A COINTEGRATION ANALYSIS BETWEEN BORSA ISTANBUL AND MAJOR FAR EAST INDEXES

Aykut GÖKSEL
110664039

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A Cointegration Analysis between Borsa Istanbul and Major Far
East Indexes

Borsa Istanbul ve Dört Büyük Uzak Doğu Endeksinin
Eşbütünleşme Analizi

Aykut GÖKSEL
110664039

Tez Danışmanı Doç. Dr. Cenktan ÖZYILDIRIM   :......................

Jüri Üyesi Yrd. Doç. Dr. Haluk Yener   :......................

Jüri. Üyesi Doç. Dr. Fuat Beyazıt   :......................

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Özet

Bu tezde Türkiye hisse senedi piyasası (Borsa İstanbul Ulusal 100 Endeksi) ve Uzakdoğu'nun en büyük beş hisse senedi piyasası olan; Hong Kong hisse senedi piyasası (Hang Seng), Çin hisse senedi piyasası(Şangay Birleşik Endeksi), Japon hisse senedi piyasası (Nikkei Endeksi), Güney Kore hisse senedi piyasası (Kospi Endeksi) arasındaki uzun dönemli eşbütünleşme ilişkisi üzerine çalışılmıştır. Analizin amacı, Johansen testi neticesinde, her bir borsanın aylık kapanışını takip ederek Borsa İstanbul'a yatırım yapılmasını sağlayacak uygun bir vektör eşitliği ortaya çıkarmaktadır.

Söz konusu testlerde Ekim 1987'den Şubat 2015'e kadarlık aylık veriler kullanılmış olup bulgulara göre, Borsa İstanbul Nikkei Endeksi ve Kospi Endeksi ile eşbütünleşik çıkmış olup, yatırım fırsatı açısından Borsa İstanbul ve Kospi Endeksi, Borsa İstanbul ve Nikkei Endeksinden daha ciddi bir bütünleşme göstermektedir.

Abstract

In this paper the long-run cointegration relationship is investigated between Turkish equity market (Borsa Istanbul National 100 Index) and Major Far East Indexes such as; Hong Kong equity market (Hang Seng), Chinese equity market (Shanghai Composite Index), Japanese equity market (Nikkei Index), South Korean equity market (Kospi Index). The aim of the analysis is to reveal a proper vector equation by Johansen test which will allow to invest in Borsa Istanbul after month closes of each stock exchange. Monthly data from October 1987 to February 2015 is used in subject tests and according to findings, Borsa Istanbul is found to be cointegrated with Nikkei Index and Kospi Index but for investment opportunity Borsa Istanbul and Kospi Index reveals a more serious integration than Nikkei Index.

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Table of Contents

List of Tables

List of Abbreviations

CU: Customs Union

HSI: Hang Seng Composite Index

KOSPI: Seoul Index

LNHSI: Log series of Hang Seng Composite Index

LNKSOSPI: Log series of Seoul Index

LNNIKX: Log series of Nikkei Index

LNSSE: Log series of Shanghai Composite Index

LNXU: Log series of Borsa Istanbul National 100

NIKX: Nikkei Index

SSE: Shanghai Composite Index

XU: Borsa Istanbul National 100

1- Introduction

By the 1980s, ability of the international capital to move across national boundaries in pursuit of better returns or portfolio diversification purposes has been grown after removing capital restrictions and transition to floating exchange rates by states. Market friendly policies such as liberalization of trade, privatization, economic incentives etc. had supported capital flows in terms of mobility. As an another aspect, global funds whom seeks shorter term investment opportunities rather than direct long term portfolio investments have extended their economic activities beyond own main lands.

Thus, as a consequence of integration of world economies, mobility of funds, technological advancements, the importance of the stock markets had increased. Currently, stock markets all over the world, has been bringing together more institutional investors than decades ago such as; hedge funds, mutual funds, exchange-traded funds (ETFs), pension funds, insurance corporations' funds etc. rather than an individual investor profile. The emergence of the institutional investor has brought to markets a new perspective, which leads a rapid changing environment in terms of operations.

