The BRICS and Nigeria's economic performance: A trade intensity analysis

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Abstract

The study examined Nigeria's trading relationship with the individual BRICS (Brazil, Russia, India, China and South Africa) by applying a combination of descriptive and econometric techniques. The findings show that Nigeria's trade intensity is highest with Brazil followed by trade with India and then South Africa. The outcome of the vector autoregressive analysis indicated that Nigeria's gross domestic product (GDP) reverts faster to equilibrium when there is a shock to exports to and imports from Brazil, as against Nigeria exports to and imports from the other BRICS countries. A key policy implication of the results is that of all the BRICS countries, Brazil appears to have the most potential in terms of improving Nigeria's trade position.

Keywords: Trade intensity, Vector autoregression, Impulse-response, BRICS, MINT, Policy.
JEL Classification: C32; C51; F14.

1. Introduction

Nigeria is touted as one of the countries with potentials to become one of the top economies in the world and this view is shared by proponents of the BRICS (Brazil, Russia, India, China and South Africa). Nigeria is even now grouped among the new emerging powers, the MINT (Mexico, Indonesia, Nigeria and Turkey) countries. The robust performance of the Nigerian economy as well as the goal of the Government to propel the economy to become one of the top 20 in the world by the year 2020 is also boosting the profile of the economy. To this end, the relationship between Nigeria and the BRICS has been of interest to stakeholders. For example, Alao (2011) provided an insight into the relationship between Nigeria and the BRICs (excluding South Africa) from a diplomatic, trade, cultural and military relations perspectives. Also, the relationship between Nigeria and South Africa is considered strategic for the whole of Africa given the latter's involvement in the BRICS.

Studies have dwelt on relationships among the BRICS, for example, Naresh and Alina (2011). However, one of the arguments against the BRICS arrangement is that rather than adopt a multilateral strategy, the individual countries are pursuing bilateral approach with different countries, including Nigeria. To this end, it is opined that there is an implicit struggle by the individual BRICS to penetrate the Nigerian economy. Also, Nigeria is believed to be strategic in identifying those markets, including the BRICS, where its bilateral interests are better served. Therefore, providing evidence on the trading relationship between Nigeria and the BRICS will shed light on the relevance of the BRICS economies to Nigeria.

Following from the above, the broad objective of this study is to discuss the extent of trade intensity between Nigeria and the individual BRICS. Specifically, the study examines how shocks to Nigeria's economy affect its exports to and imports from the BRICS. The rest of the study is organized as follows: Section 2 provides an overview of the Nigerian economy while section 3 presents the methodology for estimating the trade intensity and shocks. Section 4 presents the data and results while section 5 gives the policy implications of the results.

2. Overview of the Nigerian Economy

Following the rebasing of the GDP in April 2014, Nigeria is now the largest economy in Sub-Saharan Africa (SSA) and 26th in the world with an estimated nominal GDP of $509 billion as shown in Figure 1. Since 1999 when series of reforms have been initiated and implemented, average real GDP growth has been robust at over 6% as indicted in Figure 2.

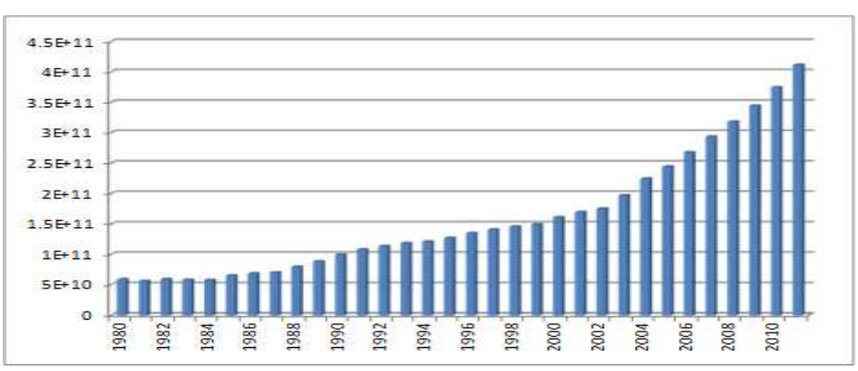


Fig-1. Nigeria's Real GDP size 1961-2011 (million)

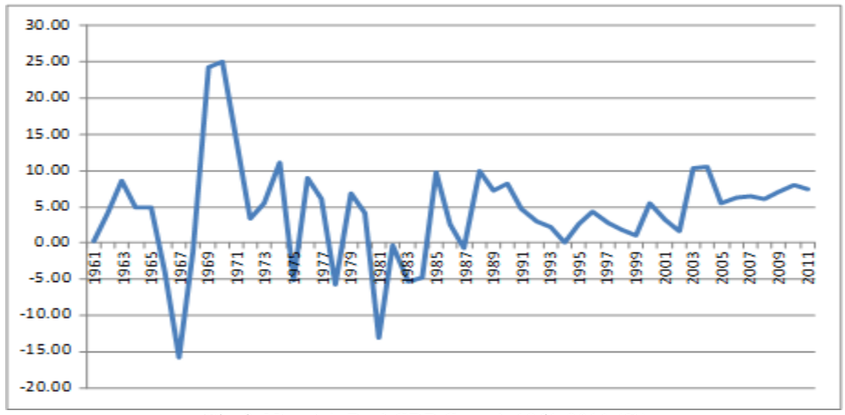
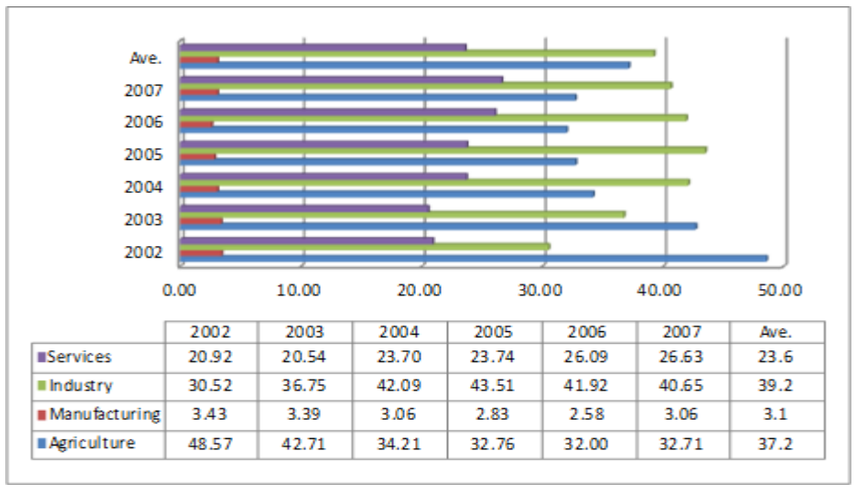


