ISSN: 0976-3376

Available Online at http://www.journalajst.com

ASIAN JOURNAL OF SCIENCE AND TECHNOLOGY

Asian Journal of Science and Technology
Vol. 08, Issue, 10, pp.6215-6223, October, 2017

RESEARCH ARTICLE

A CROSS COUNTRY ANALYSIS OF INFLATION RATE AMONG BRICS NATIONS: A VECTOR ERROR CORRECTION MODEL (VECM) APPROACH

***Dr. Vijay Kumar**

Post-Doctoral Fellow (UGC), Centre for Economic Studies, Central University of Punjab, Bathinda

ARTICLE INFO

Article History:
Received 21st July, 2017
Received in revised form
19th August, 2017
Accepted 03rd September, 2017
Published online 17th October, 2017

Key words:
Inflation rate,
Correlation,
VECM,
Cointegration,
Granger causality etc.
JEL Classification: E31, F15, F62, P24

ABSTRACT

It is a world of highly globalized era where various economies are integrating with other economies and making various groups to compete and make self-efficient to survive in such a highly competitive world. In such economic integration there are various macro-economic variables which affect each other. The present study is designed to check the inflation rate of BRICS nations which is a economic integrated group of five emerging economies in the world. The abbreviation BRICS stands form Brazil, Russia, India, China and South Africa. Each country has their own set of policies which affects their inflation rate within the country but as group it also affects other economies. As the result of the study suggested by Vector Error Correction Model (VECM) approach indicates that that there is a long-run causality for inflation rate exist among all BRICS nations but in a short-run if we taking India as a depending variable only the inflation rate of China affecting the inflation rate of India where other economies does not affecting the inflation rate of India. The secondary data is used in the study. The data has been collected for the following study is from International Monetary Fund (IMF) which is a yearly data of Inflation rate, end of period consumer prices (Annual percent change) from 1991 to 2016 of all the BRICS nations individually to analyze the pattern inflation rate and their movement of BRICS countries. The result of Granger causality test is showing causality relationship among BRICS nations for inflation rate. The following research paper also indicates how inflation of one country is cointegrated with each other.

INTRODUCTION

"By a continuing process of inflation, government can confiscate, secretly and unobserved, an important part of the wealth of their citizens"

John Maynard Keynes

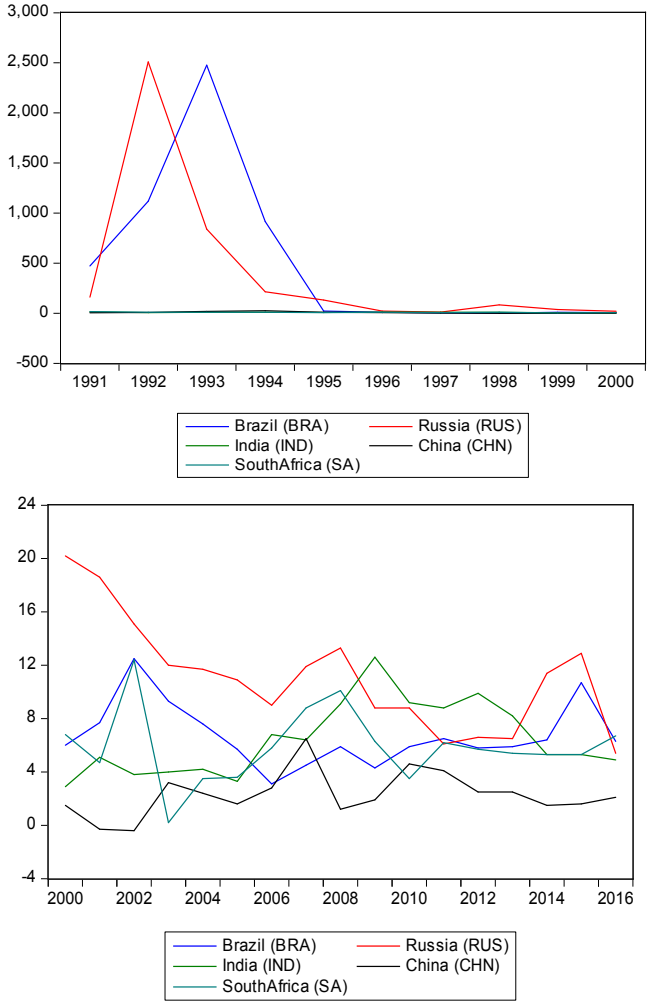
A rise in general price level of various goods and services over a period of time in economy is known as inflation. An increase in price level of any goods or services reduced its demand because purchasing power of consumer reduced from its existing capacity. Consumer Price Index (CPI), Annual per cent change in general price and Inflation rate are the important indicators to measure inflation rate of the economy. There are various economist around the world propounded various types of inflation theories based on their assumptions dealing with the inflation and economic growth of the country such as cost-push theory, demand-pull theory, Keynesian theory, Bent Hansen's dynamic model of the demand inflation, Schultze's sectorial demand-shift theory, Markup theory, Money-stock theory. Inflation is the most important factor provides direction to the economy. There are various studies suggested by various economists that inflation has its detrimental impact on economic growth of the country. The very first objective of macro-economic planning is to sustain high level of economic growth with low level inflation rate. There are various positive and negative effects of the inflation to economy was analyzed by various economist *i.e.* inflation leads to shortages of goods because of the nature of consumer's behavior to maintain stock of related goods and positive effect is that Central bank adjusts nominal interest rates to stabilize economy. An increase in money supply leads to increase in inflation. An increase in inflation rate also affects tax system of the country. It is always question that if the inflation is detrimental to economic growth then how much inflation rate is desirable. Various economists suggested that it depends on the nature of economy. An increase in inflation rate may cause price hike in the domestic product which makes export of such commodities relatively more expensive thus it also affects balance of payment.

