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STRUCTURAL CHANGE IN BOND MARKET OF BRICS COUNTRIES AN EMPIRICAL ANALYSIS

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ABSTRACT

The study is designed to analyze the bond yield rate and their volatility of BRICS nations. The abbreviation BRICS stands form Brazil, Russia, India, China and South Africa. Each country has their different bond or debt market. Monthly data from May 2007 to January 2017 is used in the following research study. Granger causality test showing causality relationship among bond market of various BRICS nations is used to check the causality relationship. The following research paper also indicates how these bond markets are integrated with each other. Data of various market have been collected from the secondary sources such as from their original bond market websites and some other sources also i.e. investing.com to analyze the pattern of bond market movement of BRICS country.

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INTRODUCTION

"I used to think that if there was reincarnation, I wanted to come back as the president or the pope or as a 400 baseball hitter. But now I would like to come back as the bond market. You can intimidate everybody."

James Carville, political advisor to President Clinton,

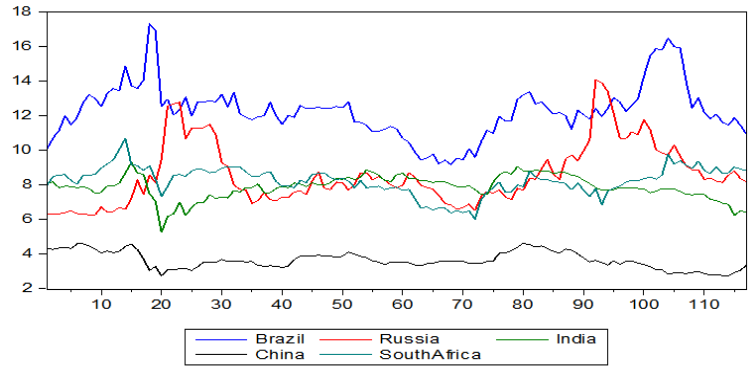
Bond Market (A Literature Review)

A bond market is a type of financial market where various types of bond are traded. This market includes primary and secondary market. The primary goal of bond market is to provide long-term funding to the public and private organizations for their expenditure. As per the report of Bank for International Settlement 2009, the size of bond market estimated at $82.2 trillion at world level. Government bond market is an important element in bond market of any country because of its size and liquidity. Government bond is considered as a more reliable in compare to corporate bond. Investors gives preference to government bond market based on their decision on credit risk comparison.

