Emerging Markets Stock Exchange Linkages: Evidence from BRICS and MIST Countrıes

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Abstract

Due to the fast acceleration of globalization, the existing relationship between world economies acquired different dimensions recently. These dimensions refer to elimination of barriers based on protectionist policies and the increase of liberalization process. As the barriers between economies are removed, markets establish closer and more intense relationship with one another. While this situation offers economies new opportunities it also exposes the economies to certain risks.

This study is designed to investigate the relationship between stock exchanges of emerging markets. Stock price indices of BRICS (Brazil, Russia, India, China and South Africa) and MIST (Mexico, Indonesia, South Korea and Turkey) countries are selected as the scope of the research. Engle-Granger and Johansen Cointegration Tests and Granger Causality Tests are performed for the daily data from 2010 to 2016 using E-Views. Engle-Granger test results show that BIST 100 (Turkey) cointegrates individually with IBOVESPA (Brasil), MICEX (Russia), NIFTY100 (India), SSE Comp. (China), JSE All Shr.(South Africa), IPC (Mexico), JSE Comp. (Indonesia) ve KOSPI (South Korea) implying that investors do not have diversification benefits between the markets. Where as Johansen test finds no cointegration among all indices for the time period investigated. According to Granger Causility test results there are evidences for granger causility from BIST 100 and other stock indices.

Keywords: BRICS, MIST, BIST 100, Johansen Cointegration Test, Emerging Markets, Stock Indices, Engle-Granger Cointegration Test.

I. Introduction

The interrelationship among the world stock markets have gained much popularity in the era of globalization. Both investors and academic scholars have been interested in examining the world equity market linkages. Most studies examined stock market comovements of developed countries. Few have concentrated on the linkages between emerging stock markets. Emerging markets are developing economies, many of which are experiencing rapid growth and industrialization. In recent years, emerging markets have attracted considerable attention from investors due to their rising shares of global economic output and stock market capitalization. One of the many attractions of emerging markets is that the risks are very different from those in developed countries. Investors can actually reduce the risk of their overall portfolio and increase long-term return by making investments with a range of different risks that then cancel each other out making their returns uncorrelated.

In 2001, the acronym BRIC was offered by U.S. investment bank Goldman Sachs, to designate the four major fast-growing economies – Brazil, Russia, India, and China. In 2011, because of its robust economic growth, South Africa joined this group and the acronym was expanded to BRICS.

In 2011, the growth of the BRIC countries had already begun to slow down, and investors withdrew their funds from the BRIC countries. 2012 a new grup of emerging economies was proposed: Mexico, Indonesia, South Korea, and Turkey, or MIST.

The purpose of this study is to contribute to literature on emerging stock market integration through whether stock market indices of BRICS and MIST countries are cointegrated with each other. This study also aims to extend the Turkish literature by including BRICS and MIST countries.

The remainder of this paper is organized as follows: the next section reviews the literature, the third section describes data and presents the results of the emprical study and final section summurizes the results and concludes the paper.

II. Literature Review

There is a broad literature on cointegration of emerging market. In this part of the paper, an attempt has been made to provide information about the recent research works undertaken in the area of emerging markets.

Khan (2011) examines the long-run relationship of the United States and 22 other developed and developing countries stock indices using daily data for the period from 1999 to 2010. Johansen (1988) and the Gregory and Hansen (1996) test to show that stock markets of most countries have become cointegrated by 2010. But short-run diversification opportunities across the countries by comparing their daily returns to the daily returns of the global index (S&P 1200) have been detected. China, Malaysia and Austria are found to be the countries with highly favorable diversification opportunities as they are not cointegrated with the US and are insensitive to the global index.

Bhattacharjee and Swaminathan (2016) conduct an analysis of the stock market integration of India and a few selected countries of the globe. The long run relationship of India with some of the selected countries across the globe is analyzed over three different phases. It is observed that cointegration of India with other stock markets is increasingly improving over the years with financial liberalization. The study finds that the Indian stock market is more responsive to the other Asian stock markets during the recession phase than in any other sub-sample periods.

