TURKISH STOCK MARKET DEPENDENCY TO INTERNATIONAL MARKETS AND EXCHANGE RATE

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Abstract: In a financially integrated global market, the returns of countries' stock markets are partially determined by world risk especially arising from developed countries. Global crisis and even some local crisis have contagious effect on almost every market. In this study, Turkish stock market dependency to world market and regional markets, effect of exchange rates to Turkish stock market return are examined with international CAPM and APT. Stock markets indices, some proxies of world market portfolios and exchange rates are main data for the study. Due to time series properties of data, conditional models are more proper to use. Conditional models consider time dependent properties of variables especially when there is heteroscedasticity problem. Those models reveal relation better between Turkish Stock market and international stock markets. Expected result of study is that Turkish stock market is exposed to risk arising from international factors and market correlations.

Keywords: Turkish Stock Market, Exchange Rate

Introduction

International financial integration is getting more attention in recent years. Economies face with more frequent crisis and their impacts became more subversive and more global. So understanding interaction and interdependence of financial markets is crucial for investors, policy makers and industry stakeholders.

Some studies focused on explaining interdependence by common factor affecting those markets. These common factors may depend on or result of economic integration, liberalisation or more macro variables that have more influence on markets especially in crisis periods. Some studies of them are Walti (2011), Baele (2005) and Cheung and Lai (1999) which focused on monetary integration, Beine and Candelon (2010) which focused on liberalization at emerging markets. On the other hand Kallberg and Pasquariello (2008) suggested that there are correlations between markets more than those fundamental factors can explain.

As the markets correlation increases, international diversification is no more benefit to reduce investment risk. This consequence remarked in some studies (e.g. Byers and Peel, 1993).

Engle et al. (1990) examined the spill over behavior of volatility between markets. GARCH models can be used for examining time dependent volatility. Engle et.al used it also for the volatility transfer from one country to another. Where the idea supports that the volatility is not country specific or not only depends on the factors of country also affected by other markets.

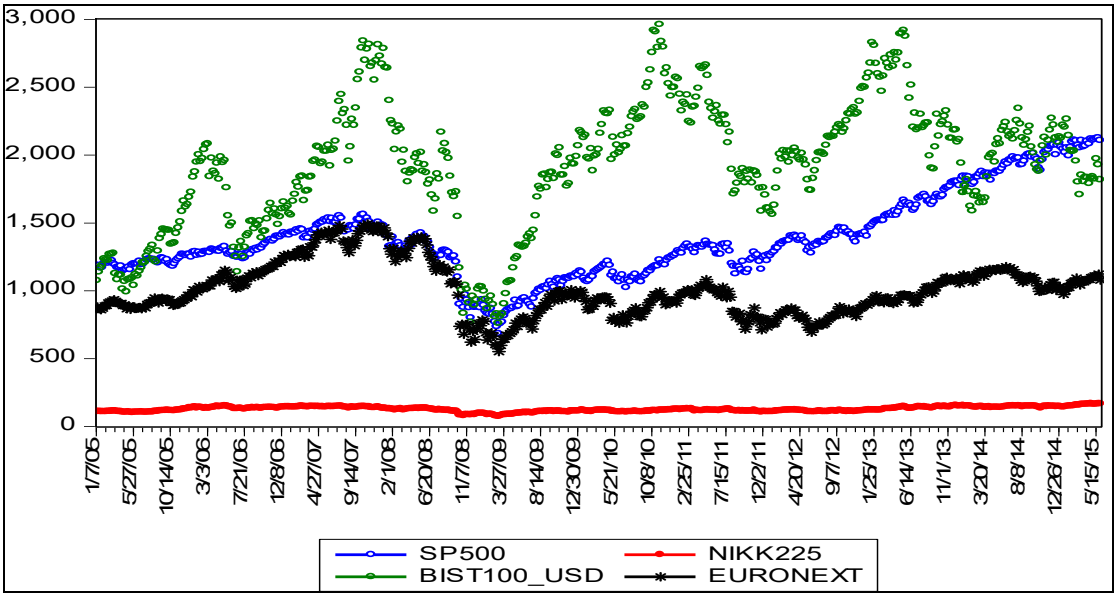
Some studies focused on the contagious behavior of crisis. Forbes and Rigobon (2002) claimed that because of market interdependence the volatility increases in a country causes an increase in the other countries and that causes higher correlation. The crisis in one country affects the other but no more than the normal period. That is the interdependency level does not change in crisis period. This study accepts that there are correlations between markets but it proposes that correlation does not change in crisis period. Bekaert et al. (2005) examined World and regional market integration and also proportion of variance driven by global, regional and local factors. The more researches about financial market correlation one can look at Bekaert et al. (2009), Dungey and Martin (2007) and Taylor and Tonks (1989).