J. M. Keynes was the first economist who focused on the inflation issue and its impact on the economic growth of the country. He tried to found out the relationship between inflation and economic growth. During their study he focused on the aggregate demand and aggregate supply of the country. His theory concludes that aggregate supply has impact on the price level and economy in short run. Mundell(1968) during their research finding suggested that inflation leads to affects people's wealth. His study concluded that if there is increase in inflation rate it will reduce people's wealth. Friedman (1977) pointed out that inflation rate may stimulate unpredictable policy to control the economy. Stackman (1981) also supported Mundell's view and concluded that an increase in inflation rate not only affects or reduce people's welfare but also lowers the state level output. Evans (1991) suggested that increase in inflation rates impose significant economic costs

on the society because future's inflation rates are uncertain. The following finding and approach was supported by various studies that the uncertainty of the price hike leads to increase inflation rate. Gomme (1993) studied relationship between inflation and employment and found that increase in inflation leads to decline in the total employment of the country. There are various cross countries analysis proved that there is a significant positive relationship between inflation and its variability. Okun (1971), Gale (1981), Hess and Moms (1996) studies confirm that there is a significance positive link exist between level of inflation and its variability. Albert Keidel. (2007) worked on the inflation pattern of china during their study. His study focused on the rural development and tried to analyze the pattern of inflation and its impact on economic development.

Inflation rate Movement in BRICS nations (Inflation rate, end of period consumer prices (Annual percent change)

The inflation rate data of Brazil has achieved a 136.75 per cent rate in 1992. It is showing an average inflation rate of 197.96 during this period. There is excessive fluctuation were recorded in inflation rate in Brazil. The highest inflation rate recorded in 1999 which was 423.53 per cent. The inflation rate data showing that Brazilian economy has to make appropriate monetary policies to control their inflation fluctuation for better economic growth.



Graph 1. Inflation Rate Movement of BRICS Nations - 1990-2016 (Single)

The inflation rate of Russia has achieved a 1469.09 per cent in 1992 and in the next year 1993 it recorded negative inflation rate -66.52 per cent. In 1998 again the inflation rate of Russia was 667.27 per cent. The data shows that in 2010 percentage of inflation rate was 0.00 which recorded negative in 2016 with the inflation rate of -58.14 per cent. The time period of 1990-91-92 was very crucial in the history of Indian economy. In 1991, Indian government adopted the policy of economic reform which affected all the sector of the economy. The inflation rate in 1991 was -5.72 per cent only where in 1994 it was 3.16 per cent. In 1998 inflation rate were recorded 0.00 per cent and in 2006 this fluctuation reached to the 106.06 per cent which was higher than last year. In 2016 the inflation rate was recorded -7.55 per cent in India. China is an emerging economy and its inflation is also highly fluctuating time by time in 1991, the inflation rate of China was 95.56 per cent where in 1994 it was recorded 35.64 per cent only. In 1998 it was negative with the value of -350.00 per cent. And in 1999 it was 0.00 per cent. In 2016 the inflation rate of china is 31.25 per cent. In case of South Africa, inflation rate in 1992 was -40.37 per cent where in 1993 and 94 it was 0.00 per cent. The inflation rate was highest in 2004 in South Africa which was 1650.00 per cent. In the next year 2005, it was moved to 2.86 per cent inflation rate. In 2016 the inflation rate in South Africa was 26.42 per cent.