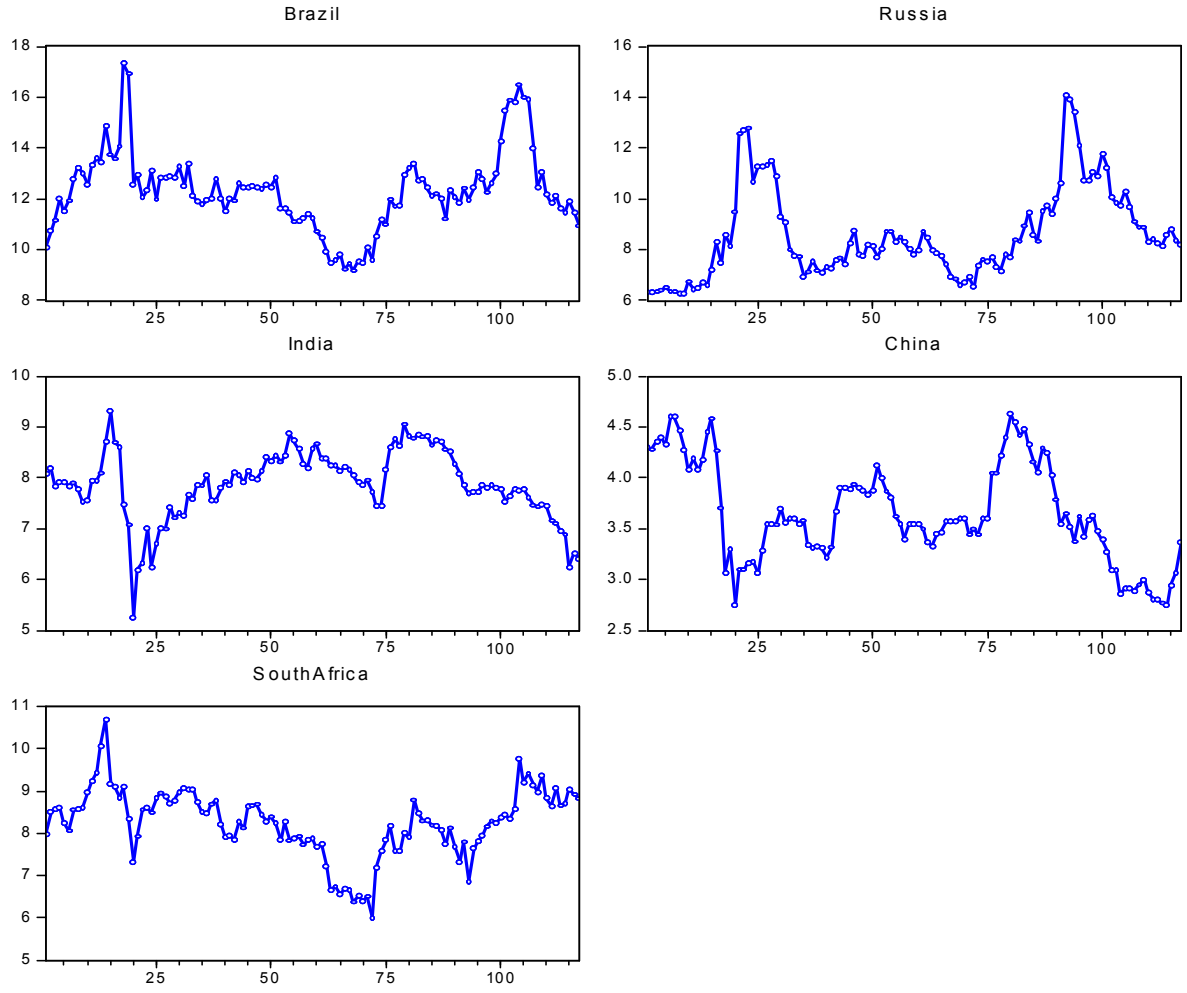
The government bond yield has low risk generally where it can be considered as risk free. Securities Industry and Financial Markets Association (SIFMA) has classified bond market in five bond markets such as corporate bond, government bond, municipal bond, mortgage and funding. There are various bond market participants are such as government, traders, institutions, investors and individuals. As per the 2012 report global bond market has increased 2% growth rate which was nearly $ 100 trillion where US bond market was at first place having 33 per cent market capture followed by Japan 14 per cent. Trading in bond market is also having risk. An investor have to suffer lose if it sell before maturity. There is an inverse relationship between interest rate and bond value or bond price. The economic environment and monetary policy directly related with the bond market growth and thus bond market vitality depends on these macro-economic factors. There are various studies explaining Bond market and their relationship with various other factors such as monetary policy and economic changes. Such studies have been done not only at world level but also on India and BRICS nations also. Many investors turn to bond market from stock market due to market volatility. Investment in bond market is more safe compare to share or stock market. Bonds are issued by various entities such as private or government organization for different

purposes. Every bond has different tax liabilities and varying risk. Purchasing a bond makes investor money lender and in return investor gets their face value and interest rate at the time of maturity of bond. The bond price always remains a subject of market fluctuation. Goldstein and Woglom (1991) studies was based on bond market of various US states and the conclusiotn of the study suggest that the value of bond yield are positively depends on their level of debt. The following result further supported by Bayoumi (1995) and Poterba and Rueban (1997). Alesina et. al. (1992) did comparatively study of 12 OECD country and find out that public debt play an important role and positively related with public and private bond yield. Lemmen (1999) worked on the bond yields issued b the government of Germany, Australia and Canada and find out that yield spread positively depends on debt ratio of government to GDP.

There is positive relationship of government between interest rates and public debt (Lemmen and Goodhart (1999), Lonning (2000), Capeland and jones (2001). There is positive relationship between fiscal variables and yield spread. Ong (2005) tried to find out the reason that where growth rate of government bond is more than the corporate bond and concluded that crowding out by the government bond is important obstacles in that. Raghavan and Sarwano (2012) find out that development of government bond leads to increase the growth rate of corporate bond. Flemming and Remolona (1997) tried to find out the relationship between the bond market and various economic announcements by the government. Krishnamurthy (2002) analyzed the liquidity on pattern of Treasury bond market on various time varying. Fair (2002) in their study concluded that bond prices are associated with the monetary shock of the country.