Horvath and Petrovski (2013) examines international stock market comovements between Western Europe (Czech Republic, Hungary and Poland) and South Eastern Europe (Croatia, Macedonia and Serbia) using multivariate GARCH models for the period of 2006–2011. They compared these two groups and find that the degree of comovements is much higher for Central Europe. The correlation of South Eastern European stock markets with developed markets is found to be zero.

Lingaraja, Selvam and Vasanth (2014) conduct an analysis on inter-linkages, comovement and causal relationship among emerging stock market indices returns and developed stock market index in Asia. Using daily time series data for a period of 12 years, from January 1st, 2002 to December 31st ,2013, they find that in the long run, three countries namely India, Taiwan and Philippines exercise the greatest influence on Singapore. The developed Asian market (Singapore) also exercises influence on India during whole study period. While India enjoys highly interlinked comovements with Singapore, out of remaining seven markets, only Philippines and Taiwan record one way bidirectional causality relationship with Singapore. The other five emerging Asian markets, China, Indonesia, Malaysia, Korea and Thailand do not have Inter-linkages and comovements with Singapore during the study period. Also, the five emerging markets China, Indonesia, Korea, Malaysia and Thailand record higher risk than India, Taiwan and Philippines.

Yarovaya and Lau (2016) investigate stock market comovements for UK, BRICS and MIST countries around global financial crisis. In their study, the application of conventional and regime-switch cointegration techniques suggests an absence of diversification benefits. Further evidence from application of a multivariate time-varying asymmetric model suggests that conditional correlation among the stock markets exhibits higher dependency when it is driven by negative shocks to the market. The results indicate that the Chinese stock market is the most attractive option for the UK investor.

Fahami (2011) aims to examine the structure of linkages and causal relationship between leading indices of BRICS economies and the United States (US), the United Kingdom and Japan. The period of analysis is divided into three sample periods as pre-crisis (January 10th, 2005 to July 22nd, 2007), crisis period (July 29th, 2007 to January 10th, 2010) and post crisis period (January 11th, 2010 to July 21st, 2011). Johansen Juselius (JJ) cointegration test and Granger causality test are applied and the results show that all the stock markets under study are cointegrated in pre-crisis, during crisis and post crisis period. China was the most influential stock market before the crisis period, whereas United States influenced most of the major equity markets during the period of turbulence. These indicate that what happens to US stock market brings impact to the other equity markets worldwide despite the emergence of BRIC countries.

Chittedi (2009) conducts a study which examines the integration of the stock market among the BRIC (Brazil, Russia, India and China) economies in general and their integration with the developed countries stock markets such as US, UK and Japan, using the Granger causality, Johansen cointegration and error correction mechanism methodology based on daily data for the period January 1998-August 2009. The results indicate that BRIC countries and USA, UK and Japan stock markets are highly cointegrated. The US and Japan market factors are influencing Indian stock market. It might be because of maximum international trade commercial activities between these countries. Indian stock market is not influenced by UK, Brazil, Russia and China markets. But Brazil and Russia markets are influenced by Indian stock market.

Gözbaşı (2010) examines the interaction between Istanbul Stock Exchange 100 index and the stock markets of 7 developing countries (namely Argentina, Brazil, Mexico, India, Malaysia, Hungary and Egypt) employing cointegration and causality analyses using weekly data between December 1995 and December 2008. The obtained results demonstrate the long-term relationship between ISE 100 and Brazilian, Indian and Egyptian stock markets, while it also indicates the short-term interaction of the ISE 100 with Mexican and Hungarian stock markets.