Research Objective

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

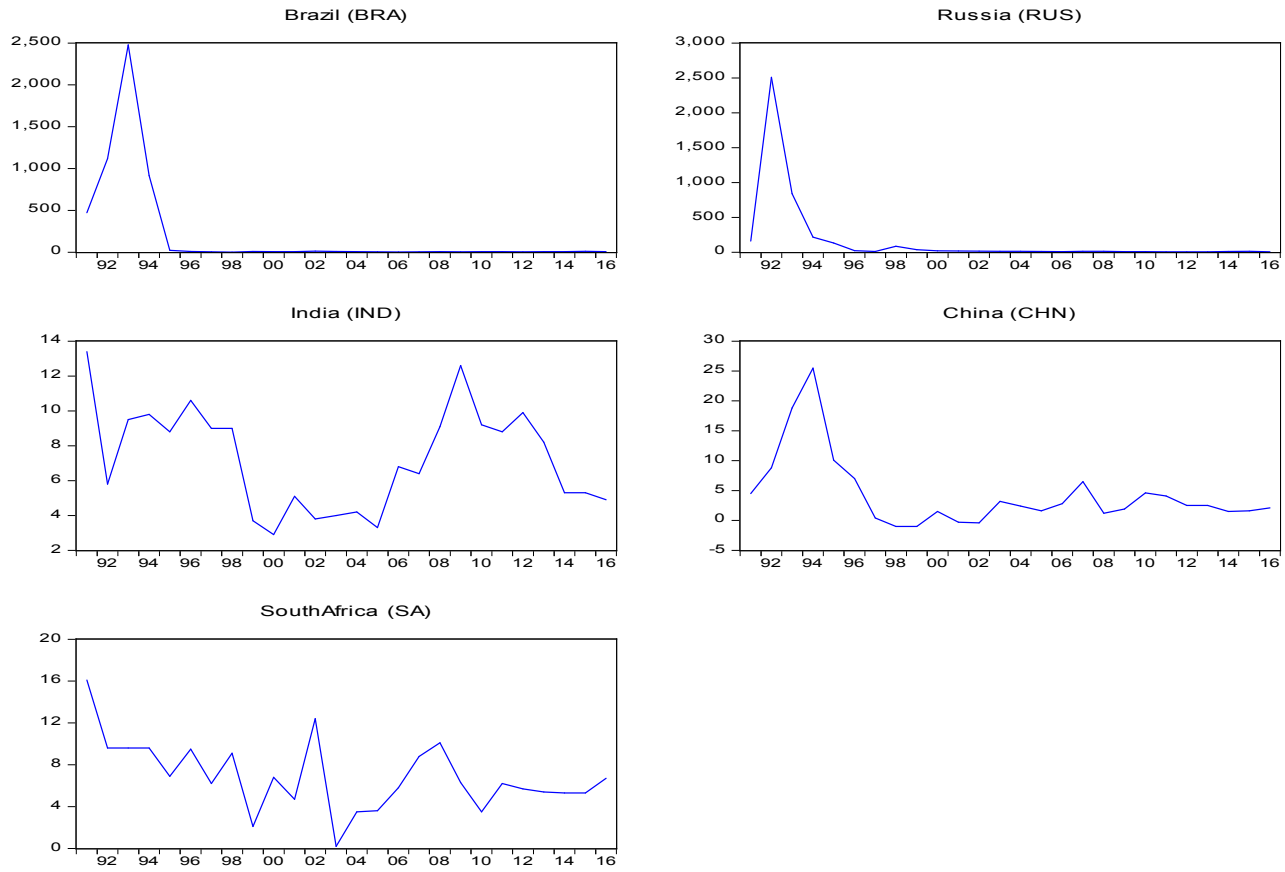
- To analyze the rate of inflation in various BRICS nations.
- To find out the correlation for inflation rate among BRICS nations.
- To check the causality relationship of inflation rate among BRICS nations.
- To analyze the long-run and short-run impact of inflation rate of other countries on India.

Significance of the Study

The following study will help to various researchers who are working on inflationary issue of BRICS countries especially in reference with India because this study is showing the movement pattern of inflation rate of BRICS nations. Apart from this, the finding of the following research study is showing the causality relationship of inflation rate of one other country to India. Thus this investigation can be helpful in adding prevailing in the present literature which will help various users to work on these issues.

RESEARCH METHODOLOGY

The study is based on the data of inflation rate of various BRICS countries. The variable used in the following study is the Inflation rate, end of period consumer prices (Annual percent change). This data has been collected from the source of International Monetary Fund (IMF). 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.



Graph 2. Inflation Rate Movements of BRICS Nations - 1990-2016 (Individual)

The following study includes the study of inflation rate and their movement, volatility and performance of selected BRICS nations. The data for this study has been collected from various other sources i.e. government agencies, International Monetary Fund (IMF). The sample of the time period spans is yearly and since 1991 to 2016. The study applied series of various statistical and econometric techniques to test the relationship among selected variables. The test applied for analysis is a most acceptable ranges of econometric techniques from; Unit root test, Correlation analysis, Cointegration test, Vector Error Correction Model (VECM) 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 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:

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

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 ;

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

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:*

$$y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + B_{xt} + \varepsilon_t, \quad (2)$$

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:

$$\Delta y_t = \Pi y_{t-1} \sum_{i=1}^{p-1} \Gamma_i \Delta y_t = \Pi y_{t-i} + BX_t + \varepsilon_t \quad (3)$$

Where,

$$\Pi = \sum_{i=1}^{p} A_i - I, \Gamma_i = -\sum_{j=i+1}^{p} A_j \quad (4)$$

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,…… k – 1.Trace test statistics for null hypothesis or r Cointegrating relation can be computed as:

$$LR_{tr}(r|k) = -T \sum_{i=r+1}^{k} \log(1 - \lambda_i) \quad (5)$$

Here λ_i represent i^{th} largest eigenvalue of matrixΠ. 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).