At present, stock markets seem most comfortable structures for such free flowing funds to be traded in. Stock markets are also usually taken into consideration by both the citizens, politicians and financial sector participants etc. for measuring economic activity within the country and a comparison criterion among other economies' activities. However, subject condition is not always valid. In comparison with others, some of the stock exchanges are positioned differently than others, holds a transnational attribution and a consistent relatively higher transaction volumes. As instance, USA/New York Stock Exchange, USA/Nasdaq, Tokyo/Nikkei, London/FTSE, China/Shanghai Composite, Hong Kong/Hang Seng, Canada/Toronto, S.Korea/Kospi are worldwide accepted top major indexes

which has the potential to influence other stock indexes depending on economic interaction.

However, stock market dependency may occur and may be measured under cointegration without satisfying any factual economic activity interaction, which is the point of origin for this study.

In this paper, following the introduction part, literature review is narrated and provided feedback about studied publications from both domestic sources and sources from abroad. Then in data and methodology section, the data which is used in examinations are presented in sub-title of data. In methodology part, lag length criteria, ADF test, trace and maximum eigenvalue test are briefly explained without so comprehensively rather not to split from the main target which is finding a proper vector equation to be used in an investment. Subsequently, in findings section, mainly trace and maximum eigenvalue test are shared and interpreted. Vector equations and the seriousness of the equations are mentioned.

Main point arises from the subject paper, is the test of hypothesis: Borsa Istanbul Index is moved with any of major Far Eastern Major Stock Index. If two equity market index moves together, which is called as "cointegrated" in econometrics field terms, may be used as an opportunity in investment environment. However, inversely, if two equity market index do not move together, the situation can also be an advantage which allows investing party to "diversify" its sources. Another useful result may be cost decreasing alternative if there is a cointegrated relation between two indices: one index trading costs may be lower than the other. So investing party may enjoy lower cost trading alternative. Examples can be augmented based on index relations but the initial motivation in this paper is to find a proper investment equation.

2- Literature Review

The integration of financial markets are studied in a broad perspective in literature. In this section, there are papers especially about the integration of Turkish equity market with other world markets. To detect a relationship between stock exchange markets, some of the early studies were used correlation analyses. However, subsequently, major of the studies were consisted of cointegration analyses.

Cointegration of the time series are initially investigated by Engle and Granger (1987) who studied a series of examples wages, prices, short-long term interest rates and nominal GNP based on suggestions of Granger (1981) about cointegration and error correction notions. Engle and Granger (1987) assumed that two time series which is said to have unit root, are integrated with the same order if series' error term is stationary. Therefore, two series are said to have a long-term relation and can be estimated with a model. Engle and Granger (1987) approach has been known as two-step model. In first step, parameters of cointegration vector are estimated, and then subject parameters are used in error correction.

The model, which Engle and Granger (1987) had tested, contained two kinds of variables. However, a model may contain more than two variables. In this case, there may be more than one cointegrating vectors, which means there may be a cointegration relations more than one. With another point of view; "if there "m" number of variables, there may be "m-1" number of cointegrating vectors" as Sevüktekin (2010) clarifies.

For this reason, Johansen (1991) developed multivariate equation approach, which exposes there may be more than one cointegration relation and at the basis of Johansen (1991) approach all variables in the model are assumed to be endogenous and no need to choose variables for normalization as Sevüktekin (2010) explains.

3

Kasman ve Kasman (1997), examined the presence of long-run relations between the Turkey's main stock exchange and five major stock exchanges of Europe and the US market before and after the Customs Union (CU) entrance in 1996 and for the period 1988-2006, using both ordinary cointegration tests of Engle and Granger (1987) and Johansen (1991). According to ordinary cointegration tests, Turkish stock market, both before and after CU entrance, are not found to be cointegrated with five major stock markets of Europe and the US market.