III. Data and Methodologyy

The aim of the study is to investigate the long run relationship between the BRICS (Brasil, Russia, India, China and South Africa) and MIST (Mexico, Indonesia, South Korea and Turkey) Countries' major stock market indices. The indices used in the study are Bovespa (Brazil), MICEX (Russia), Shanghai Stock Exchange Composite Index (China), Nifty 100 (India), Jakarta Composite Index (Indonesia), Kospi Composite Index (South Korea), Meksico IPC Index (Meksico), Johannesburg Stock Exchange All Share Index (South Africa) and BIST 100 Index (Turkey). The list of indices are presented in Table 1.

Refer Table 1

The data used in this study consist of the daily closing values of the stock market index of the major exchange in each country. The daily adjusted closing prices of each of the sample indices were collected from Yahoo Finance database and website of national stock exchange of the countries and they are all expressed in terms of local currencies. The data set covers the period January,11th, 2010 through July,30th 2016; 1200 observation are used for investigation. In this period, the synchronized trading days have been taken into consideration. The daily closing prices are transformed in natural logarithmic values. Engle-Granger and Johansen Cointegration analysis and Granger Causility Test have been applied by using E-Views 8.

While graph 1 represents the individual series based on original daily closing data, graph 2 shows the natural logarithmic series of daily data.

Refer Graph 1
Refer Graph 2

Table 2 demonstrates the descriptive statistics of stock indice series with natural logarithmic values. Jarque-Bera statictic shows that the null hypothesis of normality is rejected for all the markets at 1 % significance level. This means that all series are not normally distributed.

Refer Table 2

In Table 3, the correlation coefficients of logarithmic values of stock indices are given. It can be seen from the table that BIST 100 index is 46 % negatively correlated with IBOVESPA (Brazil) whereas 18 % positively correlated with SSE Composite Index (China), 82 % positively correlated with Jakarta Composite Index (Indonesia), 82 % positively correlated with JSE ALSI (South Africa) , 79 % positively correlated with NIFTY 100 Index (India), 58 % KOSPI Composite Index (South Korea) , 34 % with MICEX (Russia) and 83 % with Meksico IPC. Also, it can be concluded that there exists 90 % positive correlation between Meksico and Jakarta, 87 % positive correlation between India and South Africa indices. BIST 100 index has very high correlations with Indonesia, India, Meksico and South Africa stock indices with 82 %, 79 %, 83 % and 82 % respectively.

Refer Table 3

To implement Johansen approach to cointegration, the order of the integration of the indices have to be established. To ascertain the stationarity properties of each of the stock indices Augmented Dickey Fuller (ADF) and Philips and Perron (PP) unit root tests are applied. The results for the Augmented Dickey-Fuller (ADF) and PP unit root tests in Table 4 suggest that all the stock indices in their natural logarithm level are non-stationary series. In first difference form, however, these stock price indices are stationary. Thus, all those indices are first-order integrated series, or I(1) processes.

Table IV displays the results of unit root tests. The natural logarithims of stock prices follow a non-stationary process in the level form but their first differences are stationary. This means the null hypothesis for unit root for the I (1) series is rejected.

Refer Table 4

Having established that each of the stock indices are I(1), the presence of unit root in the error terms is tested. If the stock indices are integrated in the same order, the equation below is estimated.

$$\Delta e_t = ae_{t-1} + \sum_{j=1}^{q} q + ¢\Delta e_{j-t} + v_t \quad (1)$$

The presence of unit root in error terms is tested by ADF test. If the error terms of the regression is stationary, I(0), it can be concluded that the stock indices are cointegrated.

Refer Table 5

Table V gives the results of ADF test. It is understood that the error terms has no unit root, I(0), so the stock indices have a long term equilibrium point implying a long-run equilibrium relationship among variables.

Refer Table 6

Having established that all prerequisites have been provided to conduct the cointegration analysis, to determine the lag lenght, the VAR analysis which is proposed by Hall (1991) has been applied. The results are displayed in Table 6. The appropriate lag structure of the model is determined by using Akaike Information Criterion (AIC) as 2.