The aim of this study is to examine dependencies of Turkey's Stock Market (Borsa Istanbul –BIST) to some selected markets. This dependency is examined by three regression based models and by correlation analysis.

DATA

The main data for the study includes stock market indices of Turkey, Europe (in general), United States (SP500) and Japan (NIKKEI225), and also USD/YEN, USD/EURO and USD/TL exchange rates. Indices value Turkey (BIST100 in TL and USD) gathered from Borsa Istanbul web page, the other indices (US, Japan and Europe)

gathered from yahoo finance web pages. Exchange rates of USD/YEN, USD/EURO and USD/TL gathered from IMF web page, ECB and Turkish Central Bank respectively. EURONEXT and NIKKEI225 indices converted to USD by using these exchange rates. BIST100 index gathered in TL and USD from web page.
The data covers the January 2005-May2015 interval. In the graphic below BIST100, NIKKEI225, EURONEXT and SP500 indices values in USD can be seen. SP500 and EURONEXT have common trends. Turkish stock market has more volatility than the others.



Graphic 1: Selected Stock Market Indices in USD Prices

The stock market indices are all have a unit root according to Augmented Dickey Fuller (ADF) test. It is common to have unit root in financial time series data. So for the further analysis and models the data have to be stationary. The general step for making series stationary is to convert original series by using natural logarithm or calculate first difference. For the price series of any asset (indices can be accepted as an asset as well) first difference of natural logarithms of series will be return data. When r is return of asset and P_t is price than

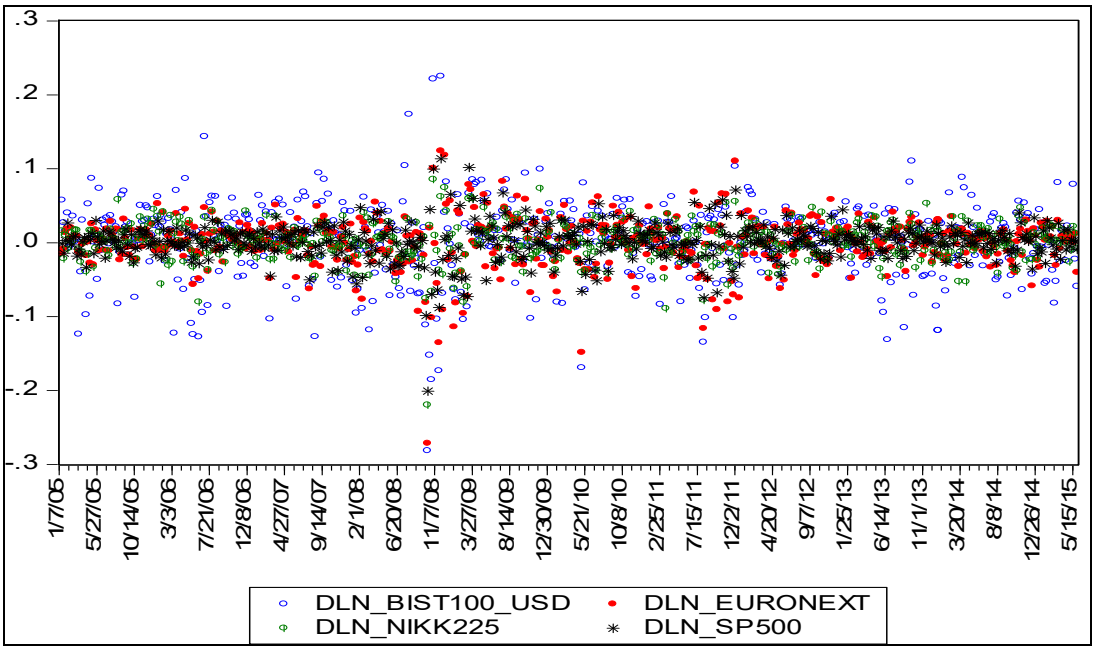
$$r_t=\ln(P_t/P_{t-1}) = \ln(P_t)-\ln(P_{t-1})$$

All the return data about indices are stationary with respect to Augmented Dickey Fuller (ADF) test. For the USD/TL exchange rate the first difference is stationary so the changes in exchange rate (S_t-S_{t-1}) are used for the analysis. In all analysis weekly returns are used. There are 542 weeks in the period. The return is calculated with respect to last working day closing prices of a week. So ends of the day exchange rates are used for the conversions of some indices to USD.