Graph 1. 10 Year Bond Yield of BRICS Nations - 2007-17 (Single Graph)



Graph 2. 10 Year Bond Yield of BRICS Nations - 2007-17 (Multiple Graph)

Movement of 10 Year Bond Yield in BRICS nations

Brazilian Bond Market

The following graph showing 10 year government bond yield data of Brazil. The fluctuation rate of bond yield is recorded between ranges of 10 to 15. The bond yield rate on May 2007 was 10.08 and on January 2017 it achieved a growth rate of 10.93. The minimum rate in the following time span recorded 9.18 whereas the maximum rate of bond yield data during this time period was recorded 17.33. The average rate of the selected data is 12.29.

Russia Bond Market

The following graph showing 10 year government bond yield data of Russia. The fluctuation rate of bond yield is recorded between ranges of 6 to 14. The bond yield rate on May 2007 was 6.31 and on January 2017 it achieved a growth rate of 8.18. The minimum rate in the following time span recorded 6.27 whereas the maximum rate of bond yield data during this time period was recorded 14.09. The average rate of the selected data is 8.57.

Indian Bond Market

The following graph showing 10 year government bond yield data of India. The fluctuation rate of bond yield is recorded between ranges of 6 to 9. The bond yield rate on May 2007 was 8.08 and on January 2017 it achieved a growth rate of 6.8. The minimum rate in the following time span recorded 5.26 whereas the maximum rate of bond yield data during this time period was recorded 9.31. The average rate of the selected data is 7.88.

China Bond Market

The following graph showing 10 year government bond yield data of China. The fluctuation rate of bond yield is recorded between ranges of 2 to 4. The bond yield rate on May 2007 was 4.2 and on January 2017 it achieved a growth rate of 3.3. The minimum rate in the following time span recorded 2.74 whereas the maximum rate of bond yield data during this time period was recorded 4.63. The average rate of the selected data is 3.64.

South Africa Bond Market

The following graph showing 10 year government bond yield data of South Africa. The fluctuation rate of bond yield is recorded between ranges of 6 to 10. The bond yield rate on May 2007 was 7.9 and on January 2017 it achieved a growth rate of 8.8. The minimum rate in the following time span recorded 6.01 whereas the maximum rate of bond yield data during this time period was recorded 10.70. The average rate of the selected data is 8.25.

Research Objective

The research object which served as a guide for the following study are as follows:

- To analyze the performance of various bond markets and their price hike of BRICS nations.
- To find out the correlation among bond market of BRICS nations.
- To check the causality relationship among various bond yields of BRICS nations.

Significance of the Study

The following study will help to investors who are seeking their money in that particular bond market of BRICS nations because this study is showing the volatility of various bond market indices. Apart from this, its finding is showing the causality relationship of one bond market to other. Thus this investigation can be helpful in adding prevailing in the present literature which will help various researchers to work on this topic and they can identify regular problems or up down in bond market.

MATERIALS AND METHODS

The study is based on the data of bond yield of BRICS countries. BRICS is a group of five countries named Brazil, Russia, India, China and South Africa. It comprises around 43 per cent population of the world alone in 2015. BRICS is truly an emerging economic integrated group and it is significant in terms of development of developing countries. The following study includes the study of bond market movement, volatility of bond yield value and performance of selected bond market. This paper assumes various bond markets of respected five countries attract various investors from various countries. The data for this study have been gathered from various government agencies, yahoo finance and investing.com. The sample of the time period spans is from May 2007 to January 2017. The study applied series of various statistical and econometric techniques to test the relationship among selected variables. The test applied ranges from; Unit root test, Correlation analysis, Cointegration test and Granger causality test etc. over the sample period. Each technique is explained in both explicit and implicit term.