Fig-2. Nigeria's Real GDP Growth 1961-2011 (%)

With respect to the structure of the economy, Figure 3 shows that between 2002 and 2007, the Nigerian economy was substantially agrarian with the agriculture sector contributing approximately 37% to the GDP, the service sector contributed 24% while manufacturing sector had the least contribution of 3.1% in the period. The industrial sector contribution of 39% is as a result of the inclusion of oil and gas activities in the computation of the sector's contribution to the GDP. However, after the rebasing of the GDP in April 2014, the structure of the Nigerian economy has changed with the share of agricultural sector to the GDP declining from 33% to 22% while the share of the services sector has increased from 26% to about 51% of GDP.



	2002	2003	2004	2005	2006	2007	Ave.
Services	20.92	20.54	23.70	23.74	26.09	26.63	23.6
Industry	30.52	36.75	42.09	43.51	41.92	40.65	39.2
Manufacturing	3.43	3.39	3.06	2.83	2.58	3.06	3.1
Agriculture	48.57	42.71	34.21	32.76	32.00	32.71	37.2

Fig-3. Composition of Nigeria's GDP (%)

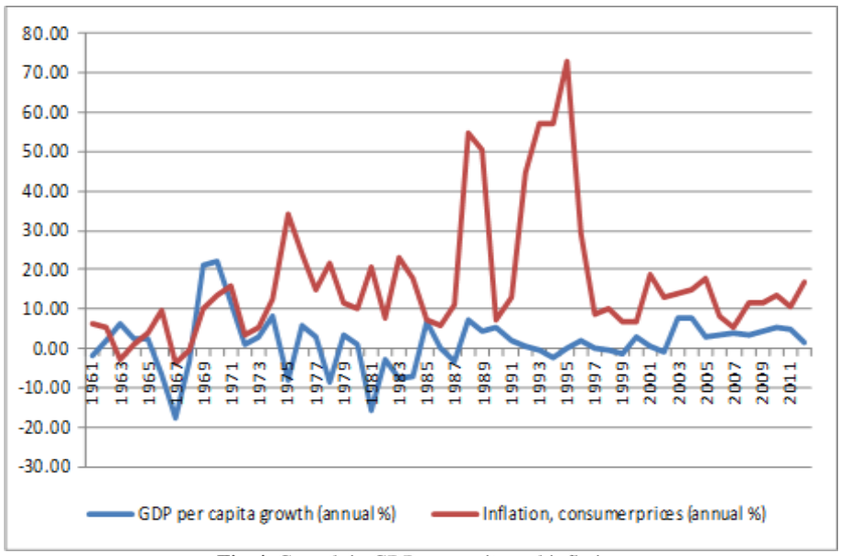


Fig-4. Growth in GDP per capita and inflation

In terms of welfare, the purchasing power as shown in Figure 4 has been eroded by rising inflation over the years. Between 1961 and 2011, the inflation rate in Nigeria averaged 16% while the growth in GDP per capita was 1.6%. This erosion in real income was prevalent in the mid-1990s when inflation rate spiked significantly as against growth in income that was relatively stable in the period. However, inflation rate has been at single digit in the recent times.

Nigeria's integration into the global economy has been on the rise since the 1990s with the trade balance increasing relative to the GDP. Figure 5 shows that between 1960 and 1989, the country's trade balance (% of GDP) averaged 34.2%. However, in the period 1990 to 2011, it averaged 76.2%, implying more integration with the global economy. With respect to the current account balance, since 2005 Nigeria has maintained a positive balance (% of

GDP), meaning that inflows into the economy have been higher than the outflows.

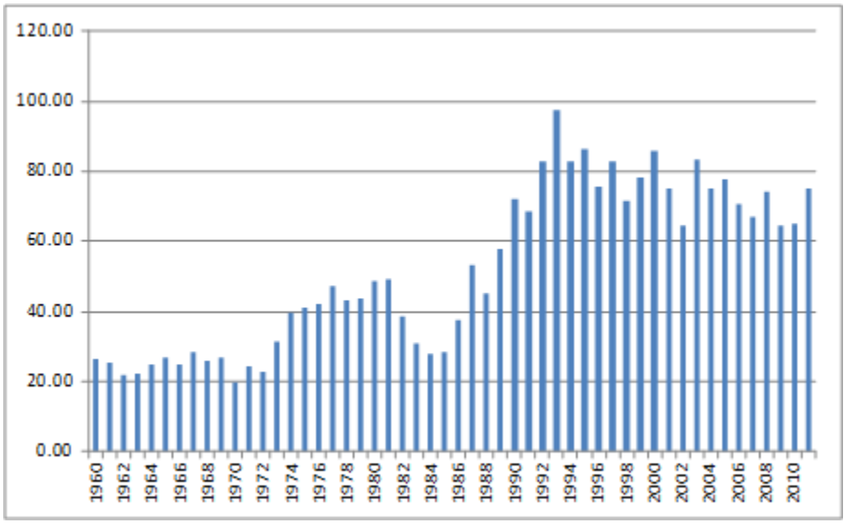


Fig-5. Nigeria's Trade Balance (% of GDP)

