

Comovement Between Pakistani Equity Market and BRICS Countries: An Investigation Through Co-Integration Analysis

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Abstract

This study is conducted to check the co-movement between the equity markets of BRICS countries that is Brazil, Russia, India and China with Pakistan. These countries are selected because they are world emerging markets. Co-movement is checked through co-integration analysis. Ten years monthly stock indices are taken for analysis that is from July 2006 to June 2016. No cointegration is found between Pakistani equity market and the BRICS countries. So, this favours the international portfolio investors. Furthermore, Brazilian market is found to be the most attractive market for the portfolio investors in order to maximize their wealth by minimizing their risk levels. The future research can be extended by using high frequency data in order to check the comovement and cointegration.

Key Words: Comovement, cointegration, BRICS, equity markets, ADF, financial risk, diversification

Introduction

No country is self-sufficient; every country depends on one another in way or another. The changes made in modes of trade and business has raised many options and opportunities to the investors to maximize their wealth. There are many factors involved in the advancement of trade, business and investment. Some of the factors responsible for the advancement of the business include technology, trade reforms, political and economic interests and the interdependency on one another. The various trade agreements, trade liberalization and economic integration between various countries have opened doors for the investors to invest across borders in order to take advantages from the investment opportunities. All this allow investors to diversify their investments in order to increase their profits with the minimum level of risk taken. Co-integration is a statistical term which is a property of time series variables.

BRICS Countries and Pakistan

The concept of BRICS was first coined by Goldman Sachs (2001) in his research paper. He said that BRICS countries that are Brazil, Russia, India and China will play a key role in the world's economy in the future. In another paper in 2003 by Goldman Sachs, tried to predict the future of world economy over the next 50 years. In that paper

it has been predicted that BRICS countries would be key players in world's economy. It is forecasted that BRICS together will have greater economy than the Group of Six (USA, UK, France, Germany, Japan and Italy) of the world in not more than the next 40 years. It has also been forecasted that over the next 50 years of time span only US and Japan can defend their position to be in the Group of Six. This situation will be only due to the emergence of new markets. According to the paper BRICS countries have many problems especially the infrastructure and their political situation.

Today we clearly see that the predictions made by Goldman Sachs (2001) are on its way to be proved. BRICS are gaining its importance economically as well as the politically. Few achievements they made over the last few years or so include the joining of World Trade Organization (WTO) by China in 2001, a step towards modernizing its industries. Brazil has gained tremendous momentum in lifting its economy over the last few years. Brazil joined strategic partnership with its two other members that is India and China.

Purpose of the Study

Purpose of the study is give guidelines to the policy makers, academia and investors to invest in markets which suit them well. The study will give all the stated parties an edge over the others while considering these countries for policy, research and an investment purpose. The objective of the study is to examine and verify the co-movement between Pakistan stock market and markets of Brazil, Russia, India and China. They are collectively termed as BRICS countries and are the emerging markets of the world. To check the co-movement through co-integration analysis is also an objective of the study. The study will contribute in the field of investment and trade, policy making and further research. The study will give guidance to the portfolio investors to minimize their risk and maximize their wealth. This paper consists of mainly four chapters. The first chapter is the "Introduction". Second chapter is about the work done in the related field in past that is the "Literature Review". Third chapter defines the "Methodology and Data Analysis" and final chapter is the ultimate "Conclusion and Suggestions".

Literature Review

Number of studies have been undertaken to analyze the comovments amongst different stock markets. Tahir and Sabir (2013) inquired the relationship between developed markets and South Asian Markets and their impact on Karachi Stock Exchange (KSE) Pakistan. They analyzed the data from July 1999 to June 2011 for four major South Asian Markets and four developed markets. They used correlation, unit root, and Granger Causality and co integration and found no relation amongst the developed markets and South Asian markets under correlation test whereas they stated that India and US markets are correlated. They further found a strong relationship between Karachi Stock Exchange and Chinese Stock Exchange under Granger Casualty test.

