

Linkage Between Stock Market and Foreign Exchange Market in Brics

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Abstract: *This paper attempts to examine whether or not a causal relationship exists between foreign exchange rates and stock market in BRICS. By applying the techniques of Granger Causality test and Co-integration test, relationships between both these markets were determined for data between 2009 and 2019. The Granger causality test result there exist unidirectional relationship between Russia, India, China and South Africa. Co-integration test results long run relationship exist for India and China. Further, the study suggest that these results would be helpful for the investor to predict one market by using the information of other market and also will help financial managers to obtain decision relating to portfolio diversification.*

Keyword: *Linkages, Causality, uni-directional, Co-integration, Portfolio diversification*

I. INTRODUCTION

BRIC is an economic initialization for the developing countries of Brazil, Russia, India, and China. Economists believe these four nations will become dominant suppliers of manufactured goods, services and raw material by the year 2050. China and India will become the world's dominant suppliers of manufactured goods and services, respectively, while Brazil and Russia will become similarly dominant as suppliers of raw materials.

This growth is due to lower labor and production costs in these countries. The BRIC initialization expanded to include South Africa as the fifth nation in 2010. Many companies also cite BRIC nations as a source of foreign expansion, or foreign direct investment (FDI) opportunities. Foreign business expansion happens in countries with promising economies in which to invest.

Equity investors purchase shares of a company with the expectation that they'll rise in value in the form of capital gains, and/or generate capital dividends. If an equity investment rises in value, the investor would receive the monetary difference if they sold their shares, or if the company's assets are liquidated and all its obligations are met. Equities can strengthen a portfolio's asset allocation by adding diversification. International investments offer to investors the opportunity of further reducing risk due to the low correlations between countries. However, with internationalization comes another important risk, one not to be omitted, i.e. the foreign exchange-risk. This risk should be properly evaluated and included in business plans in all areas of international investments,

Therefore, this paper is to investigate the linkage between stock market and foreign exchange market in BRICS. The paper is structured as follows. The next section offers a short overview of the related literature, followed by the discussion of data and

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research methodology in Section3, while Section 4 presents and discusses the main empirical results. Finally, Section 5 concludes the research and explain the limitation of this research.

II. LITERATURE REVIEW

Bonga-Bonga and Gnagne (2017) study the impact of exchange rate risk on equity returns and bond yields as well as the volatility spillover between the foreign exchange, equity and bond markets in the BRICS economies using multivariate generalized autoregressive conditional heteroscedasticity (GRACH) applied on weekly data. The results show that exchange rate volatility has a positive impact on ten-year bond yields in all BRICS countries except in South Africa, where the volatility of exchange rate has a negative impact. In addition, volatility to exchange rate positively influences equity returns in Brazil, India and South Africa, while the influence on Chinese and Russian equity returns is negative. These findings show that equity returns increase with the increase in exchange rate volatility in Brazil, India and South Africa, and decrease in China and Russia. Furthermore, the results on volatility spillovers between the equity returns, bond yields and foreign exchange markets show that the transmissions are from capital markets to foreign exchange market in South Africa, while the volatility to currency markets influence capital markets in Russia. The results of the study give evidence of bidirectional volatility transmissions in Brazil and China.

Another study by Gary and Southeastern (2016) examine the time-series relationship between stock market index prices and the macroeconomic variables of exchange rate and oil price for Brazil, Russia, India, and China (BRIC) using the Box-Jenkins ARIMA model. Although no significant relationship was found between respective exchange rate and oil price on the stock market index prices of either BRIC country, this may be due to the influence other domestic and international macroeconomic factors on stock market returns, warranting further research. Also, there was no significant relationship found between present and past stock market returns, suggesting the markets of Brazil, Russia, India, and China exhibit the weak form of market efficiency.

Kanniah and Mutry (2016) found that BRICS nations are highly open to the trade for their economic development and the international trade completely depends on the exchange rate. These two variables are directly influencing inflation in this developing economic block. In the study period, these independent variables (exchange rate, forex reserve and trade openness) individually correlate with the GDP of BRICS nations. Whereas Han and Zhou (2017) investigate the relationship between stock and foreign exchange rates for BRICS countries pre- and post- U.S. sub-prime crisis and European sovereign debt crisis. With a wide set of exchange rates, the mixed c-vine copula models are used. The results show the correlations are negative for most of the stock/exchange rate pairs. After the U.S. crisis, the stock markets in BRICS countries have stronger negative dependences and risk hedge ability with the USD and JPY currencies. However, after the European crisis, the changes of the correlations are diverse. The risk hedge effectiveness of stock markets in BRICS countries against foreign currencies decreases. These findings suggest that BRICS countries and investors should pay more attention on the multivariate exchange rates and the flows of cross-border capitals with their influence on the local stock markets after the crisis.

Another more recent study by Mechri et.al (2019) research aims to identify the impact of exchange rate volatility on the fluctuations of stock markets prices from Turkey and Tunisia. In this study, we integrate assorted determinants of stock market indices that have not been used simultaneously before. The GARCH model is employed. The results show that exchange rate volatility have a significant effect on stock market fluctuations.