Onay (2006), examined the long-term integration of countries accepted to European Union in second phase of Negotiation Process and candidate countries' during the Negotiation Process with the European Union and the US stock markets with both Johansen (1991) approach, and Engle and Granger (1987) causality test which revealed no long-term relationship between the second-round countries and the EU and US stock markets but a causality between Turkish stock market and Bulgarian stock market.

In study of Çıtak ve Gözbaşı (2007), a long-term relation between Turkish equity market and 2 developed country markets and 2 emerging market exchanges has been questioned in 3 sub periods between 1986-2006 years with monthly US dollar based data. According to results, Turkish stock market has been found related with US, British, German and Indian main stock markets in short term but Turkish stock market has not been found integrated with any of said markets in any of sub periods.

Korkmaz ve Çevik (2008), have investigated cointegration relation between Turkish stock market with 12 developed country markets and 22 emerging markets with monthly closing index data, to determine a portfolio scenario. Johansen (1991) test has been used for the study and according to results Turkish stock market has cointegration relations with 7 developed country markets and 5 emerging markets.

In another in depth study Korkmaz et al (2008), has examined the long-run cointegration relationship between Turkish stock market and 17 European Union member countries' stock markets and the stock markets of Turkey's top 10 largest foreign trade partners. In subject study, Zivot-Andrews structural break test, Johansen and Gregory-Hansen cointegration tests by using monthly index data between January 1995 and December 2007 were used. According to findings, Turkish stock market has a cointegration relationship with 17 European Union member countries' stock markets and the stock markets of Turkey's 7 trade partners. The results also reveal that Turkey has a high-level integration with the economies which have high trade volume with Turkey.

In another paper Vuran (2010), has searched for integration relations of Turkish stock market with major developed and emerging international stock markets by using Johansen (1991) approach with daily data for the period between January 2006 and January 2009. According to findings, Turkish stock market is found to be cointegrated with two developed markets and three developing stock markets

In addition to related studies, Bulut and Özdemir (2012) investigated the relationship between Istanbul Stock Exchange and Dow Jones Industrial using weekly data between 05.01.2001-30.12.2010. The relationship between series has been investigated through Granger test, long-short term and cointegration analysis; the Johansen and VEC methods. The findings revealed that subject series are integrated in the long term.

3- Data and Methodology

3.1- Data

The data of the study consist of the monthly equity market price indexes of Shanghai Composite Index(SSE), Seoul Index (KOSPI), Hang Seng Composite Index(HSI), Nikkei Index (NIKX) and Borsa Istanbul National 100(XU). Shanghai Composite Index(SSE) data is from January 1991 to January 2015 (289 observations), Seoul Index (KOSPI) data is from July 1997 to February 2015 (212 observations), Hang Seng Composite Index(HSI) and Nikkei Index (NIKX) data is from October 1987 to February 2015 (329 observations).

In addition to above-mentioned data set, Borsa Istanbul National 100(XU)'s number of observations are adjusted according to index subjected to cointegration tests.