Vector Error Correction Model (VECM)

A Vector Error Correction (VEC) model is based on the cointegration relation of the variables. This model can be only used when at least one cointegration exist between variables. Therefor it can be said that Vector Error Correction Model (VECM) is performed to check the relationship status among variables. After the confirmation of the cointegration between any variable with the help of Johansen's Cointegration test. The next step is to construct the Error Correction mechanism to check the relationship among variables. Thus, Vector Error Correction model (VECM) involves three steps. The very first step is the selection of lag-length order based on various criterions such as Akaike information criterion (AIC), Schwarz information criterion (SC), Hannan-Quinn information criterion (HQ) etc. The decision to choose which lag-length should be based on the majority of result and lower value among that majority indicates that the model will be appropriate for the data.

The second step is to check the cointegration status where the precondition for this test is that the variable must be non-stationary at their level and stationary at their first difference. Now the final step is to perform Vector Error Correction mechanism to model dynamic relationship. The basic purpose of Vector Error Correction model (VECM) is to indicate the speed of adjustment from short run equilibrium to long-run equilibrium. The Vector Error Correction Model (VECM) is a restricted VAR designed in such a way which can be used with non-stationary series of data which are known to be cointegrated. After imposing equilibrium condition in Vector Error Correction Model (VECM) it shows result which shows that how this examined mode adjusting in each time period. As per the pre-assumption condition of Vector Error Correction Model (VECM) that the variable should be cointegrated thus deviation from short run to long run equilibrium will affect the dependent variables and it will force their movement towards long run equilibrium. Thus these cointegrated vectors will indicate independent direction where long-run equilibrium condition exists. The regression equation form for Vector Error Correction Model (VECM) can be explained in the following term:

$$\Delta Y_t = \alpha_1 + p_1 e_1 + \sum_{i=0}^{n} \beta_i \Delta Y_{t-i} + \sum_{i=0}^{n} \delta_i \Delta X_{t-i} + \sum_{i=0}^{n} \gamma_i Z_{t-i} \quad (6)$$

$$\Delta X_t = \alpha_2 + p_2 e_{i-1} + \sum_{i=0}^{n} \beta_i Y_{t-i} + \sum_{i=0}^{n} \delta_i \Delta X_{t-i} + \sum_{i=0}^{n} \gamma_i Z_{t-i} \quad (7)$$

5.4

In Vector Error Correction Model (VECM) cointegration rank of the output shows the number of cointegrating vector such as a rank of three indicate that three linearly independent combinations of Non-stationary variables are stationary. Error Correction Model shows coefficient; if this coefficient is negative and significant it means that in case of short run fluctuation between dependent or independent variable will raise stable long-run relationship among variables.

Empirical Analysis: Descriptive Statistics

The Table 1 shows the descriptive statistics of the following data time series of inflation rate of BRICS nations. The average value are highest in Brazil (BRA) is 197.96 followed by Russia (RUS) which is161.47 and lowest average value is recorded in China (CHN) which is 4.323. The standard deviation represents here as a proxy of raw data and its statistic explicates that Brazil (BRA) is highly volatile having value of 545.31 followed by the Russia (RUS) it is 506.84 and least volatile inflation rate recorded in India (IND) 2.93. The variation rate in the inflation of BRICS nations was measured by Coefficient of Variation unveils that Russia (RUS) is a highly varied for inflation rate which is 313.87 per cent followed by the Brazil (BRZ) recorded 275.45 per cent, China (CHN) (139.13 per cent), South Africa (SA) (48.64 per cent) and India (IND) (40.25 per cent). The maximum value of inflation rate was found in Russia (RUS) (2508.80) and the lowest in China (-1.0000).

Correlation Test

The table 2 is showing correlation relationship status of inflation rate among 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 2003 to 2015. The following table of correlation clearly showing that inflation rate of China is highly correlated with the inflation rate of Brazil with the correlation value of 0.73 followed by correlation between Russia and Brazil with the value of 0.62 whereas the least correlation for inflation rate was recorded between India and Russia which is -0.007.