The results of the cointegration analysis can be found in Table 7 and Table 8. Firstly, test for bivariate cointegration between each pair of markets (Engle-Granger Methodology) and then multivariate cointegration (Johansen Cointegration) behavior of group of markets have been conducted.

According to Engle-Granger analysis; where the dependent variable is BIST 100 indice and the independent variables are choosen among aforementioned indices one by one, if the coefficient of is positive and significant, it can be concluded that there is a short term cointegration between those indices. If the coefficient of one day lagged value of error terms of the model (ec_ln_index $_{t-1}$) is between 1- and 0 (-1< conficient error correction < 0) and is significant, it can be said that there is a long term relationship between BIST 100 and relevant indices.

In Engel Granger analysis, since Brazil and Mexico are six hours back to Turkey, one day lagged value of those indices are taken into consideration.

Refer Table 7

As seen in Table VII, BIST 100 index is cointegrated with IBOVESPA, MICEX, NIFTY 100, Shangai Composite, Johanessburg All Share, IPC, Jakarta and KOSPI Indices both in the short and long run at 10 % significance level.

Based on the these results the next step is to investigate the significance of the cointegration vector(s) by means of Johansen cointegration test. Table VIII shows that the null of no cointegration among indices are accepted for 5 % and 10 % significance level meaning that when all indices are observed together there is no evidence of moving comovement.

Refer Table 8
Refer Table 9

Table 9 shows the results of granger causility tests. Since all the indices have 5 trading days in a week, the lag lenght has been choosen as 5. It appears that Granger causality runs one-way from IBOVESPA to BIST and IPC to BIST 100 meaning that information containing in these indices is statistically significant up to 5 days. And according to the results, BIST100 index is found to be the granger cause of SSComp., JKSE and KOSPI indices.

It is also found that there is bidirectional causility between BIST 100 and JKSE Composite index both in the short run and the long run. On the other hand, no causility has been observed between BIST100 and MICEX, NIFT100 and JSE All Share indices both in the short and long run.

IV. Results

With the increase of financial integration, while the investors who find great opportunity of mobility in global financial system, are trying to increase their return on one hand, on the other hand, are targeting investment strategies that will allow them to manage their risks. One of these strategies is to diverse their risks by invesing in different markets which have no correlations instead of investing in the markets with high integration level in the meanwhile. Cointegration analysis, in a sense, can be helpful in determining whether a statistically significant relationship between the different markets. Also the determination of short-or long-term relationship even the causility test can help them in creating strategies for risk diversification.

This study investigates the linkages between the main equity indices of BRICS (Brazil, Russia, India, China and South Africa) and MIST (Mexico, Indonesia, South Korea and Turkey) countries. According to the results of Engle-Granger Analysis; BIST 100 index is found to be cointegrated with IBOVESPA, MICEX, NIFTY 100, Shangai Composite, Johanessburg All Share, IPC, JKSE Composite and KOSPI Indices both in the short and long run. This implies that for an investment strategy covering the bivariately selected stock market indices which is created on the purpose of international risk diversification will be ineffective.

As for the results of Johansen Cointegration Tests, which examine the existance of long-run relationship in a multivariate framework, it is found that there is no long-run relationship between the selected stock market indices for the given period. It can be concluded that the opportunity for long-run diversification within that group of markets is possible and it gives an opportunity of risk diversification for international investors.

According to Granger Causility test results, BIST100 index is found to be the granger cause of Shangai Stock Exchange Composite Index and KOSPI Composite Index. There is one-way causility which runs from IBOVESPA to BIST and IPC to BIST 100. It is also found that there is bidirectional causility between BIST 100 and JKSE Composite index.