The chosen indexes in this study; both Borsa Istanbul National 100(XU) and four Major Far East Indexes are main indexes of subject countries in terms of trade volumes.
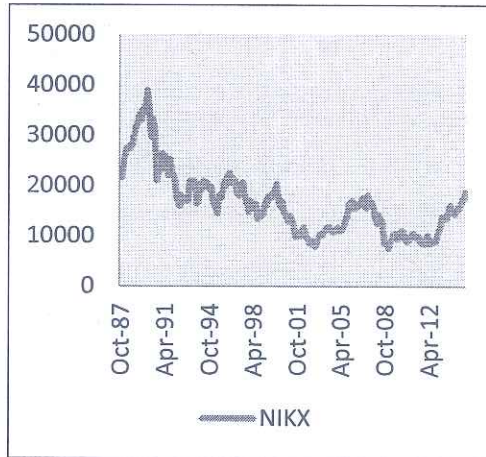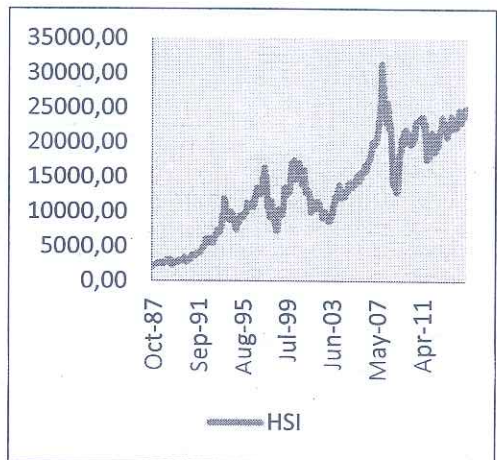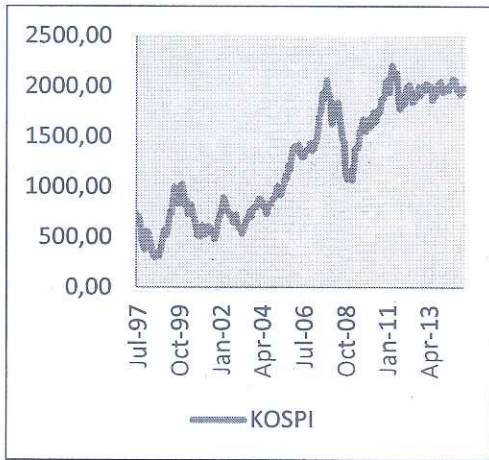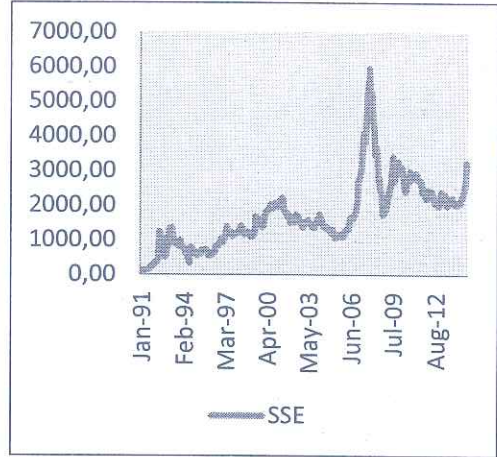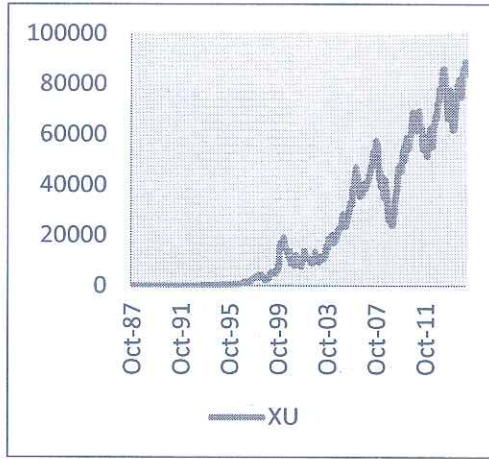
Graph 1- Monthly Closing Data for Indexes

3.2- Methodology

The cointegration relation of the above-mentioned indexes has been tested by Johansen approach. Initially, each observation of the indexes were converted to logarithmic series. Then the integration level of the series were examined. It is known that; "if a time series becomes stationary after taking first difference, the integration level of the subject series is one" which is shown as I(1). For series to be cointegrated, they have to be stationary and series have to be integrated in same level. If series are not integrated in same level, a cointegration relation cannot be examined.