Unit Root Test

Time series modeling always necessitated for checking the stationarity of the time series data keeping the fact in mind, to study conducted the Augmented Dickey-Fuller (ADF) for the following underlying data series. The result explained that all the variables i.e. BRA, RUS, IND, CHN, SA are stationary at their first level of difference. All the null hypothesis of the underlying series is rejected at their first difference and hence the data are stationary in nature with no unit root. There are various criterions i.e. Akaike Information Criterion (AIC), Schwarz Criterions (SC), Hannan-Quinn information (HQ) and Likelihood Ratio (LR) all of these suggested lag 3 for the further test. The selection of lag-length is criterion was choosing by the majority suggestion. The Lag-length result is explained in Appendix 1.1.

Cointegration Test

The Johansens cointegration test is very sensitive to the lag length criteria. There is majority of various lag-length criterion is suggested lag 3 structure. 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 there is five cointegrating equation existing in the system represented by trace statistics and maximum Eigen value at 5 per cent level of significance for the null hypothesis. The output of result showing that trace statistics in all the cases where at none, At most 1, At most 2, At most 3 or At most 4 is greater than their respected critical value at their f per cent of signification hen the null hypothesis in all the cases is rejected rather accept the alternate hypothesis. In the following equation there is five equations are cointegrated in the system.

Vector Error Correction Model (VECM)

The Vector Error Correction Model (VECM) mechanism is starts from the very first step of lag-length selection. In the following VECM model majority of various lag-length selection criterions suggested lag 3 structures thus the lag 3 is used in the further result output. There is various error correction term model with their computed t-values of their regression coefficients are estimated. The table 5 representing the result of regression coefficients. During the estimation of Vector Error Correction Model (VECM), India is selected as a dependent variable where Brazil (BRA), Russia (RUS), China (CHN) and South Africa (SA) are selected as independent variable which is known as target model for the following test. As per the suggestion by the Johansen's cointegration test, there is 5 cointegration equations are reported in the result output. The Vector Error Correction Model (VECM) automatically converts all the variables into their first difference. There are four error correction term is found in the result output. The result shows that every variable has their two lags where IND is dependent variable and other is independent variable. There is standard error is represented in brackets '( )' and t-statistics is reported in bracket '[ ]'. The result D (IND (-1)) which is -0.140652 is the coefficient of D (IND) lag 1 variable. The value of t-statistics is found when coefficient divided by its standard error but in the result output does not provides p-value so we cannot determine whether accept or reject null hypothesis. To check the p-value, Least Square method is used which provides various C1, C2…….values which represents coefficient of cointegration model of selected data set for least square method. These C1, C2…….values is known as error correction terms or speed of adjustment towards equilibrium.

Long-Run Run Causality

To check the long-run run causality running from BRA, RUS, CHN and SA to IND, C1 value is observed which suggest that the value of C1 is negative in sign and the p-value (48.68 per cent) which is significant in nature proves that there is a long-run causality running from BRA, RUS, CHN and SA to IND. Thus as per the result output we can conclude that the inflation

rate of Brazil, Russia, China and South Africa causing the inflation rate of India in long term. Further, in the next step of Vector Error Correction Model (VECM) we check the short run causality running from BRA, RUS, CHN and SA to IND. Thus we have checked various coefficient of cointegration model such as C1, C2, C3……till C14 and also various null hypothesis of the corresponding variables with the help of Wald test.

Short Run Causality

BRAZIL (BRA): The null hypothesis of BRA for the Wald test was C (7) = C (8) = 0 whether it is zero or not because if the value is zero it means there is no short run causality running from BRA to IND. The Wald test shows the value of F-statistics, Chi-square and probability value. The Wald test result output for BRA shows that the probability value is 0.650 or 65.67 per cent which is more than 5 per cent value of significance. It means that we cannot reject null hypothesis rather we accept null hypothesis it indicates that C (7) = C (8) is zero. Thus there is no short run causality running from BRA to IND. Therefore we can conclude that the growth rate of inflation in Brazil does not causing inflation rate of India in short run.

RUSSIA (RUS): The null hypothesis of RUS for the Wald test was C (9) = C (10) = 0. The result of Wald test in case of Russia as an independent variable and India as a dependent variable statistic shows that the probability value is 0.650 or 65.67 per cent which is more than 5 per cent value of significance thus we cannot reject null hypothesis. It means that we cannot reject null hypothesis which is C (9) = C (10) is zero. Thus it is clear from the result that there no short run causality running from RUS to IND. Therefore we can conclude that the growth rate of inflation in Russia does not affect the inflation rate of India in short run.

CHINA (CHN): The null hypothesis of CHN for the Wald test was C (11) = C (12) = 0.

The result of Wald test in case of China as an independent variable and India as a dependent variable statistic shows that the probability value is 0.0230 or 2 per cent per cent which is less than 5 percent thus we can reject null hypothesis. It means that we can reject null hypothesis which is C (7) = C (8) is zero. Thus it is clear from the result that there is a short run causality running from CHN to IND. Therefore we can conclude that the growth rate of inflation in China affects the inflation rate of India in short run.