They suggested the managers that KSE shall be included in developed market portfolios as KSE has no cointegration with the developed markets. So, they suggest the investors to invest in South Asian Markets as it will be beneficial in minimizing the risk and maximizing their wealth.

Chang, Nieh and Wei (2006) conducted a study to check a long term equilibrium linkage between Taiwan's equity market and the four developed European markets of France, Germany, United Kingdom and Netherlands. Chang et al (2006) analyzed the data and concluded that there is no cointegration after testing the four pairs of statistical tests that are PO, HI, JJ and KPSS. With this result they said that Taiwanese investors can take long term financial benefits by diversifying their portfolio and investing in the selected European markets. They said that these findings will help investors in the long run.

Camelia and Ilie (2012) conducted a study to check the impact of stock market variability on the economic activities of Romania and the reasons responsible for the crash of Romanian stock market in the context of correlation and co movement of stock markets. They checked the correlation and the co movement of Romanian Stock market with North American and European markets. Finally they said that Romanian investors imported the financial crisis by investing heavily in North American and European markets as a strong correlation and co movement was found amongst them.

Cheung et al., (2006) stated that structure of information is different in the crisis than in the non-crisis situations. This has been observed after the Asian financial crisis in 1997. They have checked the relationship amongst four East Asian markets and US market. After the analysis they said that it is the US market which leads the four Asian markets all the time that is before, during and after the financial crisis. They also stated that during the crisis time Japanese currency is responsible for affecting these four markets.

Chow, Huang and Niu (2012) applied regression and time varying correlation to check the integration amongst East Asian markets namely Korea, China, Hong Kong, Taiwan and Singapore and co movement with US market. Chow et al., (2012) found that integration has been increased amongst Korea, Hong Kong Taiwan and Singapore whereas integration of China has been increased since the opening of Shanghai stock market in 1990 and the US recent crisis has affected the economies of East Asian Countries. They have an interesting finding that despite the investment and trade relations Japan and US have not so close integration rather China's linkages has been increased with US.

Friedman and Shachmuove (2008) conducted a study in which they used VAR model by taking eight European countries daily returns and they find that UK, France, Germany and Netherland have strong linkages whereas the smaller markets are independent. They have further investigated that UK has 91% of innovations of its own

and it is leading market, so it is not influenced by others whereas others are affected by the larger economies like Germany and France.

Worthington and Higgs (2007) have examined the relationship and integration amongst the Asian equity markets which include three developed markets that is Hong Kong, Singapore and Japan and eight emerging economies namely Korea, Malaysia, Philippines, Taiwan, China, India and Thailand. They tested unit root test, cointegration and Granger causality test on the data and stated that there is long term relationship amongst them. They added that they also have causal relationship. They concluded that there is strong integration amongst the stated Asian markets just like European Union has it.

Busse, Goyal and Wahal (2009) examined the investment opportunities available for the US investors globally and came to the conclusion that due to many differences between the developed market and the emerging markets there is high level of variability in returns as well as the associated risk of the investment. With these findings they stated that it is harder for the investors to perform superior as compared to others.

Lucey and Muckley (2000) conducted a study and examined the short term as well as long run interrelationship between the Asian and European markets extended to the United States of America. They concluded that in short term Asian markets do not have that level of cointegration with European and US market as that between US and European markets. On other hand they concluded that Asian market have long run interdependencies with US markets and they further founded that this long run interdependencies are absent between US and European markets. So present their final remarks as that in long run correction are not informative from the diversification point of view. So they suggested US investors to take co integration into account rather than correlation if he has inclination towards diversification.