The stationarity of the series were tested through Augmented Dickey Fuller (ADF) test. Augmented Dickey Fuller (ADF) test is based three equations which are estimated based on OLS estimates:

Intercept:	$\Delta Y_t = \gamma Y_{t-1} + u_t$	(1)
Trend and Intercept:	$\Delta Y_t = \alpha_0 + \gamma Y_{t-1} + u_t$	(2)
None:	$\Delta Y_t = \alpha_0 + \alpha_1 t + \gamma Y_{t-1} + u_t$	(3)

where $\Delta Y_t = Y_t - Y_{t-1}$, t is a linear trend, u_t is an error term and α is a parameter that equals unity under null hypothesis which is: "serie(Y_t) has a unit root" ($H_0: \gamma = 0$, $H_1: \gamma \neq 0$)

Log Series of Indexes	t-Statistic	Prob.*	Test critical values:		
			1% level	5% level	10% level
LNXU	-0.851901	0.9587	-3.986284	-3.423585	-3.134762
LNHSI	-2.496907	0.3296	-3.986284	-3.423585	-3.134762
LNSSE	-4.735849	0.0007	-3.991534	-3.426132	-3.136266
LNNIKX	-1.542152	0.8131	-3.986284	-3.423585	-3.134762
LNKOSPI	-3.231440	0.0812	-4.002786	-3.431576	-3.139475
*MacKinnon (1996) one-sided p-values.					

(H0: Serie has a unit root.)
Shanghai Composite Index (SSE) data: January 1991 to January 2015 (289 observations)
Seoul Index (KOSPI) data: July 1997 to February 2015 (212 observations)
Hang Seng Composite Index (HIS), Nikkei Index (NIKX) and Borsa Istanbul (XU) data: October 1987 to February 2015 (329 observations)
Table 2- Augmented Dickey Fuller (ADF) Test Statistics of Log Series

Only Shanghai Composite Index(LNSSE) is stationary according to tests. So, it is not possible to move on with LNSSE to test cointegration with Borsa Istanbul National 100(XU) due to condition "series have to be integrated in same level". Therefore, data belong to Shanghai Composite Index will not be used hereafter in this study for testing cointegration.

Other log series belong to Seoul Index (KOSPI), Hang Seng Composite Index(HSI), Nikkei Index (NIKX) and Borsa Istanbul National 100(XU) are not stationary at level.

1st difference of log series belong to Seoul Index (KOSPI), Hang Seng Composite Index(HSI), Nikkei Index (NIKX) and Borsa Istanbul National 100(XU) are stationary. Seoul Index (KOSPI), Hang Seng Composite Index(HSI), Nikkei Index (NIKX) are now suitable to test cointegration with Borsa Istanbul National 100(XU) since all series are integrated in same level, order 1, which is denoted "I(1)".

1st Difference Log Series	t-Statistic	Prob. *	Test critical values:		
			1% level	5% level	10% level
DLNXU	-4.615843	0.0000	2.572347	-1.941837	-1.616024
DLNHSI	-17.35694	0.0000	-2.572053	-1.941796	-1.616050
DLNNIKX	-17.48039	0.0000	-2.572053	-1.941796	-1.616050
DLNKOSPI	-12.42183	0.0000	-2.576020	-1.942346	-1.615693

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

(H0: 1st Difference of Series has a unit root.)

Table 3- Augmented Dickey Fuller (ADF) Test Statistics of 1st Difference of Log Series

Thereafter satisfying preliminary conditions needed in cointegration analysis, VAR analyses are applied to determine a proper lag order for each series groups.

Optimal lag order has been determined according to Akaike Information Criterion (AIC). For series LNXU and LNNIKX lag length is 1. For series, LNXU LNHSI lag length is two and for series LNXU and LNKOSPI lag length is two.

| VAR Lag Order Selection Criteria | | | | | | |
| Endogenous variables: LNXU LNNIKX | | | | | | |
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-790.5825	NA	0.478287	4.938209	4.961707	4.947591
1	616.4839	2787.833*	7.64e-05*	-3.803638*	-3.733144*	-3.775491*
2	618.7212	4.404882	7.73e-05	-3.792655	-3.675165	-3.745744
3	619.3792	1.287203	7.89e-05	-3.771833	-3.607346	-3.706157
4	621.6056	4.328006	7.98e-05	-3.760782	-3.549300	-3.676343
5	623.7964	4.231443	8.07e-05	-3.749510	-3.491031	-3.646306
6	625.2683	2.824537	8.19e-05	-3.733759	-3.428284	-3.611790
7	627.0331	3.364693	8.31e-05	-3.719832	-3.367361	-3.579099
8	630.0814	5.773753	8.36e-05	-3.713903	-3.314435	-3.554405
* indicates lag order selected by the criterion						