South Africa (SA): The null hypothesis of SA for the Wald test was C (13) = C (14) = 0. The result of Wald test in case of South Africa as an independent variable and India as a dependent variable statistic shows that the probability value is 0.3815 or 38 per cent per cent which is more than 5 percent thus we cannot reject null hypothesis. It means that we cannot reject null hypothesis which is C (13) = C (14) is zero. Thus it is clear from the result that there is no short run causality running from SA to IND. Therefore we can conclude that the growth rate of inflation in South Africa does not affecting the inflation rate of India in short run.

Diagnostic Check: To check the appropriateness of this model we used diagnostic check for the set of data or not. It can be check with the help of R-squared, Heteroskedasticity test and Normality test.

R-squared: The value of R-squared for this result output is 0.751995 or 75.19 per cent so it is more than 60 per cent thus we can conclude that this Vector Error Correction Model (VECM) is appropriate or good thus we can accept the model.

Heteroskedasticity Test: This test shows the value of observed R-squared and there p-value; if the p-value is less than 5 per cent then we cannot reject null hypothesis rather we accept null hypothesis it means there is no Heteroskedasticity in the residual and that is desirable. The result shows that the p-value is 0.7562 or 75.62 per cent. This model does not have any Heteroskedasticity. Thus it is a good and desirable.

Table 1. Results of Descriptive Statistics Analysis

Parameters	BRA	RUS	IND	CHN	SA
Mean	197.9692	161.4769	7.284615	4.323077	6.884615
Median	6.450000	12.45000	7.500000	2.450000	6.250000
Standard Deviation	545.3150	506.8427	2.932261	6.015068	3.348993
Coefficient of Variation	275.45446	313.87938	40.25279	139.13858	48.64459
Minimum	1.700000	5.400000	2.900000	-1.000000	0.200000
Maximum	2477.100	2508.800	13.40000	25.50000	16.10000
Skewness	3.234844	4.129110	0.236897	2.270185	0.578647
Kurtosis	13.17386	19.27759	2.090061	7.940218	3.781701

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

Table 2. Results of Correlation Analysis

	BRA	RUS	IND	CHN	SA
BRA	1.000000	0.627363	0.223271	0.733892	0.361199
RUS	-	1.000000	-0.007924	0.363064	0.260729
IND	-	-	1.000000	0.340994	0.494348
CHN	-	-	-	1.000000	0.301382
SA	-	-	-	-	1.000000

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

Table3. Results of Unit Root Test - Augmented Dickey-Fuller (ADF) Test

Variable	t-statistics	Critical Value (5%)	p-value	Null Hypothesis	Remark	Unit Root
BRA	-40.39398	-3.788030	0.0000	Rejected	Stationary	No Unit Root
RUS	-5.331817	-3.029970	0.0004	Rejected	Stationary	No Unit Root
IND	-7.251528	-2.991878	0.0000	Rejected	Stationary	No Unit Root
CHN	-3.420570	-3.020686	0.0225	Rejected	Stationary	No Unit Root
SA	-9.521058	-2.991878	0.0000	Rejected	Stationary	No Unit Root

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

Table 4. Results of Johansen's Cointegration Test

Hypothesized Number of Cointegrating equations	Eigen Value	Trace Statistics	Critical Value at 5 % (p-value**)	Maximum Eigen statistics	Critical Value at 5 % (p-value**)	Remarks
None*	0.997822	264.9578	69.81889 (0.0000)	147.1095	33.87687 (0.0000)	Rejected
At Most 1*	0.941019	117.8483	47.85613 (0.0000)	67.93312	27.58434 (0.0000)	Rejected
At Most 2*	0.677897	49.91516	29.79707 (0.0001)	27.18918	21.13162 (0.0001)	Rejected
At Most 3*	0.493766	22.72598	15.49471 (0.0034)	16.33814	14.26460 (0.0034)	Rejected
At Most 4*	0.233684	6.387846	3.841466 (0.0115)	6.387846	3.841466 (0.0115)	Rejected

Sources: Computed by authors, and values are expressed in nominal terms.
There is 5 cointegraion equations resulted by Trace test at the 0.05 level
** denotes rejection of the hypothesis at the 0.05 level*
***MacKinnon-Haug-Michelis (1999) p-values*

Table 5. Results of Vector Error Correction Model (VECM)