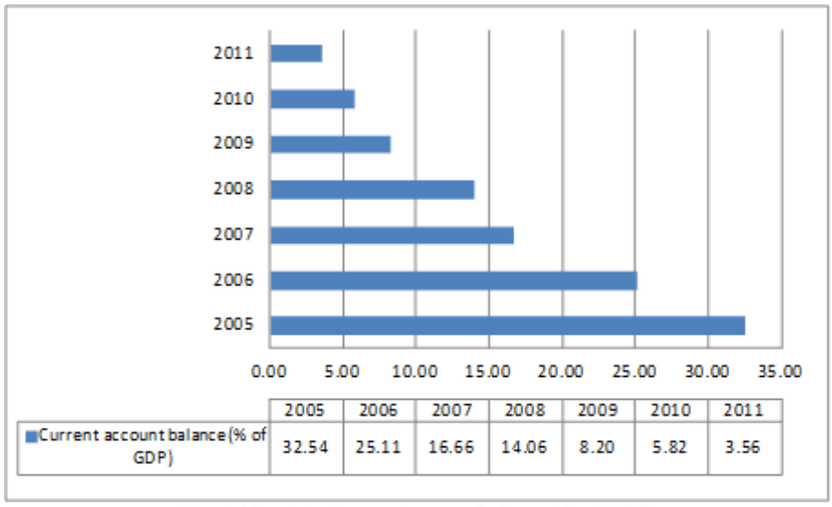


Fig-6. Nigeria's Current Account Balance (% of GDP)

3. Methodology

3.1. Descriptive Analysis

In line with studies in the literature, e.g., Oehler-Şincai (2011) the first objective of the study is to estimate the level of trade intensity between Nigeria and the individual BRICS. The trade intensity between exporter *i* and importer *j* is defined as:

$$\text{Trade Intensity (TI)} = \frac{\text{Kij}}{\text{Ki}} \Big/ \frac{\text{Kwj}}{\text{Kw}} \qquad (1)$$

Where

Xij = country i exports to country j
Xi = country i total exports
Xwj = world exports to country j
Xw = total world exports.

An index above one indicates larger exports from country *i* to country *j* than would be expected from country *j's* importance in world trade.

3.2. Estimation Technique

The estimation approach for the study is the Hjalmarsson and Österholm (2007)[1] multivariate vector autoregressive (VAR) cointegration technique which assumes that all the variables are endogenous. A VAR with p lags is stated in the form below;

$$y_t = v + A_1 y_{t-1} + A_2 y_{t-2} + \ldots + A_p y_{t-p} + \varepsilon_t \qquad (2)$$

where y_t is a K × 1 vector of endogenous variables, v is K × 1 vector of parameters, $A_1 - A_p$ are K × K matrices of parameters, and ε_t is K × 1 vector of disturbance terms. The VAR is used when there is no cointegration among the variables and it is estimated using time series that have been transformed to their stationary values. However, if evidence of cointegration exists, the vector error correction (VECM) is estimated. The number of co-integrating vectors is determined using the trace test and the maximum-eigenvalue test. Therefore, we estimate the following equation;

$$GDP_t = (EXTi_t, IMFi_t, INF_t) \quad (3)$$

Where;

GDP*t*	= Nigeria's gross domestic product
EXT*it*	= Nigeria's exports to each of the individual BRICS
IMF*it*	= Nigeria's imports from each of the BRICS
INF*t*	= Nigeria's Africa's domestic inflation rate

Given that the main limitation of the VAR/VECM model is the lack of a strong theoretical basis for estimated coefficients, the study will focus on discussing the impulse response and the variance decomposition analyses. However, before estimating equation 3, the Augmented Dickey–Fuller (ADF) test will be used to test the time series properties of the selected variables while appropriate lag length will be determined using the relevant criteria such as the Akaike Information Criterion [AIC] and the Bayesian Information Criterion [BIC].

3.3. Data Type and Source

Annual time series data from 1995 to 2011 is used to estimate the trade intensity index between Nigeria and each of the BRICS. In order to have sufficient data points for the empirical analysis, quarterly data between 2005Q1 and 2012Q1 is applied. The sources of the data include UNCTAD – for the exports and imports variables, while the GDP and inflation rates were sourced from the Central Bank of Nigeria statistical bulletins.

4. Data Presentation - Trade Flows between Nigeria and the BRICS

The trade flows between Nigeria and the individual BRICS between 1995 and 2011 is depicted in Figures 7 to 11. Specifically, and as shown in Figure 7, Brazil recorded an average $2,156.9 million trade deficit with Nigeria in the period given that its exports to Nigeria averaged $703.4 million while its imports from Nigeria averaged $2, 860.4 million. Figure 8 shows that Russia maintained trade surplus with Nigeria as its exports averaged $109.5 million and imports $6.3 million, implying that the country maintained an average trade surplus of $103.2 million with Nigeria in the period. The trade flow between India and Nigeria as shown in Figure 9 indicates that apart from 2004 and 2005 when India recorded positive trade balance with Nigeria, all other years were negative. Overall, India's exports to Nigeria averaged $801.9 million in the review period while imports were $3,939.1 million, bringing the trade deficit to an average of $3,137.2 million.

The trade flow between China and Nigeria as shown in Figure 10 indicates that the Asian country recorded trade surplus with Nigeria in the review period. China's exports to Nigeria and imports from Nigeria averaged $2.6 billion and $404.7 million respectively between 1995 and 2011, resulting in a trade surplus of $2.2 billion in the period. South Africa's trade flows with Nigeria as shown in Figure 11 indicates that total exports to Nigeria averaged $390.3 million while imports were $885.4 million, thereby giving a trade deficit of $495.1 million.

The trade intensity analysis as shown in Figure 12 indicates that between 1995 and 2011, Nigeria's trade intensity was highest with India, followed by trade with Brazil and then with South Africa. The intensity index with China and Russia are less than 1 but was lowest with Russia. This implies that among the BRICS, Russia was the smallest trading partner with Nigeria in the period 1995 – 2011.