Unit Root Test

The very first step in time series analysis is to check the stationarity of the time series data. Unit root test helps to find out where data of particular time series is having the property of stationarity or the data is of non- stationarity nature. There are various test under Unit Root Test is used to check such property of the time series. Augmented-Dickey Fuller (ADF) test has been used in the following study which is an extended version of Dickey-Fuller (DF) Test (1979). It is an econometric test which is used to test the null hypothesis of any unit root in a time series and also used to check the property of stationarity of the data. Augmented-Dickey Fuller (ADF) test is generally used for the more complex set of time series. In ADF statistics, negative number is used in the test. The more negative value will give a strongest reason to reject the hypothesis which indicates unit root of the data at some level of confidence. In Augmented-Dickey Fuller (ADF) test data is check at level or 1st difference or 2nd difference. Augmented-Dickey Fuller (ADF) test can be expressed in following form:

$$\Delta y_t = \alpha + \beta t + \Upsilon y_{t-1} + \delta_1 \Delta y_{t-1} + \ldots\ldots\ldots + \delta_{p-1} \Delta y_{t-p-1} + \varepsilon_{t,} \quad (1)$$

Where α is used to express constant, β expressing the coefficient on a time scale and p is used to express lag order of

autoregressive process. In the following expression $\alpha=0$, β =0corresponding to modeling in a random walk. ADF test includes lags of the order p which allows higher order of autoregressive process. It should be noticed that lag of the p should be determined when ADF is being used. lag of p is determined by the t-values on coefficient. An alternative approach Schwarz Info Criterion (SIC) and Alkaike information criterion (AIC) is used in the following study.

Pearson Correlation coefficient

To check the linear and symmetrical relationship among various variables, the Pearson correlation coefficients were estimated. It is mostly widely used correlation statistical tool to measure the degree of relationship among various linearly related variables. The formula of Pearson correlation coefficient can be explain as

$$r = \frac{1}{n-1}\sum \frac{(x_i - \overline{X})(y_i - \overline{Y})}{s_x s_y}; \qquad (2)$$

Where r denoting correlation coefficient. It has its ranges from -1.0 to +1.0 where closer r is to +1 or -1, the relationship among variables can be check with this value. If the value of r is more close to 0, it indicates that there is no relationship between the selected variables whereas if the value of r is positive it show that if one variable gets larger than the other variable will also gets larger but if the value of r is negative it show that one variable getting larger while other getting smaller known as 'inverse correlation'.

Cointegration Test

After the confirmation of unit root in the time series the next step is to check the relationship among the various variable in a long run time period. Johansens (1991) used VAR based cointegration test which is used in the following study. Considering a VAR of order p:

$$y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + B_{xt} + \varepsilon_t, \qquad (3)$$

Here y_t is showing k – vector of non-stationary I (1) variables, x_t is used to represent d – vector of deterministic variables, ε_t showing vector of innovations,

We can express VAR as:

$$\Delta y_t = \Pi y_{t-1} \sum_{i=1}^{p-1} \Gamma_i \Delta y_t = \Pi y_{t-i} + BX_t + \varepsilon_t \qquad (4)$$

Where,

$$\Pi = \sum_{i=1}^{p} A_i \quad I, \quad \Gamma_i = \quad \sum_{j=i+1}^{p} A_j \qquad (5)$$

According to Granger's representation theorem if the coefficient matrix Π reduced its rank $r < k$, then $k \times r$ matrices α and β each with the rank r such that $\Pi = \alpha \beta'$ and $\beta' y_t$ is I (0). Cointegration relationship can be shown by r number and column of β will show Cointegrating vector. There are two another statistics which is used in the Johansens cointegration. The first one is the trace test statistics and another is maximum eigenvalue test statistics.

Trace Test Statistics

Trace test statistics is used to test the rank of Matrix Π is r_0 or not. Here the null hypothesis is that rank (Π) = r_0 and alternative hypothesis is that $r_0 <$ rank (Π) $\leq n$, where n represent maximum number of possible Cointegrating vector. Trace test will succeed only when the null hypothesis will be rejected and the next null hypothesis is that rank (Π) = $r_0 + 1$ and alternative hypothesis is that $r_0 + 1 <$ rank (Π) $\leq n$. Thus trace statistics test null hypothesis of r Cointegrating relation against alternative of k Cointegrating relation. k represents number of endogenous variables, for $r = 0, 1, \ldots\ldots k-1$.
Trace test statistics for null hypothesis or r Cointegrating relation can be computed as:

$$LR_{tr}(r|k) = \quad T \sum_{i=r+1}^{k} \log(1 \quad \lambda_i) \qquad (6)$$

Here λ_i represent i^{th} largest eigenvalue of matrix Π. T represent the number of observation and LR represents likelihood ratio statistics.