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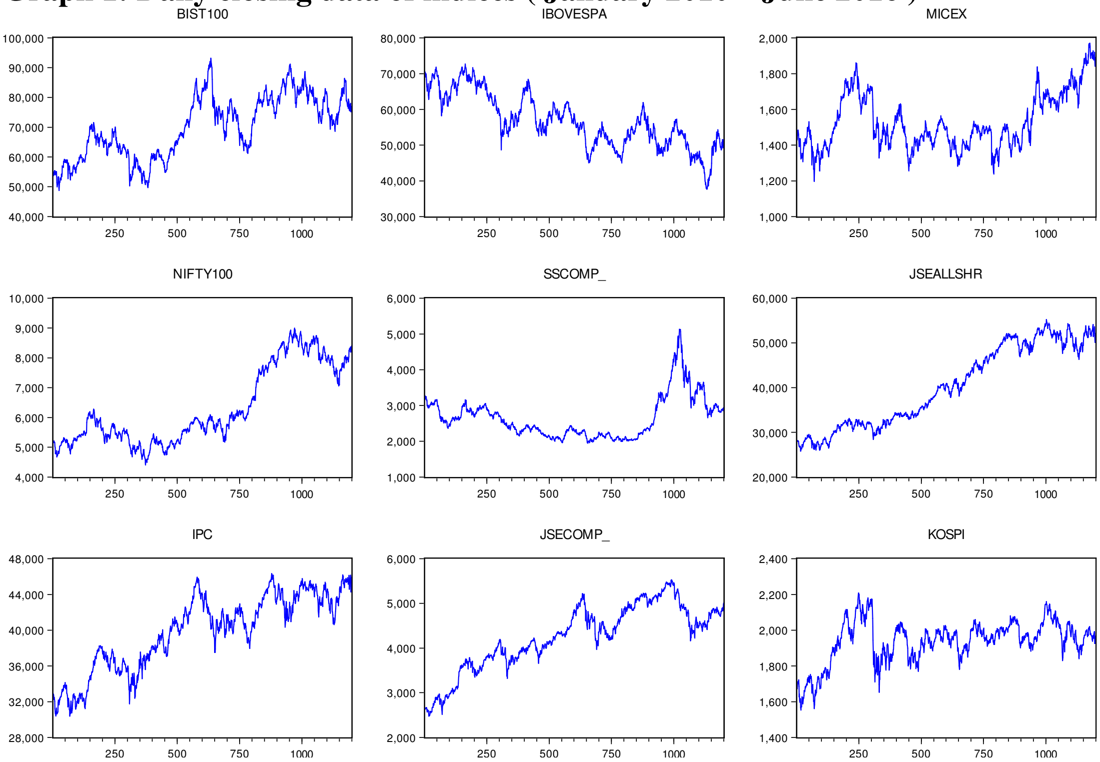
Table 1: List of the indices

COUNTRY	INDEX	COUNTRY	INDEX
Brasil	IBOVESPA	Mexico	IPC Index
Russia	MICEX	Indonesia	Jakarta Composite Index
India	NIFTY 100	South Korea	KOSPI Composite Index
China	Shangai SE Composite Index	Turkey	BIST 100
South Africa	Johannesburg SE All Share Index		

Graph 1: Daily closing data of indices (January 2010 – June 2016)



Graph 2: Indice Series with Logarithmic Value (January 2010 – June 2016)