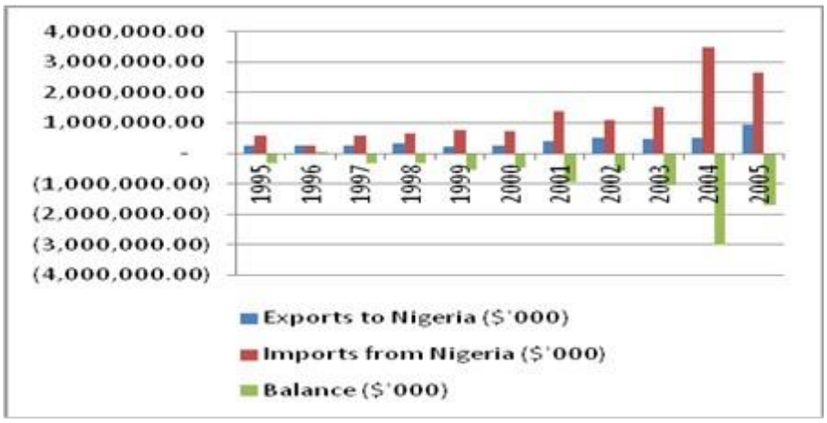


Fig-7. Nigeria - Brazil Trade Balance

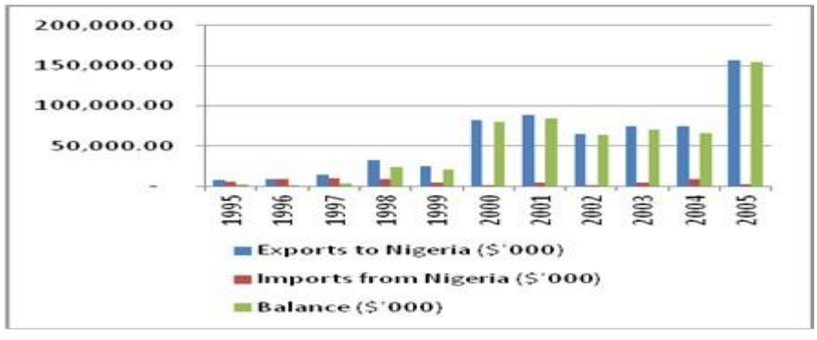


Fig-9. Nigeria - India Trade Balance

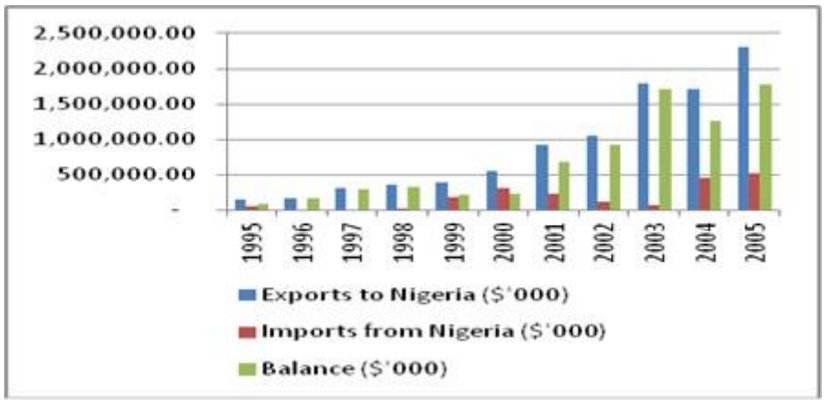


Fig-10. Nigeria - China Trade Balance

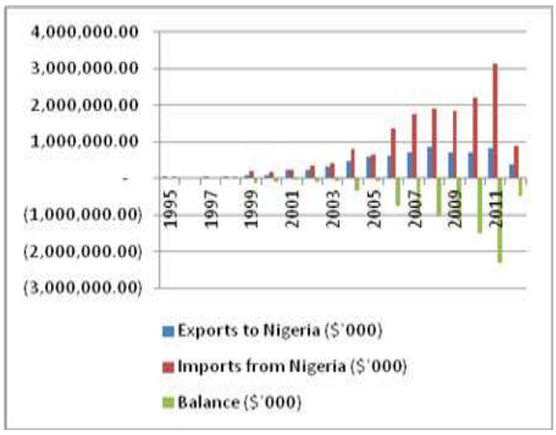


Fig-11. Nigeria - S/Africa Trade Balance

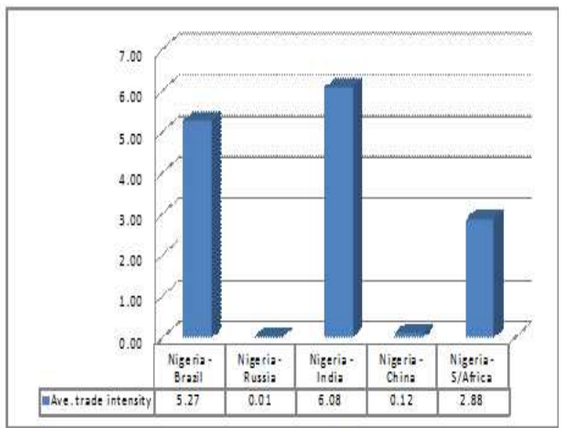


Fig-12. Nigeria - BRICS Trade Intensity

5. Results

In this section, attempt is made to provide empirical support for the trading relationship between Nigeria and the individual BRICS using the traditional VAR technique, although some studies, for example Mustafa and Kabundi (2011) used the Global VAR. The analysis focuses on Nigeria and Brazil, Nigeria and China and then Nigeria and South Africa, all between 2005Q1 and 2012Q1. However, the unavailability of data for Russia and India means that both countries are omitted from the analysis.

5.1. Nigeria and Brazil

5.1.1. Unit Root, Lag Length and Cointegration

Table 1 shows the results of the test for time series properties of the variables using the Augmented Dicker Fuller (ADF) test. The outcome indicates that all the indicators, gross domestic product (GDP), Nigeria's exports to Brazil (EXTBR), Nigeria's imports from Brazil (IMFBR) and Nigeria's inflation rate (INF) are I (1) series as they are stationary after first differencing.