Ali et al., (2011) said that the key factors in arousing the interest of investors to invest in other stocks to subject of co-movement between the stocks of different countries is the increasing level of globalization. They conducted a study in which they had tried to investigate the co movement between Pakistani equity market and seven other countries which include U.S.A, U.K, India, Malaysia, Taiwan, Singapore, Indonesia and Japan. They investigated this through co integration test and monthly stock prices have been used for a period of ten years that is from July1998 to June 2008.They concluded that Pakistani equity market has no co-integration with the markets of U.S.A, U.K, Singapore , Taiwan and Malaysia. Here they have suggested the investor to invest freely and it will help them to minimize their risk and maximize their wealth. While Co-integration do exists between Pakistan equity market and China, Indonesia, India and Japanese equity market and the stock prices move together. So here the investor has very low chance of risk minimization while investing in these countries Stocks along with the investment in Pakistani equity market. During the data analysis

they had tested the variables for the unit root to give order to the integration by employing Augmented Dickey Fuller statistics (ADF). After establishing the order of integration, co integration test was applied to predict (check) the long run relationship. Finally Granger Causality has been applied to check the short run relationship among the stock indices of different markets. The study shows that co integration vary with the selection of frequency of stock that is suing , daily, weekly, monthly ,quarterly stock indices/prices.

Trivedia and Birav (2013) said that financial crisis over the globe (1997, 2008 etc.) has inclined the interest of the research to work in this particular field that is theoretical and applied finance. Stock market is one of the most attractive areas for conducting an applied research. Many policy makers, financial investors and academicians have provided many results by analyzing this issue. They investigated the co movements between the emerging and developed stock equity from the global financial crisis perspective. They took daily indices closing prices for the period of ten years that is from January 2003 to January 2013. They run series of integration test and found that co-movements, interdependency and inter-linkages do exists between developed and under developed equity markets .They found that the highest return payer country is Hungary and emerging stock market country with relatively high risk ratio is Romania. While among the developed equity markets France and Japan were found with highest return payer and having risk ratio. They used advanced level econometric models and technologies.

Aktan and Bulut (2008) conducted a research to examine the impact of corporate entrepreneurship on the financial performance of the firms in Turkey. The data taken for analysis include 2032 respondents of active 312 firms. They run multiple regression and confirmatory factor analysis to test the hypothesis. They found that there is a positive correlation between the tested hypotheses that is the innovativeness, risk orientation (level of risk taking) relative aggressiveness and proactiveness of entrepreneurs firms with the financial performance.

Ruxanda and Stoenescu (2009) tested bivariant and multi variant co integration and their applications in different stock markets which include stock exchange indexes from Romania, France and U.S.A. They have used stock prices daily. Dickey fuller and unit root test were used and they found that non stationary series were three and every series is of 1st order integration They also tested Engle Granger procedure and found that BAT(Romania stock series) and CAC40 (France stock exchange) are integrated. So finally they estimated the error correction model. So they found that around 2 % of the gap between the two series is adjusted every day. Finally they run Johansen procedure and concluded that co integration system is formed between the three series. Eventually they came to the conclusion that co integrated variables can be used to generate error correction model.

Zhou (2013) conducted a study of co movement relation between U.S.A, U.K, Japan and the Asian emerging markets and he found that there exists a common long term equilibrium relationship of some emerging markets with some developed markets. He also said the interdependency increase between the Asian emerging markets and developed markets after 1997 Asian financial crisis. Levy and Sarnat (1970) stated that one of the reasons for going for diversification internationally is that stock prices move together within a close economy where the investing cannot minimize their risk and maximize their wealth.

Grubel and Fadner (1971) said that the stock prices of both global and international move together and have no or weak relationship which results in higher gains and lower loss due to changes only in exchange rates. They further stated that co movement of stock prices across countries are not related due to different government setups, policies, Management, and economic dependencies. Sodie, *et al.* (1999) found that the risk can be minimized if investors invest in unrelated stock and there are higher possibilities and securities across countries have low correlation. So investors can easily diversify their portfolio by investing in a cross countries securities.