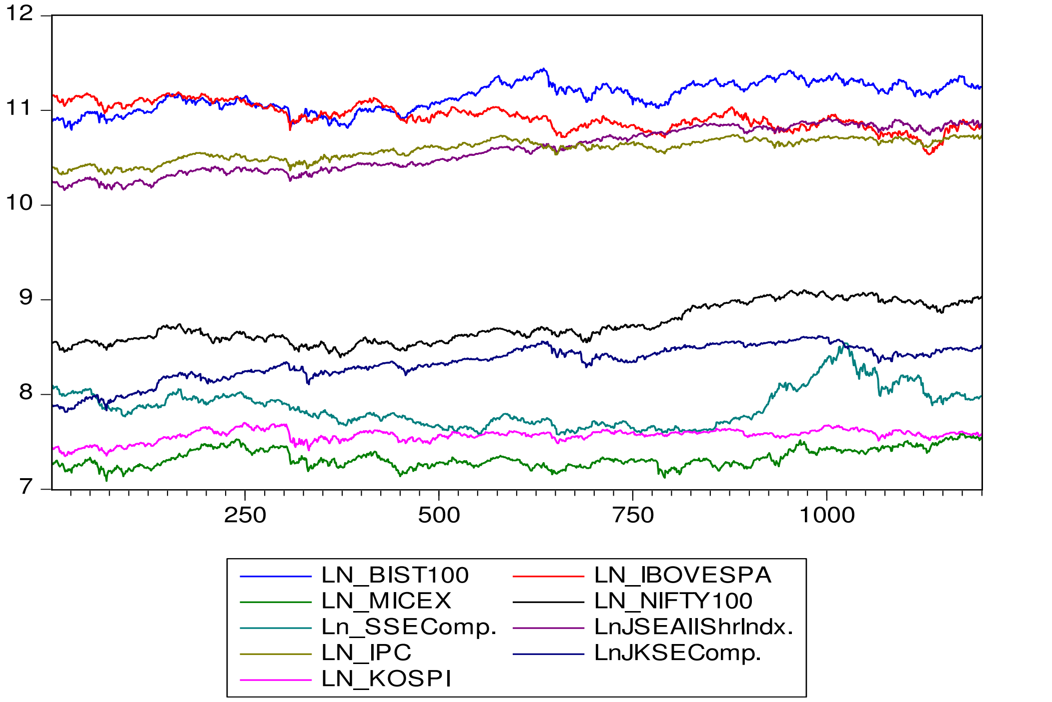


Table 2: Descriptive Statistics of Logarithmic Series

	ln_BIST100	ln_IBOVESPA	ln_MICEX	ln_NIFTY100	ln_SSECOMP	ln_JSEALLSHR	ln_IPC	ln_JKSECOMP	ln_KOSPI
Mean	11.14524	10.93588	7.327480	8.732213	7.862643	10.57791	10.58597	8.338996	7.567182
Median	11.16393	10.92883	7.304788	8.670240	7.815584	10.59255	10.61378	8.372050	7.579648
Maximum	11.44228	11.19351	7.585733	9.104024	8.543227	10.91851	10.74319	8.616729	7.700001
Minimum	10.79424	10.53596	7.087899	8.391267	7.575590	10.15786	10.32115	7.814227	7.347809
Std. Dev.	0.151053	0.133820	0.098961	0.197188	0.202936	0.228867	0.110196	0.184211	0.063712
Skewness	-0.230528	-0.146875	0.477792	0.470959	0.851962	-0.104819	-0.602954	-0.869877	-0.943137
Kurtosis	1.974633	2.573048	2.380231	1.757538	3.362354	1.540053	2.278875	3.183318	3.856377
Jarque-Bera	63.19747	13.42887	64.86278	121.5461	151.7330	108.7697	98.71166	153.0174	214.5705
Probability	0.000000	0.001213	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	13374.29	13123.05	8792.976	10478.66	9435.171	12693.50	12703.16	10006.80	9080.618
Sum Sq. Dev.	27.35768	21.47145	11.74220	46.62087	49.37845	62.80392	14.55976	40.68631	4.867029
Observations	1200	1200	1200	1200	1200	1200	1200	1200	1200