Table-1. Augmented Dickey Fuller Test

	P-value at Level	P-value at First Difference
GDP	0.7576	0.0000
EXTBR	0.3715	0.0000
IMFBR	0.7594	0.0000
INF	0.4866	0.0158

Source: Authors' estimations

In order to proceed to ascertaining if there are cointegrating vectors in the equation, we first choose the appropriate lag length using the Akaike information criterion (AIC), the Schwarz Bayesian criterion (SBIC), and the Hannan-Quinn criterion (HQC). Therefore, Table 2 provides that the appropriate lag length is 2 as suggested by the AIC and HQC criterion.

Table-2. Lag length selection

Lags	loglik	p(LR)	AIC	BIC	HQC
1	44.0471		-1.9237	-0.9486*	-1.6533
2	67.1352	0.0000	-2.4908*	-0.7356	-2.0040*

Note: AIC = Akaike criterion, SBIC = Schwarz Bayesian criterion and HQC = Hannan-Quinn criterion.

The result of the Johansen cointegration test as shown in Table 3 indicates that using the eigenvalue and trace tests, there exist at least one cointegrating vector in the equation. Therefore, the vector error correction model is estimated prior to using the impulse response analysis to ascertain how Nigeria's GDP responds to shocks in exports to and imports from Brazil.

Table-3. Johansen Co-integration Test

Rank	Eigenvalue	Trace test	P-value
0	0.8755	108.7700	0.0000
1	0.7259	56.6790	0.0000
2	0.5107	24.3210	0.0014
3	0.2274	6.4510	0.0111

Source: Authors' estimations

5.1.2. Impulse Response Analysis

The response of Nigeria's GDP to a one standard error shock to exports to Brazil is depicted in Figure 13 and the GDP responds positively in Q1, moderates afterwards and was negative in Q4. Following from this, the response gets positive but unstable until the effect gets flat from Q10. On the contrary, the response of GDP to a shock in imports from Brazil as shown in Figure 14 indicates that the effect of the response was mixed in the initial quarters. While the response was positive and sharp between Q1 and Q2, the response in Q3 was negative before becoming positive again in Q4 and then dies out from Q5. When compared with the response to a shock to exports to Brazil, it means that the GDP reverts faster to equilibrium when there is a shock to imports from Brazil.

When emphasis is placed on how Nigeria's exports to Brazil respond to a one standard error shock to the GDP, Figure 15 shows that the response declined in Q1 and eventually dies out from Q10. Similarly, the response of Nigeria's imports from Brazil to a one standard error shock to the GDP as shown in Figure 16 also dies out from Q10 after declining in Q1 and also negative in Q2. The response of Nigeria's GDP to a one standard error shock to the domestic inflation rate shows that the initial response is sharp and negative between Q1 and Q3 before becoming relatively stable, although still negative. This negative response of the GDP to a shock to inflation, however, becomes flat from Q10 and remained so throughout the period.