Worthington (2003) checked the stock prices linkage of Asian markets for the period of January 1998 and February 2000. Six emerging markets of Taiwan, Indonesia, Thailand, Philippines, Korea and Malaysia and three developed markets of Japan, Singapore and Hong Kong. By using multi co integration analysis results. He has shown that there is lower causal relationship among the Asian markets so he suggested that investors can go for diversification in the Asian markets. Kawan *et al.*, (1995) studied the markets of Australia, U.K, Japan, Hong Kong, Singapore, U.S, South Korea, Taiwan and Germany and came to the conclusion that these markets have lead-lag relationships. Ghosh, *et al.* (1999) found that there exist a long run equilibrium relationship between some of the Asian markets and some of the emerging markets. Singh (2010) came to the conclusion that Indian and Chinese markets have co integration with developed markets of U.S.A, U.K, Japan, and Hong Kong after the mortgage crisis of 2008 under the granger causality analysis.

Zhou (2008) found out that the Chinese markets has the highest return also with the higher risk level while India has the highest standard deviation. They showed that Indian and Indonesian markets have higher co integration with U.K. China has Co integration with U.S.A. Singapore has co integration with Japan and Philippines have co integration with Japan and U.K. So they have lower diversification opportunities among themselves. They found that after the Asian financial crisis in 1997 the positive correlations have increased among these countries so here investors have little chance to minimize their risk of portfolio.

Romana (2013) quantified the impact of global financial crisis on the emerging capital markets. They found out that the emerging capital markets have asymmetric volatility effects taking in account the fact that negative information has more intense and

adverse effects than the positive information. BRICS economies that are Brazil, Russia, India and China have emerging capital markets and empirical analysis is based on this. They have used the methodology including unit root test, granger causality test, BDS test, and Augmented Dickey Fuller stationary test and Johansen co integration method. Romana (2003) stated that internationalization of capital emerging market have very deep implication with the 2007 global financial crisis that started from U.S. Wong, Perum, Terrell, and Lim (2004) found that there exists comovement between some Asian emerging markets and the developed where as some emerging markets differ from other developed markets where they have long term equilibrium relationship. They found that the co integration has been increased since 1997 Asian financial crisis, so, the advantage of diversification is adversely affected.

Methodology

Most of the studies have shown that most of the markets have co movements amongst them. Due to globalization, formation of trade blocks and trade and investment contracts between markets, have increased the opportunities for the investors all over the globe. Researchers have shown that many markets have integration amongst them. Using correlation, unit root, and Granger Causality and co integration Tahir and Sabir (2013) found no relation amongst the developed markets and South Asian markets under correlation test whereas they found that India and US markets are correlated. They further found a strong relationship between Karachi Stock Exchange and Chinese Stock Exchange under Granger Casualty test. They suggested the managers that KSE shall be included in developed market portfolios as KSE has no cointegration with the developed markets. So, they suggest the investors to invest in South Asian Markets as it will be beneficial in minimizing the risk and maximizing their wealth.

The more the co integration or co movement, the less it is beneficial for the investors to diversify its portfolio. Here the motive of the investor is diversifying its portfolio and maximizing their wealth. If the co integration is low then it will be beneficial for the investors to invest in those markets. All this is backed by the portfolio investment theory which says that investors can maximize their wealth and minimize their risk through diversification that is by making a portfolio of investments rather than stick to just one type of securities or market. This means not putting all the eggs in a single basket.

Research Design

The research is quantitative as degree of co movement and co integration has to be checked amongst the selected markets. In quantitative research we have to deal with numerical data, explaining a phenomenon. Secondly various statistical tests are applied on the data to get the ultimate results. Here in this study the co movement has to be checked between Pakistani equity market and the four emerging markets of the world namely Brazil, Russia, India and China (BRICS) through co integration analysis. The

co movement differs amongst the stock indices from time to time. This inconsistent behaviour is due to the selection of time period, the frequency of observation taken that is daily, weekly or monthly and the selection of stock markets to be tested.