Maximum Eigenvalue Test

Maximum eigenvalue statistics is used to test null hypothesis of r Cointegrating relations against alternative of $r + 1$ cointegrating relation. It examines whether the largest eigenvalue is zero relative to alternative that next largest Eigen value is zero. Firstly it test whether rank of matrix Π is zero. The null hypothesis is that rank (Π) = 0 and alternative is that rank (Π) = 1 and further it tests null hypothesis is that rank (Π) = 1, 2, … and alternative hypothesis is that rank (Π) = 2, 3,……

The test of maximum eigenvalue is a likelihood ratio test which can be expressed in a following way:

$$LR\ (r_0,\ r_0 + 1) = -T \ln (1 - \lambda_{r0+1})$$

Where $LR\ (r_0,\ r_0 + 1)$ is likelihood ratio test statistics which is used to test whether rank (Π) = r_0 versus alternate hypothesis that rank (Π) = $r_0 + 1$.

Selection of lag length is very important in Johansens cointegration test. Thus for suitable VAR model firstly selection of appropriate lag structure is very necessary. Appropriate lag structure selection is based on Akaike Information Criterion (AIC), Schwarz Criterions (SC) and Likelihood Ratio (LR).

EMPIRICAL ANALYSIS

Descriptive Statistics

Table (1.1) shows the descriptive statistics of the selected bond yield of various country's government bond yield. The average bond yield value are highest in Brazil (12.29143) followed by Russia (8.579906) and lowest in China having the average bond yield value (3.648889). The standard deviation represents here as a proxy of raw data and its statistic explicates that Russia (1.783689) is highly volatile market followed by the Brazil (1.560834) and China (0.491166) has least volatile bond yield value. The variation in the selected bond yield value of selected countries measured by Coefficient of Variation unveils that Russia (20.78per cent) remained a highly varied market followed by the China (13.46per cent), Brazil

Table 1. Results of Descriptive Statistics Test

Descriptive Statistics	Brazil	Russia	India	China	South Africa
Mean	12.29143	8.579906	7.880120	3.648889	8.257735
Median	12.19500	8.180000	7.912000	3.575000	8.325000
Standard Deviation	1.560834	1.783629	0.680260	0.491166	0.797705
Coefficient of Variation	12.69855	20.78844	8.63260	13.46069	9.66009
Minimum	9.180000	6.272000	5.260000	2.744000	6.010000
Maximum	17.33000	14.09000	9.316000	4.630000	10.70000

Sources: Computed by authors, and values are expressed in nominal terms.

Table 2. Results of Correlation Analysis

	Brazil	Russia	India	China	South Africa
Brazil	1				
Russia	0.2917449028893636	1			
India	-0.124352204261633	-0.3358068398298422	1		
China	-0.08295677682784025	-0.3975670840275974	0.6583902916712104	1	
South Africa	0.6848818779899614	0.03983245541522357	-0.1781798858623985	0.006368405806605438	1

Sources: Computed by authors, and values are expressed in nominal terms.

Table 3. Results of Unit Root Test - Augmented Dickey-Fuller (ADF) Test

Variables in their first differences with intercept and Trend	Augmented Dickey Fuller Test Statistics	Critical Values	Decision
BRA	-11.24254	At 1% : 3.488063 At 5% : -2.886732 At 10% : -2.580281	Reject Null hypothesis of no unit root
RUS	-9.537852	At 1% : -3.488063 At 5% : -2.886732 At 10% : -2.580281	Reject Null hypothesis of no unit root
IND	-6.940364	At 1% : -3.489117 At 5% : -2.887190 At 10% : -2.580525	Reject Null hypothesis of no unit root
CHN	-9.500297	At 1% : -3.488063 At 5% : -2.886732 At 10% : -2.580281	Reject Null hypothesis of no unit root
SA	-12.56915	At 1% : -3.488063 At 5% : -2.886732 At 10% : -2.580281	Reject Null hypothesis of no unit root

Sources: Computed by authors, and values are expressed in nominal terms.