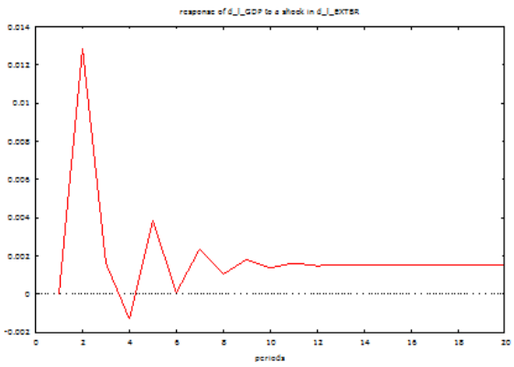


Fig-13. Response of GDP to shock in exports to Brazil

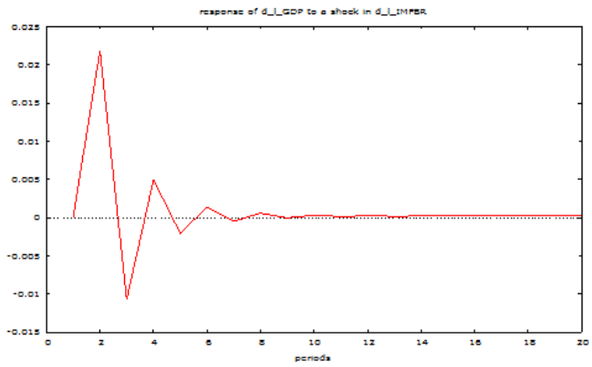


Fig-14. Response of GDP to shock in imports from Brazil

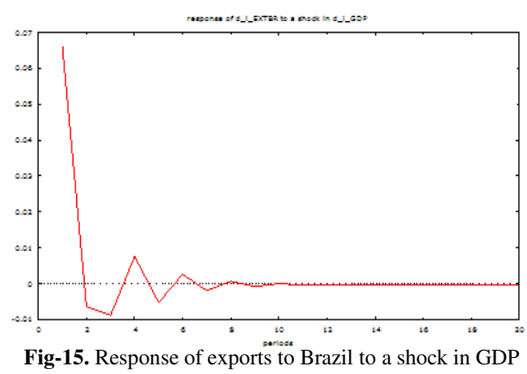


Fig-15. Response of exports to Brazil to a shock in GDP

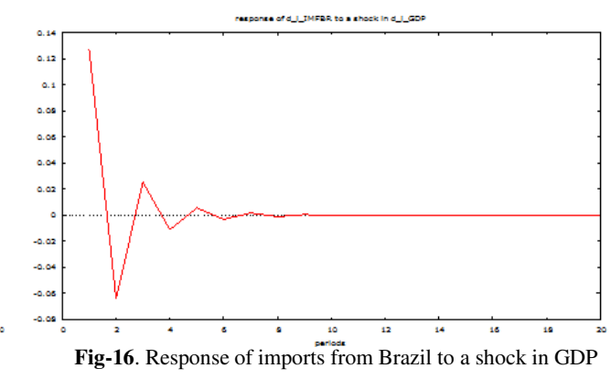


Fig-16. Response of imports from Brazil to a shock in GDP

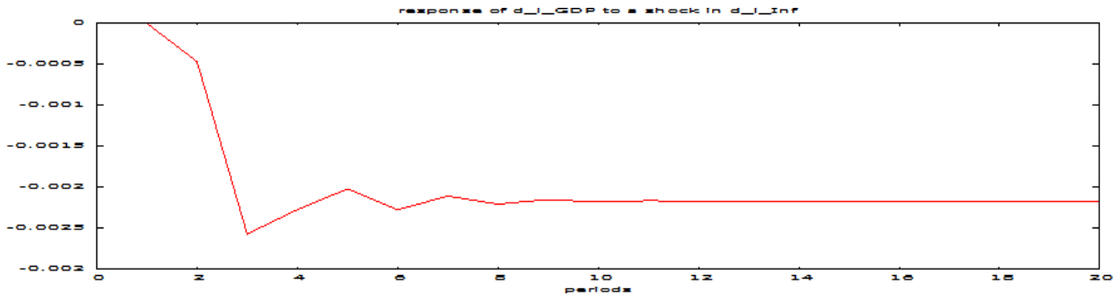


Fig-17. Response of GDP to a shock in domestic inflation

5.1.3. Variance Decomposition Analysis

The objective of the variance decomposition analysis is to provide the extent to which the variation in a particular variable is explained by the other variables in the equation. Table 1 in Appendix[2] A shows that on average 87% of the variation in Nigeria's GDP is explained by own effect, followed by imports from Brazil (9.2%), exports to Brazil (2.9%), while inflation rate explains the least average variation of approximately 0.7% of the GDP. Similarly, Table 2 indicates that own effect explains the highest variation of 89% in Nigeria's exports to Brazil followed by inflation (7%), imports from Brazil (2.3%), while the least variation of 2.1% is explained by the GDP. Also, own effect explains the highest average variation of 74% in imports from Brazil while GDP explains 14.8%, followed by exports to Brazil (9.1%), while inflation explains the least average variation of 1.8%. With respect to the level of variation in the domestic inflation rate, Table 4 explains that own effect is responsible for average 67% while exports to Brazil is responsible for 32%, followed by imports from Brazil (1.2%) and GDP (0.09%).

5.1.4. Diagnostic Tests

Diagnostic tests are conducted in order to provide validation to the results of the trading relationship between Nigeria and Brazil. The results as shown in Table 4 below indicate that the errors are normally distributed while there is no evidence of the presence of autocorrelation and heteroskedasticity.

Table-4. Post estimation tests

	Null hypothesis	**P-value**
Normality	Error is normally distributed	0.6231
Autocorrelation	Autocorrelation not present	0.8560
Heteroskedasticity	No presence of heteroskedasticity	0.2156

Source: Authors' estimates

5.2. Nigeria and China

5.2.1. Unit Root, Lag Length and Cointegration

Table 5 shows that in addition to the gross domestic product and inflation rate that are stationary after first differencing, Nigeria's exports to China (EXTCH) and imports from China (IMFCH) are also I (1) series and are appropriate to be included in the VAR estimation.

Table-5. Stationarity Test

	P-value at Level	**P-value at First Difference**
GDP	0.7576	0.0000
EXTCH	0.6504	0.0000
IMFCH	0.5177	0.0000
INF	0.4866	0.0158

Source: Authors' estimates

In addition to testing for the time series properties of the variables, Table 6 shows that the lag length selection of 2 is the appropriate level as suggested by the Akaike criterion and the Hannan-Quinn criterion.

Table-6. Lag Length Selection

Lags	**loglik**	**p(LR)**	**AIC**	**BIC**	**HQC**
1	30.3923		-0.8314	0.1437*	-0.5609
2	53.9310	0.0000	-1.4345*	0.3207	-0.9476*

Note: AIC = Akaike criterion, BIC = Schwarz Bayesian criterion and HQC = Hannan-Quinn criterion.

From the results of the Johansen cointegration test in Table 7, at least one cointegrating vector is present in the equation using the eigenvalue and trace tests. This means that we estimate the VECM with the aim of ascertaining the impulse response and error variance decomposition.

Table-7. Johansen Co-integration Test

Rank	**Eigenvalue**	**Trace test**	**P-value**
0	0.8362	89.0660	0.0000
1	0.5592	43.8410	0.0005
2	0.4411	23.3640	0.0021
3	0.2973	8.8198	0.0030

Source: Authors' estimations

5.2.2. Impulse Response Analysis

The impulse response analysis for Nigeria's GDP and exports to China is shown in Figure 18. The response of the GDP to a shock in exports to China is positive in the initial quarters but by Q4 the response becomes negative. Although this improved by Q5, the effect was flat from Q9 and remained so afterwards. When the impulse response analysis is reversed, that is, considering the response of Nigeria's exports to China to a one standard error shock to GDP, Figure 19 shows that the unstable response between Q1 and Q4 gave way for stability, with the effect remaining flat and positive from Q5.

The response of the GDP to a one standard error shock in imports from China as shown in Figure 20 depicts that the effect dies out from Q6 after the sharp positive response in Q1 and the negative response between Q3 and Q4. Again, the reversal of the impulse response analysis as shown in Figure 21 indicates that in the event of a shock to the GDP, the response of imports from China is a sharp decline from the positive level in Q1 to a negative response in Q2. The response improved between Q3 and Q4 and then dies out from Q6.

With respect to the response of Nigeria's GDP to a one standard error shock to the domestic inflation rate, Figure 22 shows that the response is a sharp negative decline between Q1 and Q5 before becoming flat for the rest of the period from Q6.