Nikkei Index (NIKX) data: October 1987 to February 2015 (329 observations)

Table 4.1- VAR Lag Order Selection of the Series LNXU-LNNIKX

| VAR Lag Order Selection Criteria | | | | | | |
| Endogenous variables: LNHSI LNXU | | | | | | |
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-796.9302	NA	0.497581	4.977758	5.001256	4.987140
1	578.6350	2725.419	9.67e-05	-3.567819	-3.497325*	-3.539672*
2	582.7392	8.080636	9.67e-05*	-3.568469*	-3.450978	-3.521558
3	583.1455	0.794868	9.89e-05	-3.546078	-3.381591	-3.480402
4	585.2647	4.119501	0.000100	-3.534359	-3.322877	-3.449919
5	586.4613	2.311239	0.000102	-3.516893	-3.258414	-3.413689
6	587.6719	2.323143	0.000104	-3.499513	-3.194038	-3.377545
7	590.9262	6.204445	0.000104	-3.494867	-3.142396	-3.354134
8	597.5039	12.45876*	0.000102	-3.510928	-3.111461	-3.351430
* indicates lag order selected by the criterion						

Hang Seng Composite Index (HIS) data: October 1987 to February 2015 (329 observations)

Table 4.2- VAR Lag Order Selection of the Series LNHSI LNXU

| VAR Lag Order Selection Criteria | | | | | | |
| Endogenous variables: LNKOSPI LNXU | | | | | | |
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-210.0136	NA	0.027401	2.078565	2.111095	2.091724
1	388.2567	1178.944	8.08e-05	-3.747615	-3.650023*	-3.708137*
2	393.2529	9.747442*	8.00e-05*	-3.757381*	-3.594728	-3.691585
3	394.6332	2.665942	8.21e-05	-3.731698	-3.503984	-3.639583
4	397.7576	5.973215	8.28e-05	-3.723114	-3.430339	-3.604681
5	399.6167	3.517664	8.46e-05	-3.702125	-3.344288	-3.557373
6	404.1780	8.541305	8.41e-05	-3.707628	-3.284730	-3.536558
7	407.0717	5.361830	8.51e-05	-3.696782	-3.208823	-3.499393
8	410.7449	6.734169	8.54e-05	-3.693578	-3.140558	-3.469871
* indicates lag order selected by the criterion						

Seoul Index (KOSPI) data: July 1997 to February 2015 (212 observations)

Table 4.3- VAR Lag Order Selection of the Series LNKOSPI LNXU

Subsequent to lag length determination, cointegration analyses has been realized to reveal any long term related equations and if revealed, the number of cointegration relations between series and the significance of roots are investigated and findings will be presented next part.

4- Findings

Firstly, LNXU- LNNIKX relation has been investigated. Hypothesis will be conducted as follows:

For Trace part,

H0: There is no cointegration relation

H1: There is a cointegrating vector

For Maximum Eigenvalue part

H0: There is at least one cointegrating vector

H1: There is more than one cointegrating vector

According to test outline, both null hypothesis are rejected. Then Vector Error Correction is realized.