Data Collection and Sample

The data type for the research is secondary one and is collected from the secondary sources. Websites of the stock markets under study and yahoo finance site are used for collecting the required data. Monthly stock indices are taken of each market from their websites and yahoo finance. The data consists of 120 monthly observations for the period from July, 2006 to June, 2015 for each. The reasons behind taking monthly indices not daily, quarterly or annual stock indices is that quarterly or annual data may result in false results when not compromising on the available degrees of freedom required in selecting appropriate lag structures (Patra, & Poshakwale, 2006). The following are stock market of the selected countries for the study.

Table 1 *Selected Countries and their Stock Markets*

Country	Index
Pakistan	Karachi Stock Exchange (KSE-100 Index)
Brazil	Brazil Stock Exchange (BOVESPA)
Russia	Russia stock market (MICEX)
India	Bombay Stock Exchange (BSE Sensex)
China	Hong Kong Stock Exchange (Hang Seng Index)
South Africa	Johannesburg Stock Exchange (JSE)

Specification of Variables

The variables to be tested are the degree of co movement and correlation of stock markets indices between Pakistani equity market and BRICS countries that is Brazil, Russia, India and China. Variables are formed in such a way that co-movement and co-integration is checked in the following sequence;

- Pakistan and Brazil
- Pakistan and Russia
- Pakistan and India
- Pakistan and China
- Pakistan and South Africa.

The data that is to be tested is taken from the stock markets websites and yahoo finance. The tests to be tested on the required data include unit root test, Engle Granger test and cointegration analysis. Data is normalized in two cases. Firstly logarithmic transformation is taken to check the stationarity of the data. Secondly natural logarithm is taken to check non-stationarity of the data for the co-integration purpose.

$$I) \quad \text{Log}(P0/P1)$$

$$II) \quad \text{Log}(P1)$$

Unit Root Test (ADF)

To check the long run relationship between Pakistan stock market (KSE) and equity markets of the BRICS countries. It is important to verify whether the data series is stationary or non-stationary. For this entire, augmented Dickey Fuller unit root test has been in use. It has the following model in mathematical form.

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 \Delta Y_{t-1} + \varepsilon_t$$

β_1 is examined to check the stationarity of the data. Where

$$\beta_1 = \sigma - 1$$

Co-integration Test

Engle Granger test is employed to check the co-integration between time series data of Pakistani equity market and BRICS countries markets. The data sets are said to be co-integrated if certain common deviation or drift is found amongst them. Linear combination of W_t and U_t must be stationary if they are co-integrated.

Mathematically;

$$W_t = \beta U_t - V_t$$

So at first step all the data is transformed in logarithmic form then unit root test (ADF) is employed to check the data whether it is stationary or non-stationary. Then data is passed through co-integration test for which Engle Granger test is employed.

Data Analysis and Interpretation

After devising the methodology, the time series data is passed through many statistical tests. At the first step descriptive analysis is performed, after that, unit root test (ADF) is employed. At the third step after verifying the stationarity via unit root test the co-integration test is conducted by running the test of Engle Granger.

Descriptive Analysis

Descriptive statistics is performed after the logged transformation of the data for the selected markets.

Table 2 *Descriptive Statistics of the Selected Countries*

Country	Mean	Standard Deviation	Maximum	Minimum	Skewness	Kurtosis
Pakistan	0.0193	0.0732	0.2022	-0.2204	-0.6359	1.2893
Brazil	0.0265	0.0621	0.1445	-0.1215	-0.3267	-0.2846

Russia	0.0238	0.0763	0.1472	0.1821	0.6282	0.0300
India	0.0214	0.0744	0.1461	-0.1983	-1.0332	1.0784
China	0.0132	0.0556	0.1441	-0.1703	-0.6441	1.5934

Mean is the average value. Standard deviation is the level of risk. Skewness is the data distribution of the time series around the mean whereas kurtosis shows the peakness or flatness of the time series.