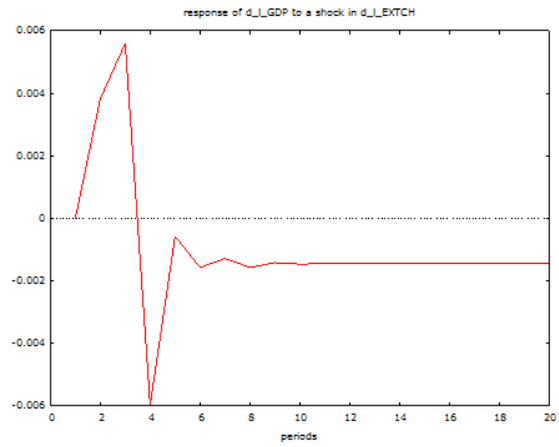


Fig-18. Response of GDP to shock in exports to China

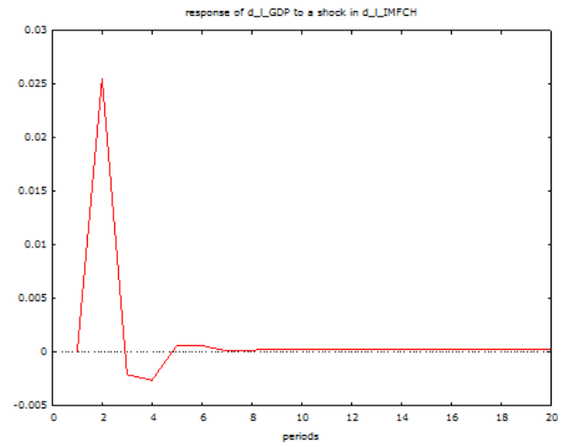


Fig-19. Response of GDP to shock in imports from China

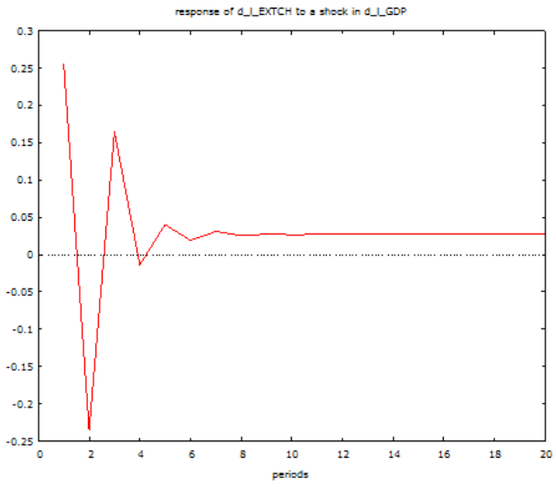


Fig-20. Response of exports to China_to a shock in GDP

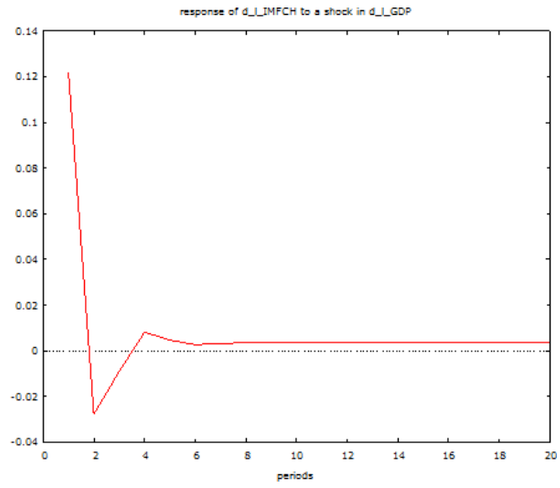


Fig-21. Response of imports from China_to a shock in GDP

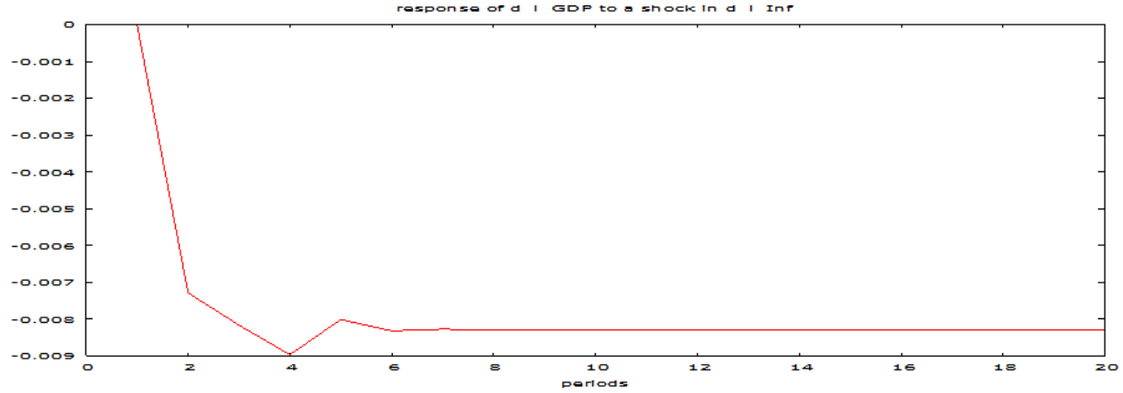


Fig-22. Response of GDP to a shock in domestic inflation

5.2.3. Variance Decomposition Analysis

The results of the variance decomposition analysis for the trading relationship between Nigeria and China are provided in Appendix B. Table 1 show that own effect explains the highest variation of 81% in Nigeria's GDP while inflation rate explains the second highest variation of 9%. Imports from China explain 8.8% in the variation in the

GDP while exports to China explain the least variation of 1.2% in the GDP. The results of the variance decomposition for Nigeria's exports to China is shown in Table 2 and indicates that own effect explains 81% of the variation followed by the inflation rate and then the GDP. Imports from China explain the least variation in Nigeria's exports to China.

Also, Table 3 shows that the GDP explains the highest variation of 43% in Nigeria's imports from China followed by own effect of 40% and then inflation rate with approximately 11%. Exports to China explain the least variation of 6% in Nigeria's imports from China. The highest variation in the domestic inflation rate of 94% is explained by own shock as shown in Table 4, while exports to China is responsible for 3% of the variation in domestic inflation. The GDP and imports from China are responsible for 2% and 0.6% of the variation in Nigeria's domestic inflation rate in that order.

5.2.4. Diagnostic Tests

In order to provide some evidence of validity for the results of the trading relationship between Nigeria and China, the combined residual plot shown in Figure 23 indicates that the residuals are stationary. This suggests that the results obtained are valid.

