichler, M. (2012). Causal Inference in Time Series Analysis. In Berzuini, Carlo. Causality : statistical perspectives and applications *(PDF) (3. ed.). Hoboken, N.J.: Wiley. pp. 327–352.*

Enders, W. (2004). Applied Econometric Time Series (Second ed.). Hoboken: John Wiley & Sons.

Engle, Robert F. (1982). *Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation*. Econometrica 50 (4): 987–1007.

Erdönmez, P., & Tülay, B.(1999). *Küresel Krizlere Yeni Yaklaşımlar*, Türkiye Bankacılar Birliği Bankacılar Dergisi, Sayı:31, s.100

Granger, C. W. J. (1969). Investigating Causal Relations by Econometric Models and Cross-spectral Methods. Econometrica 37 (3): 424–438.

Granger, Clive W. J (2004). Time Series Analysis, Cointegration, and Applications *(PDF). American Economic Review 94 (3): 421–425.*

Hacker, R. S.; Hatemi-J, A. (2008). Optimal lag-length choice in stable and unstable VAR models under situations of homoscedasticity and ARCH*.* Journal of Applied Statistics *35 (6): 601–615.*

Hatemi-J, A. (2004). Multivariate tests for autocorrelation in the stable and unstable VAR models*. Economic Modelling 21 (4): 661–683.*

Hatemi-J, A.; Hacker, R. S. (2009). Can the LR test be helpful in choosing the optimal lag order in the VAR model when information criteria suggest different lag orders? .Applied Economics *41 (9): 1489–1500.*

http://BIST100.gov.tr/genel/tarih.htm

Kasa, K.; (1992), *Common stochastic trends in international stock markets,* Journal of Monetary Economics, pp. 95-124.

Kayali, M.(2004).*Yeni Ekonomi ve Finansal Piyasalar üzerindeki Etkileri.* 3. Ulusal Bilgi Ekonomi ve Yönetim Kongresi Bildiriler Kitabı, Eskişehir, s.618

Kernisky, D. A. (1997). *Proactive crisis management and ethical discourse: Dow chemical issues management bulletins 1979-1990,* Journal of Business Ethics, 16 (8), p.843-853.

Kibritçioğlu, A.(2001). *Türkiye'de Ekonomik Krizler ve Hükümetler,1969– 2001.*Yeni Türkiye Dergisi, Ekonomik Krizler Özel Sayısı.

Kibritçioğlu,B.(2000). *Parasal Krizler*. Hazine Müsteşarlığı Yayınlanmamış Uzmanlık Tezi. Ankara.

Kondak, N.(1999). *Menkul Kıymet Pazarlarına Giriş*. İstanbul: Der Yayınları, s.45

Krugman, P. (2009), *Revenge of the Glut,* http://www.nytimes.com/2009/03/02/opinion/02krugman.html 18.04.2012

Küçükkocaoğlu, G. (2005). *Elektronik Emir İletim Yöntemi'nin İstanbul Menkul 133 Kıymetler Borsası'nın Mikro Yapısı Üzerine Etkisi.* www.baskent.edu.tr/~gurayk/kisiselelektronikemir1.pdf : 10.08.09, s.4-5

Legendre, A. & Legendre, M. (1805), Nouvelles méthodes pour la détermination des orbites des comètes [New Methods for the Determination of the Orbits of Comets] (in French), Paris: F. Didot

Lipsky, J. (2008), *The Global Econonomy and Financial Crisis*, http:// www.imf.org/external/np/speeches/2008/092408.htm. 13.04.2012

Mann, Prem S. (1995). Introductory Statistics (2nd ed.). Wiley.

Mavrakis, E. & Christos, A.; (2008), *Stock Markets' Linkages: An Empirical Investigation for Long-Term International Diversification Benefits*, International Research Journal of Finance and Economics, pp. 163-178.

Nick, Todd G. (2007). Descriptive Statistics. Topics in Biostatistics. Methods in Molecular Biology *404. New York: Springer. pp. 33–52.*

Seth, Anil (2007). Granger causality. Scholarpedia.doi:10.4249/scholarpedia.1667

Stigler, Stephen M. (1981). Gauss and the Invention of Least Squares. Ann. Stat. 9 (3): 465–474.

Trochim, William M. K. (2006). "Descriptive statistics". Research Methods Knowledge Base. Retrieved 14 March 2011.

Vural, B.; (2010), *IMKB 100 endeksinin uluslararası hisse senedi endeksleri ile ilişkisinin eşbütünleşim analizi ile belirlenmesi"* İstanbul Üniversitesi İşletme Fakültesi Dergisi, 39(1), p.154-168.

Wikipedia. (2016). *Autoregressive_conditional_heteroskedasticity*. Retrieved on 9th April, 2016 from: https://en.wikipedia.org/wiki/Autoregressive_conditional_heteroskedasticity

Wikipedia. (2016). *Descriptive statistics*. Retrieved on 13rd March, 2016 from: https://en.wikipedia.org/wiki/Descriptive_statistics

Wikipedia. (2016). *Dickey-Fuller test*. Retrieved on 3rd March, 2016 from: https://en.wikipedia.org/wiki/Dickey-Fuller_test

Wikipedia. (2016). *Granger causality*. Retrieved on 29th May, 2016 from: https://en.wikipedia.org/wiki/Granger_causality

Wikipedia. (2016). *Least squares*. Retrieved on 14th May, 2016 from: https://en.wikipedia.org/wiki/Least_squares

Wikipedia. (2016). *Variance decomposition of forecast errors.* Retrieved on 10th April, 2016 from: https://en.wikipedia.org/wiki/Variance_decomposition_of_forecast_errors

Wikipedia. (2016). *Vector autoregression.* Retrieved on 20th February, 2016 from: https://en.wikipedia.org/wiki/Vector_autoregression