Table 3: Correlation Matrix of Logarithmic Series

CORRELATION	ln_BIST100	ln_IBOVESPA	ln_MICEX	ln_NIFTY100	ln_SSECOMP	ln_JSEALLSHR	ln_IPC	ln_JKSECOMP	ln_KOSPI
ln_BIST100	1.000000								
ln_IBOVESPA	-0.463210	1.000000							
ln_MICEX	0.343940	-0.148483	1.000000						
ln_NIFTY100	0.795284	-0.549890	0.492883	1.000000					
ln_SSECOMP	0.189752	-0.013532	0.607011	0.487221	1.000000				
ln_JSEALLSHR	0.820574	-0.737474	0.360147	0.872915	0.173755	1.000000			
ln_IPC	0.839872	-0.593849	0.365480	0.733976	0.067818	0.907467	1.000000		
ln_JKSECOMP	0.827993	-0.653222	0.270946	0.720776	0.009003	0.888367	0.900882	1.000000	
ln_KOSPI	0.586948	-0.161482	0.549015	0.468321	0.140267	0.554521	0.635995	0.681932	1.000000

Table 4: The Results of Stationarity Test *(Engle-Granger Analysis)*

	ADF Test for unit root in I(0)		PP Test for unit root in I(0)		ADF Test for unit root in I(I)		PP Test for unit root in I(I)	
AIC	None		None		None		None	
	t-stat.	Prob.	t-stat.	Prob.	t-stat.	Prob.	t-stat.	Prob.
ln_BIST100	0.561843	0.8375	0.564256	0.8380	-34.7921	0.0000	-34.7921	0.0000
ln_IBOVESPA	-0.57838	0.4668	-0.58065	0.4659	-34.2047	0.0000	-34.2023	0.0000
ln_MICEX	0.466124	0.8152	0.470344	0.8163	-35.1373	0.0000	-35.1373	0.0000
ln_NIFTY100	1.073817	0.9266	1.08861	0.9285	-32.2243	0.0000	-32.2243	0.0000
ln_SSComp.	-0.07100	0.6589	-0.19011	0.6177	-7.84835	0.0000	-33.7085	0.0000
ln_JSEALLShr.	1.829828	0.9843	1.68373	0.9780	-26.7475	0.0000	-35.6654	0.0000
ln_IPC	1.049219	0.9234	1.03306	0.9213	-19.2573	0.0000	-34.1296	0.0000
ln_JKSEComp.	1.591121	0.9731	1.556768	0.9711	-22.9747	0.0000	-34.6047	0.0000
ln_KOSPI	0.617685	0.8497	0.377872	0.7932	-8.52973	0.0000	-33.3146	0.0000

Table 5: Unit root test for Residual of Regression (*Johansen Analysis*)

		t-statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.867794	0.0001
Test critical values:	1% level	-2.566894	
	5% level	-1.941088	
	10% level	-1.616521	

Table 6: Lag Length Selection (Johansen Analysis)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	12117	NA	1.17E-20	-20.34958	-20.31115	-20.3351
1	32475.97	40375.77	1.86E-35	-54.43021	**-54.04587***	-54.28537
2	32639.58	322.0002	**1.62e-35***	**-54.56905***	-53.83882	**-54.29387***
3	32703.38	124.5817	1.66E-35	-54.54013	-53.464	-54.13459
4	32756.36	102.6654	1.74E-35	-54.49304	-53.07101	-53.95715
5	32800.67	85.20302	1.86E-35	-54.43138	-52.66346	-53.76514
6	32847.37	89.07373	1.97E-35	-54.37372	-52.2599	-53.57714
7	32879.41	60.64065	2.14E-35	-54.29145	-51.83173	-53.36451
8	32926.79	88.93847	2.26E-35	-54.23493	-51.42932	-53.17764
9	32964.15	69.57947	2.44E-35	-54.1616	-51.01008	-52.97396
10	33021.13	**105.2511***	2.54E-35	-54.12123	-50.62382	-52.80324