Trend assumption: No deterministic trend (restricted constant)
Series: LNXU LNNIKX
Lags interval (in first differences): No lags

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.055064	24.03956	20.26184	**0.0144**
At most 1	0.016515	5.462209	9.164546	0.2365

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.055064	18.57735	15.89210	**0.0185**
At most 1	0.016515	5.462209	9.164546	0.2365

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 5- LNXU-LNNIKX Johansen Test

Vector Error Correction Estimates Standard errors in ( ) & t-statistics in [ ]		
Cointegrating Eq:	CointEq1	
LNXU(-1)	1.000000	
LNNIKX(-1)	-37.29830 (18.7039) [-1.99414]	
C	326.0104 (180.510) [1.80605]	
Error Correction:	D(LNXU)	D(LNNIKX)
CointEq1	-0.001035 (0.00025) [-4.07856]	0.000101 (0.00011) [0.88207]
R-squared	0.009996	0.002315
Adj. R-squared	0.009996	0.002315
Sum sq. resids	6.437289	1.307927
S.E. equation	0.140306	0.063244
F-statistic	NA	NA
Log likelihood	179.2568	440.6177
Akaike AIC	-1.086931	-2.680596
Schwarz SC	-1.075367	-2.669032
Mean dependent	0.028288	-0.000484
S.D. dependent	0.141013	0.063317
Determinant resid covariance (dof adj.)		7.67E-05
Determinant resid covariance		7.62E-05
Log likelihood		624.1417
Akaike information criterion		-3.775254
Schwarz criterion		-3.717434

Table 6- LNXU-LNNIKX Vector Error Correction Estimates

The long-term equation between series is:

"LNXU= -326.01 + 37.29 (LNNIKX)"

Despite the coefficient of LNNIKX is positive, it does not support an investment to be realized since the coefficient is not a serious value.

Anticipating a change worth of 37.29% in Borsa Istanbul after a 1% change in Nikkei Index, is not a serious approach.

Secondly, LNXU- LNKOSPI relation has been investigated. Hypothesis will be conducted as follows:

For Trace part

H0: There is no cointegration relation

H1: There is a cointegrating vector

For Maximum Eigenvalue part

H0: There is at least one cointegrating vector

H1: There is two cointegrating vector

According to test outline, null hypothesis in trace part is rejected but null hypothesis in maximum eigenvalue part cannot be rejected.

Then Vector Error Correction is realized.

Date: 03/07/15   Time: 14:39
Sample (adjusted): 1997M09 2015M02
Included observations: 210 after adjustments
Trend assumption: No deterministic trend (restricted constant)
Series: LNKOSPI LNXU
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.168405	42.51895	20.26184	**0.0000**
At most 1	0.017899	3.792784	9.164546	0.4438

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.168405	38.72616	15.89210	**0.0000**
At most 1	0.017899	3.792784	9.164546	0.4438

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 7- LNXU- LNKOSPI Johansen Test

Vector Error Correction Estimates
Date: 03/07/15   Time: 14:43
Sample (adjusted): 1997M09 2015M02
Included observations: 210 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LNXU(-1)	1.000000
LNKOSPI(-1)	-1.813372 (0.10870) [-16.6823]
C	2.523709 (0.76418) [3.30250]

Error Correction:	D(LNXU)	D(LNKOSPI)
CointEq1	-0.106050 (0.02287) [-4.63658]	0.037009 (0.01599) [2.31384]
D(LNXU(-1))	-0.006480 (0.06985) [-0.09278]	0.032567 (0.04884) [0.66676]
D(LNKOSPI(-1))	-0.100604 (0.10352) [-0.97187]	0.164212 (0.07239) [2.26853]

Table 8- LNXU-LNKOSPI Vector Error Correction Estimates

The long-term equation between series is:

"LNXU= -2.52 + 1.81 (LNKOSPI)"

Since the coefficient of LNKOSPI is positive, it reveals an investment approach, which may be realized since the coefficient is a serious value unlike in above test of LNNIKX. Anticipating a change worth of 1.81% in Borsa Istanbul after a 1% change in Kospi Index, exposes a possible alternative of investment.

Lastly, LNXU- LNHSI relation has been investigated. Hypothesis will be conducted as follows:

For Trace part

H0: There is no cointegration relation

H1: There is a cointegrating vector

For Maximum Eigenvalue part

H0: There is at least one cointegrating vector

H1: There is two cointegrating vector

According to test outline, both null hypothesis of trace and maximum eigenvalue cannot be rejected. Therefore, there is no relation between LNXU- LNHSI.