The table below shows that the descriptive statistics of the variables used in the models and analysis. BIST100 USD returns have the highest volatility with highest standard deviation. The graphics of returns can be seen in graphic 2. It can be clearly observed volatility increase in years 2008-2009.

Table 1: Descriptive Statistics for Log return of selected market indices

	Mean	Median	Max	Min	Std. Dev.	Obs.
RET_BIST100 TL	0.00219	0.00552	0.15758	-0.19273	0.03822	542
RET_BIST100 USD	0.00097	0.00545	0.22482	-0.28150	0.05258	542
RET_EURONEXT	0.00037	0.00366	0.12427	-0.27166	0.03416	542
RET_NIKKEI225	0.00077	0.00195	0.08560	-0.21962	0.02595	542
RET_SP500	0.00106	0.00217	0.11356	-0.20084	0.02518	542
USD/TL EXC First Difference	0.00231	0.00015	0.22180	-0.19930	0.03133	542



Graphic 2: Return (Log first difference) of Selected Stock Market Indices in USD

International Capital Asset Pricing Model (CAPM)

The CAPM was introduced by Jack Treynor (1961, 1962), William F. Sharpe (1964), John Lintner (1965) and Jan Mossin (1966) independently, building on the earlier work of Harry Markowitz on diversification and modern portfolio theory. Capital Asset Pricing Model (CAPM) proposes that the expected return of any asset is derived from the market overall return with an sensitivity level (coefficient Beta). If any specific asset having the coefficient one, than it is expected to yield market return, if it is less than one than this asset will yield less return (or less loss) than the market realized. In other words Beta (β) indicates the systematic risk (the risk that all investment opportunities exposed to) level of assets with respect to market risk. In details the CAPM model is:

$E(R_i) = R_f + \beta_i (R_m - R_f)$

R_i : return of asset i ("E" means expected value); R_f : risk free asset or investment return R_m: market return

The Capital asset pricing theory is applicable internationally by estimating individual country return from a world market return proxy. In this study world market return is estimated by returns geometric average of Euronext, SP500 and NIKKEI225 indices in USD and the model is as below:

R(BIST100_USD) = C + β* R(WORLD_INDEX)

"R" stands for return and in international level with exchange rate risk, it is assumed that there is not any riskless asset and risk free rate of return.

Table 2: Test Result of The Regression Model (International CAPM)

Dependent Variable: DLN_BIST100_USD
Method: Least Squares
Sample (adjusted): 1/14/2005 5/29/2015
Included observations: 542 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000117	0.001737	0.067362	0.9463
RET_WORLD	1.311890	0.067774	19.35675	0.0000
R-squared	0.409632	Mean dependent var		0.000971
Adjusted R-squared	0.408539	S.D. dependent var		0.052576
S.E. of regression	0.040434	Akaike info criterion		-3.574585
Sum squared resid	0.882871	Schwarz criterion		-3.558736
Log likelihood	970.7126	Hannan-Quinn criter.		-3.568388
F-statistic	374.6836	Durbin-Watson stat		2.058901
Prob(F-statistic)	0.000000			

From the table 2, the coefficient beta (β) has the positive and statistically significant value. Which means Turkey stock market's overall return is dependent to world market return and it has bigger than one. Turkey's stock market is more volatile than the world average. Test result gives the constant value insignificant. In CAPM constant value is proxy for the riskless asset return and internationally it is expected to be zero.

These results also propose that the international diversification may not ensure expected risk reduction within the more systematic risk property of countries.

MORE MODELS ON INTERNATIONAL EFFECT TO TURKEY'S STOCK MARKET

Multifactor models suggest that expected return of any asset can be derived from various macro economic factors in addition to market return. Changes in those factors changes expectations from any asset return and it can be modeled. In this study those factors are selected from international factors.

$R(BIST100\_USD) = C + \beta_1 * R(SP500) + \beta_2 * R(EURONEXT) + \beta_3 * R(NIKKEI225)$

From the result in Table 3, all indices significant positive effect on Turkish Stock Market returns. The highest coefficient value belongs to EURONEXT (0.644). Again the constant is insignificant that means it has the value zero. This model have multicollinearity problem because of high correlation between independent variables but they still have positive significant coefficient.