Table 7: Engle-Granger Cointegration Analysis Results

	Short Period Linking		Long Period Linking		
	CONFICIENT	**PROBALITY**		**CONFICIENT**	**PROBALITY**
		Criteria %10			**Criteria %10**
d(ln_IBOVESPA) (-1)	0.13526	0.0000	**ec_ln_IBOVESPA(-1)**	-0.00601	0.0824
d(ln_MICEX)	0.48501	0.0000	**ec_ln_MICEX(-1)**	-0.00690	0.0288
d(ln_NIFTY100)	0.49735	0.0000	**ec_ln_NIFTY100(-1)**	-0.01609	0.0016
d(ln_SSComp.)	0.13275	0.0000	**ec_ln_SSComp.(-1)**	-0.00791	0.0177
d(ln_JSEALLShr.)	0.72604	0.0000	**ec_ln_JSEALLShr.(-1)**	-0.01567	0.0019
d(ln_IPC) (-1)	0.08137	0.0605	**ec_ln_IPC(-1)**	-0.01981	0.0004
d(ln_JKSEComp.)	0.44151	0.0000	**ec_ln_JKSEComp.(-1)**	-0.01814	0.0011
d(ln_KOSPI)	0.45858	0.0000	**ec_ln_KOSPI(-1)**	-0.00763	0.0506

Table 8: Results of Johansen Cointegration Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.037409	167.0456	197.3709	0.5551
At most 1	0.02464	121.4076	159.5297	0.8255
At most 2	0.017193	91.54443	125.6154	0.8351
At most 3	0.016436	70.78577	95.75366	0.6961
At most 4	0.013327	50.94838	69.81889	0.5961
At most 5	0.011437	34.88866	47.85613	0.4539
At most 6	0.009283	21.11965	29.79707	0.3502
At most 7	0.005971	9.956595	15.49471	0.2841
At most 8	0.002326	2.787821	3.841466	0.0950

Table 9: The Results of Granger Causility Tests

Lag 5	Long Period (ln series)			Short Period (d_ln series)		
	F-Statistic	Prob. (%5)	Result	F-Statistic	Prob. (%5)	Result
ln_IBOVESPA	5.444613779	0.000058366	H_0 reject!	6.282033926	0.000009200	H_0 reject!
ln_BIST100	1.598962416	0.157450885	H_0 accept!	0.485896331	0.786988497	H_0 accept!
ln_MICEX	0.73280141	0.598882512	H_0 accept!	0.222831474	0.952763409	H_0 accept!
ln_BIST100	0.349630419	0.882660122	H_0 accept!	0.175400126	0.971808911	H_0 accept!
ln_NIFTY100	1.847975027	0.100765451	H_0 accept!	1.618885411	0.152038547	H_0 accept!
ln_BIST100	1.797318265	0.110509205	H_0 accept!	1.841264207	0.102010123	H_0 accept!
ln_SSComp.	0.344685695	0.885817162	H_0 accept!	0.128788831	0.985871032	H_0 accept!
ln_BIST100	2.912198269	0.012776372	H_0 reject!	2.061217434	0.067822009	H_0 accept!
ln_JSEALLShr.	1.027973052	0.399600240	H_0 accept!	0.292979919	0.916976917	H_0 accept!
ln_BIST100	0.693341461	0.628534707	H_0 accept!	1.450690587	0.203361967	H_0 accept!
ln_IPC	2.901357973	0.013059986	H_0 reject!	2.017678365	0.073598954	H_0 accept!
ln_BIST100	1.582588291	0.162027157	H_0 accept!	1.611153565	0.154119332	H_0 accept!
ln_JKSEComp.	2.678069724	0.020458133	H_0 reject!	2.292128323	0.043661261	H_0 reject!
ln_BIST100	8.39388985	0.000000082	H_0 reject!	8.469252784	0.000000069	H_0 reject!
ln_KOSPI	1.034692445	0.395637702	H_0 accept!	0.764397329	0.575514602	H_0 accept!
ln_BIST100	9.829548894	0.000000003	H_0 reject!	9.797579004	0.000000003	H_0 reject!

(H_0 : Indice X does not granger cause of Indice Y.)

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