Based on above literature review, several gaps in the literature have been identified, indeed, previous works used very short periods of study, many important variables were neglected, and some results were contradictory.

III. RESEARCH METHODOLOGY

This study aims to examine the relationship between stock market and foreign exchange market in BRICS. The study is based on the secondary data and weekly data is adopted for the study i.e., 01 April 2009 to 31st March 2019 yielding a total of 522 observations. The reason for using weekly data is to capture more information than we can do in monthly data. The sample includes five countries i.e., Brazil, Russia, India, China and South Africa.

Bovespa Equity Index has been selected as representative stock market for Brazil and the national currency of Brazil is Brazilian Real. Russian Trading System Index (RTSI) has been selected as representative stock market for Russia and the national currency of Russia is Russian Ruble. National Stock Exchange(NSE) has been selected as representative stock market for India and the national currency of India is Indian Rupee (INR). Shanghai Composite Index has been selected as representative stock market for China and the national currency of China is Chinese Yuan. FTSE/JSE All Share Index has been selected as representative stock market for South Africa and the national currency of South Africa is South African Rand. The data is collected from secondary sources such as www.yahooofinance.com, www.investing.com, www.indiaonline.com and www.econstats.com.

IV. RESEARCH HYPOTHESIS

The research hypothesis is developed on the basis of current literature on co-integrating relationship of stock return and exchange rate volatility and the unknown direction of relationship of the exchange rate, stock return volatility. As it is still not clear whether the exchange rate volatility is causing the exchange rate volatility or the stock return volatility is causing exchange rate volatility.

Hypothesis 1(Long run relationship)

Ho: There is no long-run relationship between exchange rate and stock return volatility

H1: There is long-run relationship between exchange rate and stock return volatility

Hypothesis 2(Short run relationship)

Ho: Exchange rate does not granger cause stock return

H1: Exchange rate granger causes stock return

V. ANALYSIS & DISCUSSION

Table 1: Descriptive statistics of Stock Market

Countries	Mean(%)	S.D(%)	Skewness	Kurtosis	Jarque-Bera
Brazil	1.860	26.653	9.388	161.923	84.762
Russia	2.295	60.852	4.169	62.945	19.054
India	0.223	2.110	7.367	118.654	33.451
China	0.022	0.553	12.125	227.600	40.891
South Africa	1.160	12.453	8.983	152.108	39.029

The table 1 summarizes the descriptive statistics of BRICS stock market index. The average stock price of Russia i.e.,2.295 is found to be higher while compared to all other countries stock market index. It is very that investor had the higher opportunity of earning higher return in Russia stock market while compared to other countries. Nevertheless, those high returns do not come without a higher risk i.e., the standard deviation is found to be higher for Russian stock market i.e., 60.852. The Skewness is found to be positive for all the countries which implies long right tails suggesting that the investors have a higher probability of earning positive returns in the market. The coefficients of kurtosis were found to be positive for all the countries which indicates platykurtosis (flatness of data).

Table 2: Descriptive statistics of Exchange Rate

Countries	Mean	S.D	Skewness	Kurtosis	Jarque-Bera
Brazil	7.42E-05	0.001	14.840	294.383	51.347
Russia	0.001252	0.0182	11.893	216.348	33.784
India	0.022	0.0224	20.653	456.502	46.121
China	0.0001	0.003	22.400	508.597	42.565
South Africa	0.0002	0.004	13.773	264.517	67.192

The table 2 summarizes the descriptive statistics of BRICS exchange rate. The average stock price of Brazil i.e., 7.42 E-05 is found to be higher while compared to all other countries exchange rate against USD. It is very that investor had the higher opportunity of earning higher return in USD/BRL while compared to other countries exchange rates. The standard deviation is found to be higher for USD/INR i.e., 0.0224. The Skewness is found to be positive for all the countries which implies long right tails suggesting that the investors have a higher probability of earning positive returns in the foreign exchange market. The coefficients of kurtosis were found to be positive for all the countries which indicates platykurtosis (flatness of data).

Table 3: Unit Root test of Stock market

Countries	ADF Test		PP Test	
	Level	First Difference	Level	First Difference
Brazil	-2.784	-23.686*	-2.784	-23.686*
Russia	-1.603	-22.502*	-1.672	-22.502*
India	-1.140	-22.475*	-1.092	-22.631*
China	-1.937	-24.143*	-1.559	-25.316*
South Africa	-0.195	-23.535*	0.264	-24.733*

*indicates 1% level of Significance

The table 3 reports the Dickey-Fuller test and PP statistics under the null hypothesis of unit root. The table also presents the number of lagged difference terms included in the regression. The hypothesis of unit root against the stationary alternative is not rejected at the 5% level for exchange rates and stock index with or without a deterministic trend. However, the first difference of these variables is stationary under the test. Hence, the study concludes that these variables are integrated of order 1.