(12.69per cent), South Africa (9.66 per cent), and India (8.63 per cent). The maximum value of selected bond yield countries was found in Brazil (17.3300) and the lowest in China (2.7440). The Table (2) is showing correlation result among various bond markets of various BRICS countries which was capture by estimating Pearson correlation coefficient mentioned above. The following table showing the result of correlation among various selected variables for the time period of May 2007 to January 2017. The following table of correlation clearly showing that bond market of Brazil is highly correlated with the bond market of South Africa whereas bond market of China is least correlated with the bond market of Russia.

Unit Root Test - Augmented Dickey-Fuller (ADF) Test

Time series modeling always necessitated for checking the stationary of data keeping the fact in mind, to study conducted the Augmented Dickey Fuller (ADF) test to check the stationarity of underlying data series. The following table clearly indicating that all the null hypothesis of no unit root for all five selected time series are rejected because ADF test statistics value are less than the critical values at 1%, 5% and 10% levels of significances at their first differences. It can be said that due to presence of the rejection of null hypothesis the data are stationary which is supported by the result shown in the table. The appropriate Lag-length criterion was choosing by following AIC criterion (Appendix 1.1).

Cointegration Test

Table (4) showing the result of Johansen's likelihood test result with the help of trace test statistics and maximum Eigen value. The Johansens cointegration test is very sensitive to the lag length criteria. There is only one lag length is used as suggested by various lags length criteria such as Schwarz, Akaike and Hannan-Quinn information criteria. The Johansen cointegration method suggests basically two tests one is trace test and another is maximum Eigen value test which determine the number of cointegrating vectors. These both tests indicate that one cointegrating equation at 5 percent significance level as first null hypothesis. The value of trace test and maximum Eigen values are calculated to check that null hypothesis that the variable were not cointegrated (r=0). Both of the test result in the following study accepted the alternative of one or more cointegrating vector. All the null hypothesis are accepted because trace test statistics and maximum Eigen value are less than their corresponding value at 5 per cent of level of significance. The test result of both trace test statistics and maximum Eigen value confirmed that all five bond market of BRICS nations are not cointegrated with each other thus increase in bond yield of any country does not transferring to other bond market. The result of granger causality test shown in table no () indicating that somewhere null hypothesis is accepted where at some place it is failed to reject based on their F-statistics and p-value i.e.

Table 5. Results of Granger Causality Test

Null Hypothesis:	Observation	F-Statistic	Prob.	Decision
Russia does not Granger Cause Brazil	115	0.49693	0.6098	Failed to reject
Brazil does not Granger Cause Russia		7.87356	0.0006	Reject
India does not Granger Cause Brazil	115	0.31326	0.7317	Failed to reject
Brazil does not Granger Cause India		2.42356	0.0933	Failed to reject
China does not Granger Cause Brazil	115	7.51715	0.0009	Reject
Brazil does not Granger Cause China		2.62133	0.0772	Failed to reject
South Africa does not Granger Cause Brazil	115	0.54614	0.5807	Failed to reject
Brazil does not Granger Cause South Africa		4.50281	0.0132	Reject
India does not Granger Cause Russia	115	3.44491	0.0354	Reject
Russia does not Granger Cause India		0.15761	0.8544	Failed to reject
China does not Granger Cause Russia	115	1.93191	0.1498	Failed to reject
Russia does not Granger Cause China		1.61890	0.2028	Failed to reject
South Africa does not Granger Cause Russia	115	4.84433	0.0096	Reject
Russia does not Granger Cause South Africa		0.63196	0.5335	Failed to reject
China does not Granger Cause India	115	3.30425	0.0404	Reject
India does not Granger Cause China		1.60038	0.2065	Failed to reject
South Africa does not Granger Cause India	115	3.86945	0.0238	Failed to reject
India does not Granger Cause South Africa		3.14605	0.0469	Reject
South Africa does not Granger Cause China	115	3.29628	0.0407	Reject
China does not Granger Cause South Africa		0.06742	0.9348	Failed to reject

Sources: Computed by authors, and values are expressed in nominal terms.

Russia does not granger cause Brazil, but Brazil does granger cause Russia; India does not granger cause Brazil and Brazil also does not granger cause India; China does granger cause Brazil where as Brazil does not granger cause China etc.