Variable	ΔIND_t	ΔBRA_t	ΔRUS_t	ΔCHN_t	ΔSA_t
Constant	-2.781062	-83.74003	-35.81572	-0.962217	-5.898787
[t-statistic]	[-0.84148]	[-8.89070]	[-1.44227]	[-0.31289]	[-1.41310]
(p-value)	(3.30496)	(9.41883)	(24.8329)	(3.07523)	(4.17435)
EC_{t-1}	-0.311153	1.032921	-1.676199	0.271667	0.504556
	[-1.39122]	[1.62053]	[-0.99744]	[1.30541]	[1.78611]
	(0.22365)	(0.63740)	(1.68051)	(0.20811)	(0.28249)
EC_{t-2}	-0.031107	-0.518486	-0.136292	0.036777	-0.083575
	[-0.83742]	[-4.89769]	[-0.48831]	[1.06401]	[-1.78132]
	(0.03715)	(0.10586)	(0.27911)	(0.03456)	(0.04692)
EC_{t-3}	0.004989	-0.028134	-0.322686	-0.081011	0.144912
	[0.11020]	[-0.21807]	[-0.94868]	[-1.92324]	[2.53446]
	(0.04527)	(0.12901)	(0.34014)	(0.04212)	(0.05718)
EC_{t-4}	0.778127	-3.180420	1.975214	-1.212023	-0.103521
	[1.44583]	[-2.07357]	[0.48845]	[-2.42027]	[-0.15229]
	(0.53819)	(1.53379)	(4.04387)	(0.50078)	(0.67976)
ΔIND_{t-1}	-0.140652	-0.521181	-0.640475	0.126774	0.142328
[t-statistic]	[-0.67564]	[-0.87847]	[-0.40946]	[0.65446]	[0.54130]
(p-value)	(0.20818)	(0.59329)	(1.56421)	(0.19371)	(0.26294)
ΔIND_{t-2}	-0.179450	0.242254	1.945843	0.068038	0.382464
[t-statistic]	[-0.86563]	[0.41004]	[1.24921]	[0.35272]	[1.46069]
(p-value)	(0.20730)	(0.59080)	(1.55765)	(0.19289)	(0.26184)
ΔBRA_{t-1}	0.005201	0.078038	0.294131	-0.045770	0.059611
[t-statistic]	[0.29111]	[1.53251]	[2.19082]	[-2.75291]	[2.64139]
(p-value)	(0.01787)	(0.05092)	(0.13426)	(0.01663)	(0.02257)
ΔBR_{t-2}	0.004235	-0.081891	0.038293	-0.002178	-0.002185
[t-statistic]	[0.58788]	[-3.98833]	[0.70736]	[-0.32485]	[-0.24013]
(p-value)	(0.00720)	(0.02053)	(0.05413)	(0.00670)	(0.00910)
ΔRUS_{t-1}	-0.026514	0.188372	-0.109525	0.015304	-0.083580
[t-statistic]	[-0.85578]	[2.13338]	[-0.47047]	[0.53087]	[-2.13580]
(p-value)	(0.03098)	(0.08830)	(0.23280)	(0.02883)	(0.03913)
ΔRUS_{t-1}	0.003458	0.015212	-0.254875	0.038391	-0.051964
[t-statistic]	[0.19380]	[0.29914]	[-1.90105]	[2.31231]	[-2.30571]
(p-value)	(0.01784)	(0.05085)	(0.13407)	(0.01660)	(0.02254)
ΔCHN_{t-1}	-0.331961	1.688712	-4.216908	0.203351	0.210927
[t-statistic]	[-0.91137]	[1.62679]	[-1.54077]	[0.59999]	[0.45848]
(p-value)	(0.36424)	(1.03806)	(2.73688)	(0.33893)	(0.46006)
ΔCHN_{t-2}	0.261969	1.990384	0.198932	-0.121767	0.760420
[t-statistic]	[1.05253]	[2.80602]	[0.10637]	[-0.52578]	[2.41889]
(p-value)	(0.24889)	(0.70933)	(1.87015)	(0.23159)	(0.31437)
ΔSA_{t-1}	0.013492	0.200168	-1.235795	0.139654	0.922152
[t-statistic]	[0.04508]	[0.23465]	[-0.54948]	[0.50142]	[2.43919]
(p-value)	(0.29932)	(0.85303)	(2.24904)	(0.27851)	(0.37806)
ΔSA_{t-2}	0.150669	0.310210	-0.199540	0.007683	0.702644
[t-statistic]	[0.85011]	[0.61415]	[-0.14984]	[0.04658]	[3.13881]
(p-value)	(0.17723)	(0.50510)	(1.33171)	(0.16492)	(0.22386)