Table 4: Unit root test of Exchange rate

Countries	ADF Test		PP Test	
	Level	First Difference	Level	First Difference
Brazil	-1.532	-14.010*	-1.538	-22.653*
Russia	-1.139	-20.884*	-1.290	-21.520
India	-0.937	-20.910*	-0.974	-20.907*
China	-1.253	-22.450*	-1.540	-22.744*
South Africa	-1.309	-23.867*	-1.293	-23.935*

*indicates 1% level of Significance

The table 4 reports the Dickey-Fuller test and PP statistics under the null hypothesis of unit root. The table also presents the number of lagged difference terms included in the regression. The hypothesis of unit root against the stationary alternative is not rejected at the 5% level for exchange rates and stock index with or without a deterministic trend. However, the first difference of these variables is stationary under the test. Hence, the study concludes that these variables are integrated of order 1.

Table 5: Lag selection criteria for selecting optimal lag length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-23884.71	NA	1.13e+28	92.97553	93.05807	93.00788
1	-16006.86	15418.51	8.14e+14	62.71153	63.61940*	63.06736*
2	-15890.32	223.5709	7.63e+14*	62.64715*	64.38035	63.32645
3	-15826.21	120.4880	8.79e+14	62.78679	65.34533	63.78957
4	-15763.28	115.8047	1.02e+15	62.93107	66.31494	64.25733
5	-15702.70	109.1506	1.19e+15	63.08443	67.29364	64.73416
6	-15625.50	136.0689*	1.31e+15	63.17316	68.20770	65.14637
7	-15567.43	100.1053	1.55e+15	63.33629	69.19617	65.63298
8	-15497.59	117.6584	1.76e+15	63.45367	70.13889	66.07384

*

indicates lag order selected by the criterion, LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

The table 5 shows the different lag length suggested by criteria used for the both the markets. The Schwarz Information Criteria and Hann-Quinn information criterion suggest 1 lag length whereas modified LR test statistic suggests 6, Akaike Information Criteria and Final Prediction Error suggest 2 lag lengths. Thus, the lag number 2 is opted for the study to carry out Granger Causality test and Johansen Co-integration Test.

Table 6: Co-integration Test of Exchange Rate and Stock Indices Returns Volatility

Countries	Hypothesis No.	Eigen Value	Trace Statistics	5% Critical value	Prob.**
Brazil	None*	0.0205	14.037	12.320	0.025
	Atmost1	0.0062	3.270	4.129	0.083
Russia	None	0.0134	7.998	15.494	0.465
	Atmost1	0.0018	0.972	3.841	0.324
India	None*	0.0312	19.743	12.320	0.002
	Atmost1	0.0062	3.249	4.129	0.084
China	None	0.0106	7.301	15.494	0.542
	Atmost1	0.0034	1.776	3.841	0.182
South Africa	None	0.0118	6.663	15.494	0.617
	Atmost1	0.0008	0.4604	3.841	0.497

The table 6 represent the long run relationship between stock market and foreign exchange market. It is found that long run relation exist for Russia and India i.e., in every period of short-term the USD/INR and Nifty tend to be mutually adjusted to

achieve its long-term equilibrium and in every period of short-term the USD/BRL and Bovespa tend to be mutually adjusted to achieve its long-term equilibrium.

Table 7: Pair wise Granger Causality Tests of Exchange Rate and Stock Indices Returns

Countries	Null Hypothesis	Obs	F-Stat	Prob.
Brazil	Bovespa does not granger cause USD_BRL	520	1.268	0.281
	USD_BRL does not granger cause Bovespa		1.154	0.330
Russia	RTSI does not granger cause USD_RUB	520		0.004*
	USD_RUB does not granger cause RTSI			0.191
India	Nifty does not granger cause USD_INR	520	2.932	0.054**
	USD_INR does not granger cause Nifty		2.187	0.113
China	SSE does not granger cause USD_CNY	520	3.354	0.035**
	USD_CNY does not granger cause SSE		0.426	0.653
South Africa	FTSE_JSE does not granger cause USD_RAND	520	0.694	0.499
	USD_RAND does not granger cause FTSE_JSE		2.529	0.080***

The F- values and the p- values in the test (see table 7) results suggest that the null hypotheses of *RTSI* does not granger cause USD_RUB, Nifty does not granger cause USD_INR, SSE does not granger cause USD_CNY are found to be significant statistically. There is an evidence of uni- directional causality from RTSI to USD_RUB, Nifty to USD_INR and SSE to USD_CNY which means in the short run change in Russian stock market, Indian stock market and China stock market will cause a change in Russian foreign exchange market, Indian foreign exchange market and China foreign exchange market. .

VI. CONCLUSION

This paper tries to explore the linkage between foreign exchange rates and stock market of BRICS countries. The objective of the paper was to find the relationship between both these markets. Granger Causality and Co-integration test is applied for this purpose and the evidence is there that there is a long run relationship for Russia and India i.e., in every period of short-term the

USD/INR and Nifty tend to be mutually adjusted to achieve its long-term equilibrium and in every period of short-term the USD/BRL and Bovespa tend to be mutually adjusted to achieve its long-term equilibrium. Also, there exist short term unidirectional relationship between Russia, India, China and South Africa. Thus, these results would be helpful for the investor to predict one market by using the information of other market and also will help financial managers to obtain decision relating to portfolio diversification.

VII. REFERENCES

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