FINDING AND CONCLUSION

The average bond yield value are highest in Brazil (12.29143) followed by Russia (8.579906) and lowest in China having the average bond yield value (3.648889). Russia (1.783689) is highly volatile market followed by the Brazil (1.560834) and China (0.491166) has least volatile bond yield value. Russia (20.78 per cent) remained a highly varied market followed by the China (13.46per cent), Brazil (12.69per cent), South Africa (9.66 per cent), and India (8.63 per cent). The following table of correlation clearly showing that bond market of Brazil is highly correlated with the bond market of South Africa whereas bond market of China is least correlated with the bond market of Russia. The test result of cointegration test confirmed that all five bond market of BRICS nations are not cointegrated with each other thus increase in bond yield of any country does not transferring to other bond market. The result of granger causality test explain that some bond market are causing other whereas other does not causing i.e. Russia does not granger cause Brazil, but Brazil does granger cause Russia; India does not granger cause Brazil and Brazil also does not granger cause India; China does granger cause Brazil where as Brazil does not granger cause China etc.

REFERENCES

Alesina, A., De Broeck, M., Prati, A. and Tabellini, G. 1992. "Default Risk on Government Debt in OECD Countries", *Economic Policy* 15, 427-451.

Balduzzi, P., E. Elton, and T. Green, 2001. Economic News and Bond Prices: Evidence from U.S. Treasury Market, forthcoming, *Journal of Financial and Quantitative Analysis.*

Bayoumi, T.A., Goldstein, M. and Woglom, G. 1995. "Do Credit Markets Discipline Sovereign Borrowers? Evidence from US States", *Journal of Money, Credit, and Banking* 27, 1046-1059.

Bernoth K., Hagen J. V.and Schuknecht L. 2004. "Sovereign Risk Premia In The European Government Bond Market " Working Paper NO. 369 / JUNE 2004

Copeland, L. and Jones, S.-A. 2001. "Default Probabilities of European Sovereign Debt: Market-based estimates", *Applied Economic Letters* 8, 321-324.

Fair, 2002. Events that shook the market, Journal of Business 75, 713-731.

Fleming, M., and E. Remolona, 1997. What moves the bond market? Economic Policy Review, Vol. 3, No. 4, December 1997, 31-50.

Goldstein, M., Woglom, G. 1992. "Market Based Fiscal Discipline in Monetary Unions: Evidence from the US Municipal Bond Market", in M. Canzoneri, V. Grilli, and P. Masson (eds.) *Establishing a Central Bank*, Cambridge University Press, 1992.

Krishnamurthy, A., 2002. The bond/old-bond spread, Journal of Financial Economics 66, 463-506.

Lemmen, J. 1999. "Managing Government Default Risk in Federal States", FMG Special Paper No. 116.

Lemmen, J. and Goodhart, C. 1999. "Government Bond Markets: A Panel Data Econometric Analysis", *Eastern Economic Journal* 25, 77-107.

Lonning, I.M. 2000. "Default Premia on European Government Debt", *Weltwirtschaftliches Archiv* 136, 259-283.

Luengnaruemitchai, P. and L. Lian Ong, 2005. "An Anatomy of Corporate Bond Markets: Growing Pains and Knowledge Gains", IMF Working Paper, www.imf.org

Poterba, J. and Rueben, K. 1999. "State Fiscal Institutions and the U.S. Municipal Bond Market", in J. Poterba and J. von Hagen (eds.) *Fiscal Institutions and Fiscal Performance*, University of Chicago Press, 1999.

Raghavan, S. and D. Sarwano 2012. "Development of the Corporate Bond Market in India: an Empirical and Policy Analysis", International Conference on Economics and Finance Research, IPEDR Vol. 32, www.ipedr.com

Appendix

Appendix 1. Lag-Length Table

Lag	LogL	LR	FPE	AIC	SC
0	-642.0087	NA	0.098503	11.87172	11.99518
1	-228.5428	781.4126	7.91e-05	4.743905	5.484643*
2	-182.8426	82.17657	5.43e-05*	4.364084	5.722103
3	-167.5873	26.03193	6.53e-05	4.542886	6.518187
4	-137.2171	49.03815	6.00e-05	4.444350	7.036933
5	-107.8787	44.68046*	5.67e-05	4.364747	7.574611
6	-82.67140	36.07651	5.84e-05	4.360943	8.188089
7	-56.23588	35.40905	5.97e-05	4.334603*	8.779031
8	-38.67838	21.90660	7.31e-05	4.471163	9.532872

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