The table above shows the values of descriptive statistics in terms of mean, standard deviation, stocks maximum and minimum returns, the skewness and kurtosis of the time series. Mean is the average value of the time series. Brazil has the highest mean value and China has the lowest mean value. Russia has the highest level of standard deviation followed by India and Pakistan respectively. Skewness shows the normal distribution of the data. The skewness value for Pakistan, Brazil, India and China is negative which means that extreme values lies on the left and most of the values are clustered on the right side of the mean whereas Russia also has the same data distribution but with positive value of 0.6282 which is also less than zero. Kurtosis is a statistical term which shows the height or flatness of the data distribution. All the time series of the selected markets have values less than 3 which mean that normal distribution has wider peakness and is more flat than normal. Also, the extreme values have less probability and most of the data is concentrated around the mean. This type of distribution is termed as platykurtic.

Unit Root Test (ADF)

The Augmented Dickey Fuller Test is employed to check the stationarity of the time series.

Table 3 *Augmented Dickey Fuller Test*

Indices	Level	
	With Constant	With Constant and Trend
Pakistan	0.3186	0.9905
Brazil	0.9503	0.02795
Russia	0.7755	0.9306
India	0.972	0.4356

China	0.7964	0.8262
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*The table presents P-value @ 5% significance level which shows stationarity of the series.

The above table is the result of the Unit Root Test (ADF) which shows that time series of all the selected markets are non-stationary with P-value greater than 0.05(5%) with constant at level. The time series is stationary for Brazil having P-value less than 0.05(5%) with constant and trend. Here H0 is rejected while rest of the series is found to be non-stationary. Means H0 is accepted and H1 is rejected.

Engle Granger Test

After running ADF test with the help of which we found whether the data is stationary or non-stationary, Engle Granger test is employed to check the cointegration amongst the markets.

Table 4 *Engle Granger Test*

Country	P-Value
Pakistan and Brazil	0.9263
Pakistan and Russia	0.2706
Pakistan and India	0.8207
Pakistan and China	0.8527
Pakistan and South Africa	0.9281

**Co-integration test showing P-value @ 5% significance level.*

Analyzing the results of the Engle Granger output stated in the Table above, it can be inferred that step one tests the stationarity of KSE which shows that KSE time series is non-stationary. Step two shows that the time series of Brazil is also non-stationary. As a result of the cointegrating regression, it can be inferred that the regression residual is also non-stationary which shows that the two series are not cointegrated having P-value greater than 0.05 that is 5%. Similarly co-integration is examined for KSE and Russia. Results were the same for both series as cited above that time series of both the markets are non-stationary and the residual P-value is also greater than 5%(0.05) which means that no cointegration is found amongst them. Similar findings are found for the other two combinations that is no combination of time series found to be co-integrated.

Conclusion

After conducting the study regarding the co-movement between Pakistan stock market and markets of the selected countries namely Brazil, Russia, India and China through co-integration analysis by using their monthly indices, it has been concluded that Brazil has the highest returns where as Russia has the highest level of standard deviation. So, it is inferred from the analysis that Brazil is the most attractive market from the investment point of view for portfolio managers or investors where investors can minimize their level of risk and maximize their wealth. After analyzing the co-integration test of Engle Granger it has been concluded that Pakistan has no co-integration with any of the selected markets means that Pakistan is not co-integrated with Brazil, Russia, India or China. It is recommended for the Pakistani portfolio investors to invest freely in the selected markets without any hesitation as no co-integration is reported amongst them.

The research can be extended by examining the co-integration for the higher frequency (daily or weekly). The other area to extend this research is to examine the relation of Pakistani equity market with other markets. This study is supplement for the academia for further investigation of relationship amongst these markets by using different models and variables.

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