Table 3: Test Result of The Regression Model with Selected Stock Price Indices

Dependent Variable: DLN_BIST100_USD
Method: Least Squares
Sample (adjusted): 1/14/2005 5/29/2015
Included observations: 542 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000182	0.001732	0.105343	0.9161
DLN_SP500	0.362336	0.121710	2.977050	0.0030
DLN_EURONEXT	0.644708	0.095911	6.721958	0.0000
DLN_NIKK225	0.210907	0.092124	2.289376	0.0224

R-squared	0.417714	Mean dependent var	0.000971
Adjusted R-squared	0.414467	S.D. dependent var	0.052576
S.E. of regression	0.040231	Akaike info criterion	-3.580989
Sum squared resid	0.870785	Schwarz criterion	-3.549290
Log likelihood	974.4480	Hannan-Quinn criter.	-3.568593
F-statistic	128.6480	Durbin-Watson stat	2.055664
Prob(F-statistic)	0.000000		

The third model for Turkey's stock market return is below. In the third model because of one of the independent variable is exchange rate, Turkish Lira return of stock market is used as dependent variable. Similar to previous models, both two factors have significant coefficients. Effect of exchange rate (USD/TL) is negative that means increase in exchange rate have negative effect on stock market return. For the Turkish investors means increase in exchange rate drops stock market prices. This is another dimension of international dependency.

$R(BIST100\_TL) = C + \beta_1 * R(WORLD) + \beta_2 * D(EXC\_USD\_TL)$

EXC_USD_TL is the exchange rate of USD/TL and first difference (D) is used for the model because the original series is not stationary.

Table 4: Test Result of The Regression Model with World Return and Exchange Rate

Dependent Variable: DLN_BIST100_TL
Method: Least Squares
Sample (adjusted): 1/14/2005 5/29/2015
Included observations: 542 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002714	0.001249	2.172345	0.0303
RET_WORLD	0.632144	0.055787	11.33140	0.0000
D_EXCH_USD_TL	-0.404580	0.045668	-8.859151	0.0000

R-squared	0.429147	Mean dependent var	0.002191
Adjusted R-squared	0.427029	S.D. dependent var	0.038219
S.E. of regression	0.028930	Akaike info criterion	-4.242343
Sum squared resid	0.451119	Schwarz criterion	-4.218569
Log likelihood	1152.675	Hannan-Quinn criter.	-4.233047
F-statistic	202.6006	Durbin-Watson stat	2.296096
Prob(F-statistic)	0.000000		

Static and Dynamic Correlations Between Turkey's Stock Market and Other Markets

Another method for measuring Turkish stock market dependency to other markets is correlation analysis. Correlation matrixes of selected variables are in table 5. High correlation between BIST100 TL and USD is a mathematical result and it is meaningless. Similar to previous models EURONEXT have the highest correlation with Turkish stock market. A change in exchange rate is negative effect on Borsa Istanbul returns.

Table 5: Correlation Matrix for The Factors Used in Previous Models

	RET_BIST100 TL	RET_BIST100 USD	RET_EURONEXT	RET_NIKKEI225	RET_SP500	USD/TL EXC First Difference
RET_BIST100 TL	1.000	0.960	0.577	0.462	0.536	-0.541
RET_BIST100 USD	0.960	1.000	0.632	0.498	0.582	-0.690
RET_EURONEXT	0.577	0.632	1.000	0.681	0.821	-0.477
RET_NIKKEI225	0.462	0.498	0.681	1.000	0.623	-0.420
RET_SP500	0.536	0.582	0.821	0.623	1.000	-0.429
USD/TL EXC First Differ	-0.541	-0.690	-0.477	-0.420	-0.429	1.000

Financial time series mostly have changing variance (heteroscedasticity) problem. For a series GARCH models and its extensions are used for the modeling variance. Dynamic conditional correlation (DCC) is an extension of GARCH method that reveals the correlation with time dimension (Engle 2002; Cappiello et al.2006). It determines conditional correlation which means it changes for the time. With this method correlation behavior changes can be observed.