Trend assumption: Linear deterministic trend
Series: LNHSI LNXU

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.028933	13.65310	15.49471	**0.0930**
At most 1 *	0.012316	4.052326	3.841466	0.0441

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.028933	9.600778	14.26460	**0.2395**
At most 1 *	0.012316	4.052326	3.841466	0.0441

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 9- LNXU- LNHSI Johansen Test

To summarize the outcomes, Turkish equity market(Borsa Istanbul National 100 Index) data is not in the same order with Chinese equity market(Shanghai Composite Index) which means series are not suitable for a cointegration test.

A cointegration relation between Borsa Istanbul National 100 Index and Hong Kong equity market(Hang Seng Index) are able to be tested. However, there is no cointegration between subject indexes.

Borsa Istanbul National 100 Index has long term cointegration relations with both Japanese equity market(Nikkei Index) and South Korean equity market(Kospi Index).

The cointegration vectors of the subject tests are like the following:
"LNXU = -2.52 + 1.81 (LNKOSPI)"
"LNXU = -326.01 + 37.29 (LNNIKX)"

5- Conclusion

With increasing integration among countries, the capital movements have also been affected and money has been flowing rapidly all over world. Rapidly flowing money triggered vast amount of financial markets' evolution. Markets have started to position themselves more investor friendly, which enabled new investment opportunities. Investors who seek higher returns or seeking for lower levels of risks or seeking for cheaper transaction alternatives etc. have changed their local profile to a globally acting unit. Thereby "financial integration" notion has arisen as a consequence of several dynamics.

In this study, a part of financial integration, which is "equity market integration", has been examined between Borsa Istanbul main index and four other major Far East Indexes, which have largest transaction volumes, and each reflects a crucial section from their whole equity markets.

As stated in some of previously mentioned studies, when there is a cointegration relation, there may a be potential investment opportunity between markets which is; if two markets has different working hours and one of them closes before the other, there may be a lead-lag alike movement.

According to tests with Hong Kong equity market (Hang Seng), Chinese equity market (Shanghai Composite Index), Japanese equity market(Nikkei Index), South Korean equity market (Kospi Index) and Borsa Istanbul, Nikkei index and Kospi Index have been satisfying a cointegration relation as below mentioned:

"LNXU = -2.52 + 1.81 (LNKOSPI)"

"LNXU = -326.01 + 37.29 (LNNIKX)"

These two equations mean that Borsa Istanbul may be affected from both Nikkei Index of Kospi Index. Nikkei Index is one of the most largely traded index in the world so it is possible to affect any kind of market, especially an emerging market economy located: Borsa Istanbul. However, even is not being a large exchange, Kospi Index may also affect Borsa Istanbul since both are classified under emerging market economies which may be preferred at the same time. These classification may lead to a lead-lag relationship since both indexes are not operate in the same hours or two different investment vehicle may invest in both Borsa Istanbul and Kospi Index at the same time.

The relation between Chinese equity market and Borsa Istanbul cannot be even tested due to series are not integrated in the same level. Chinese equity market: Shanghai Composite Index is stationary unlike the conventional sense.

The main reason why Hong Kong equity market and Borsa Istanbul do not cointegrate may be that funds do not invest simultaneously in subject indexes which means those markets are not substitutes or successive capital flow lines. Hong Kong, as being a more investment friendly country, probably has a more different investment environment than Turkish equity market. Borsa Istanbul is not affected by the activity of Hang Seng Index which may allow an investor to diversify its funds between Borsa Istanbul and Hang Seng Index due to reason that subject indexes do not move together.

There may be other dynamics like transaction costs, investor profile and risk preferences, economic factors etc. but in this study, as mentioned in introduction part, only cointegration relation has been tested.

Consequently, despite having econometric and significant statistical integration, Borsa Istanbul and South Korean equity market(Kospi Index) reveals a more applicable investment equation than Japanese equity

market(Nikkei Index) since Nikkei Index's coefficient is not found to be serious.

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