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

Table 6. Results of Granger Causality Test

Null Hypothesis	Observation	F-Statistic	Probability	Decision
RUS does not Granger Cause BRA	24	7464.23	3.E-28	Failed to reject
BRA does not Granger Cause RUS		7.67321	0.0036	Rejected
IND does not Granger Cause BRA	24	7.10202	0.0050	Rejected
BRA does not Granger Cause IND		0.62235	0.5473	Failed to reject
CHN does not Granger Cause BRA	24	0.07939	0.9240	Failed to reject
BRA does not Granger Cause CHN		22.9484	9.E-06	Failed to reject
SA does not Granger Cause BRA	24	4.21173	0.0306	Rejected
BRA does not Granger Cause SA		0.73753	0.4915	Failed to reject
IND does not Granger Cause RUS	24	0.70419	0.5070	Failed to reject
RUS does not Granger Cause IND		1.30965	0.2932	Failed to reject
CHN does not Granger Cause RUS	24	2.08884	0.1514	Failed to reject
RUS does not Granger Cause CHN		38.0039	2.E-07	Failed to reject
SA does not Granger Cause RUS	24	0.81495	0.4575	Failed to reject
RUS does not Granger Cause SA		0.89718	0.4243	Failed to reject
CHN does not Granger Cause IND	24	1.96731	0.1673	Failed to reject
IND does not Granger Cause CHN		0.22090	0.8038	Failed to reject
SA does not Granger Cause IND	24	1.40894	0.2688	Failed to reject
IND does not Granger Cause SA		0.10604	0.8999	Failed to reject
SA does not Granger Cause CHN	24	2.36952	0.1206	Failed to reject
CHN does not Granger Cause SA		1.28348	0.3000	Failed to reject

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

Normality Test: In the normality test output we check p-value which explain whether accept or reject null hypothesis. The p-value of is 0.1763 or 17.63 per cent therefore we cannot reject null hypothesis rather we accept null hypothesis meaning that residual is normally distributed and it is desirable.

Granger Causality Test

The result of granger causality test shown in table 6 indicating that majority of the null hypothesis is accepted where in some cases it is failed to reject based on their probability value. In the result of following table it is mentioned that the null hypothesis for Brazil does not granger cause Russia, India does not granger cause Brazil and South Africa does not granger cause Brazil is rejected and all the other variable granger cause to each other for the null hypothesis is accepted as shown in the result table.

Finding and Conclusion

Inflation is the indicator of economic growth and we are living in highly globalized economic environment where various economies are interlinked with each other at various macro-economic level. The present study focused on the emerging economies of BRICS nations. It is an economic integrated group of countries where country cointegrated with each other at various levels. The following study was based on the cross country analysis of BRICS nation for their Inflation growth rate and its impact on other economics. In this study the sample period of 1991 to 2016 is selected for the study. As per the result of descriptive statistics the average growth rate of inflation was highest in Brazil followed by Russia and the least average growth rate of inflation recorded in China. Brazil is noticed as highly volatile in case of inflation followed by Russia and India is recorded as least volatile in inflation rate.

The variation in the inflation rate was highest in Russia followed by Brazil and least in India. The correlation test shows that the inflation rate of China is highly correlated to Brazil followed by Russia highly correlated with Brazil which means that if the inflation rate in China increases it will also increase the inflation rate of Brazil and if the inflation rate of Russia will increase or decrease it will also affect Brazil. The result shows that the inflation rate of India is negatively short run time period. In case of China, The inflation rate of China affects the inflation rate of India means that increase of decrease in the inflation rate will also having its impact on inflation rate of India. The inflation rate of South Africa does not affect inflation rate of India which is confirmed by the result output.

REFERENCES

Evans, M. 1991. "Discovering the link between inflation rates and inflation uncertainty", *Journal of money credit and banking*, 23, 169-182

Evans, M., and Wachtel, P. 1993. "Inflation regimes and the sources of inflation uncertainty", *Journal of Money, Credit, and Banking*, 25, 475-51

Friedman, M. 1977. Nobel lecture "Inflation and unemployment", *Journal of Political Economy*, 85, 451–472.

Gale, W. A., 1981. "Temporal variability of United States consumer price index", *Journal of Money, Credit and Banking*. 13, 273-297.

Hess, G.D., and Morris, C.S. 1996. "The long-run costs of moderate inflation", *Economic Review*, Federal Reserve Bank of Kansas City, 71-88.

Gomme, Paul 1993. "Money and Growth Revisited: Measuring the Costs of Inflation in an Endogenous Growth Model," *Journal of Monetary Economics,* Volume 32, pp. 51–77.

Keidel A. 2007."China's Economic Fluctuations and Their Implications for Its Rural Economy", Carnegie Endowment for International Peace, www.Carnegie Endowment.org.

Keynes, J. M. 1936."*The General Theory of Employment, Interest, and Money*", Macmillan, London.

Mundell, Robert A. 1960. "The Monetary Dynamics of International Adjustment under Fixed and Flexible Exchange Rates," *Quarterly Journal of Economics*, Vol. 74 (May), pp. 227–57.

Okun, A. 1971. "The mirage of steady inflation", *Brookings Papers on Economic Activity 2*, 485- 498.

Stockman, A. 1980, "A Theory of Exchange Rate Determination," *Journal of Political Economy*, 673-98 (a).

Appendix

Appendix (1.1) Lag-Length Table

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-421.6090	NA	8.88e+09	37.09643	37.34328	37.15851
1	-338.5393	122.7986	60564998	32.04690	33.52798	32.41938
2	-294.3234	46.13836	16374265	30.37595	33.09126	31.05884
3	-204.0449	54.95212*	187569.8*	24.69956*	28.64910*	25.69286*

****