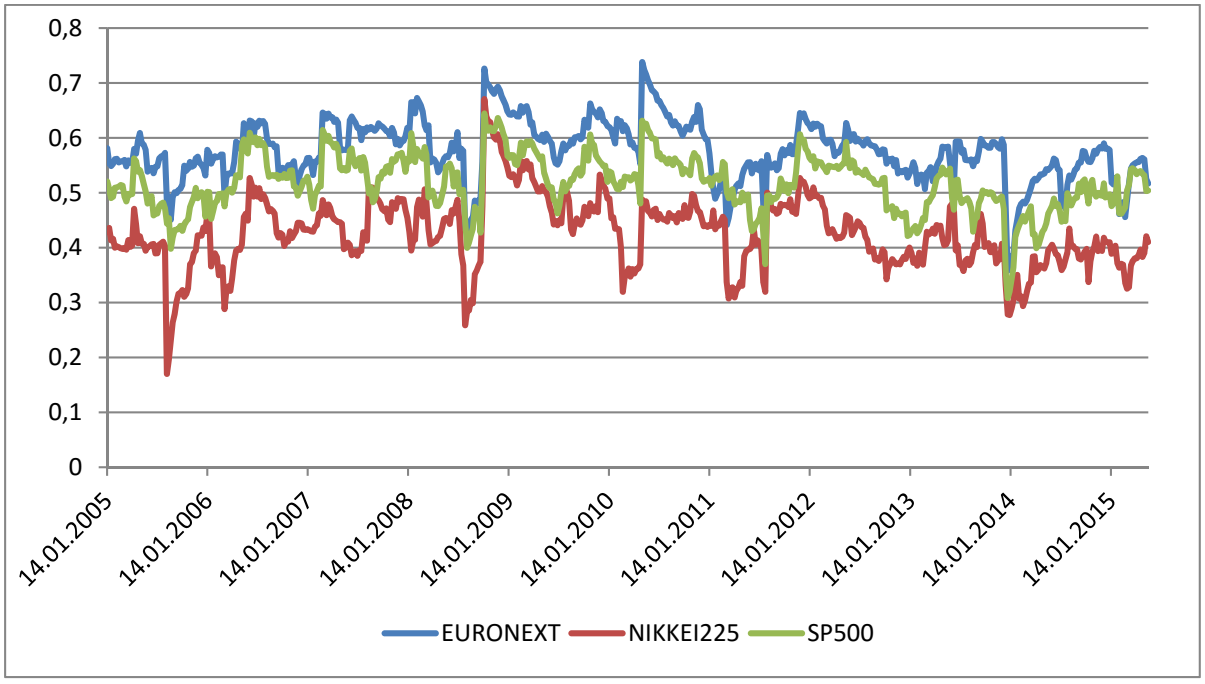
There is various methods for conditional (means changes over time) correlation methods. DCC is one of them and it can be done by using eviews package. When DCC applied it gives a correlation series for original observation time frame. So Table 6 gives the descriptive statistics of correlations between Borsa Istanbul index USD return and the other indices returns. The correlations are deviates within narrow band and almost every group have the same property.

Table 6: Descriptive Statistics of Dynamic Conditional Correlation of Borsa Istanbul USD return (BIST100_USD) with Other Markets Returns

	Mean	Median	Max	Min	Std. Dev.	Obs.
EURONEXT	0.576	0.577	0.738	0.358	0.055	542
NIKKEI225	0.425	0.424	0.671	0.170	0.064	542
SP500	0.517	0.517	0.644	0.308	0.051	542

Graphical representation of correlations are in graphic 3. Every correlation series have similar trends but correlation between Borsa Istanbul and Euronext follow higher level than the others. The correlation in mid 2008 to end of 2010 follows higher than the other periods.

This graphic also shows that there are positive correlations between markets.



Graphic 3: Dynamic Conditional Correlation of Borsa Istanbul USD return (BIST100_USD) with Other Markets Returns

Conclusion

In this study preliminary work for determining interaction between Turkish Stock Market and rest of the world is realized. The examination completed with limited number of indices and economic factor (exchange rate). Some models needs to be revised with more international market proxies and economic factors. More detailed geographic diversification of market would be better.

Even though these limitations the study gives promising results about the international dependency of markets. As the World become more global and investment opportunities go beyond the borders, financial markets becomes one global markets. In such a condition systematic risk cannot be inevitable, in other words it cannot be eliminated by diversification.

The correlations between markets change over time, generally it increases in crisis period, but more detailed analysis can be done and focus on regional or seasonal effect. Conditional correlation and conditional variance concepts gives more information about world risk and its effect to financial market.

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