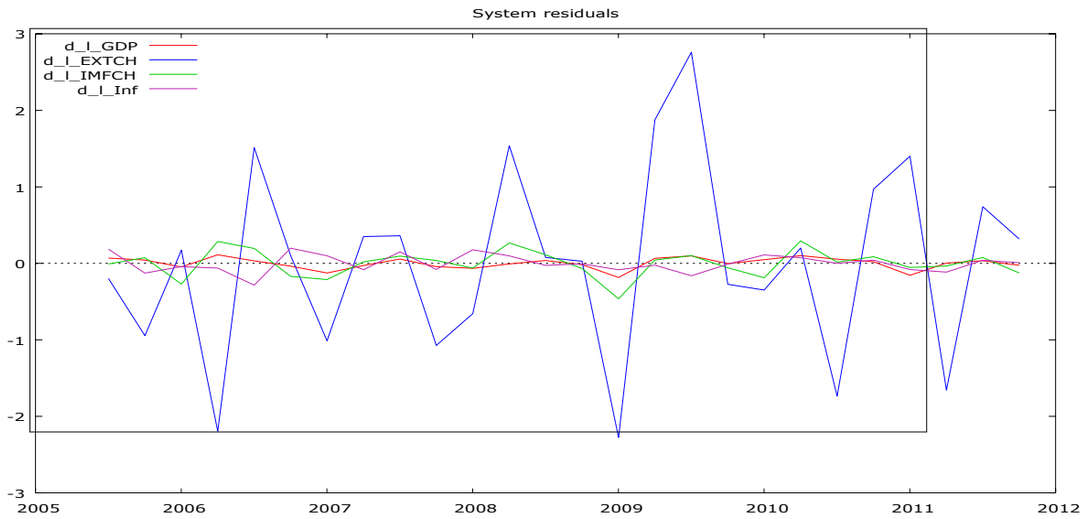


Figure-23. Combined residual plot

In addition to the combined plots, Table 8 shows the results of other diagnostic tests and indicates that the errors are normally distributed, while we also fail to reject the null hypotheses of no presence of autocorrelation and heteroskedasticity.

Table-8. Post Estimation Tests

	Null hypothesis	**P-value**
Normality	Error is normally distributed	0.7524
Autocorrelation	Autocorrelation not present	0.7450
Heteroskedasticity	No presence of heteroskedasticity	0.2405

Source: Authors' estimations

5.3. Nigeria and South Africa

5.3.1. Unit Root, Lag Length and Cointegration

Table 9 shows that Nigeria's exports to South Africa (EXTSA) and imports from South Africa (IMFSA) have unit root at level before becoming stationary after first differencing, making them I (1) series alongside GDP and inflation. In addition, Table 10 shows that all the selection lag length selection criteria indicate that 1 is the appropriate lag length.

Table-9. Augmented Dickey Fuller Test

	P-value at Level	**P-value at First Difference**
GDP	0.7576	0.0000
EXTSA	0.1060	0.0000
IMFSA	0.7985	0.0000
INF	0.4866	0.0158

Source: Authors' estimations

Table-10. Lag length selection

Lags	**loglik**	**p(LR)**	**AIC**	**BIC**	**HQC**
1	27.1746		-0.5739*	0.4011*	-0.3035*
2	36.9062	0.2454	-0.0725	1.6826	0.4143

Note: AIC = Akaike criterion, BIC = Schwarz Bayesian criterion and HQC = Hannan-Quinn criterion

The results for the eigenvalue and trace tests as reported in Table 11 indicate that there exists at least one cointegrating vector in the equation. This implies that the vector autoregressive model can be estimated with the aim of tracing out the response of Nigeria's GDP to shocks to its exports to South Africa, its imports from South Africa as well as the domestic inflation rate. Following from this, the variance decomposition analysis is also carried out.

Table-11. Johansen Co-integration Test

Rank	Eigenvalue	Trace test	P-value
0	0.85098	98.7520	0.0000
1	0.60524	49.2560	0.0000
2	0.53278	25.0900	0.0010
3	0.18456	5.3048	0.0213

Source: Authors' estimations

5.3.2. Impulse Response Analysis

The response of Nigeria' GDP to a one standard error shock to exports to South Africa is depicted in Figure 24. The response between Q1 and Q6 was unstable, fluctuating in the positive and negative regions before moderating between Q7 and Q10. The effect of the shock finally dies out from Q11. Figure 25 shows that the response of Nigeria's GDP to a shock in imports from South Africa is negative in Q1. Although the response improved in Q2, it stayed negative before becoming flat from Q6.

However, in the event of a shock to the GDP, Nigeria's exports to South Africa as shown in Figure 26 indicates a sharp decline from a positive level to negative in Q2. The volatility in the response reduced from Q3 before the effect finally dies out from Q10. Also, when a shock to GDP is considered, the response of Nigeria's imports from South Africa as shown in Figure 27 indicates that from a positive state in Q1, the response is negative in Q3 and becomes flat from Q4. With respect to the response of Nigeria's GDP to a one standard error shock to the domestic inflation rate, Figure 28 shows that the response is a sharp negative decline between Q1 and Q2 before becoming flat for the rest of the period from Q4.

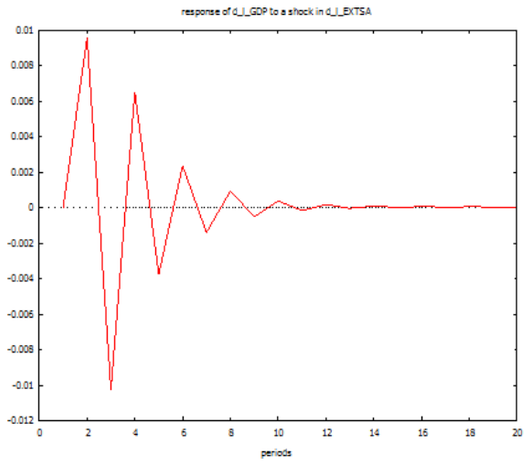


Fig-24. Response of GDP to shock in exports to S/Africa

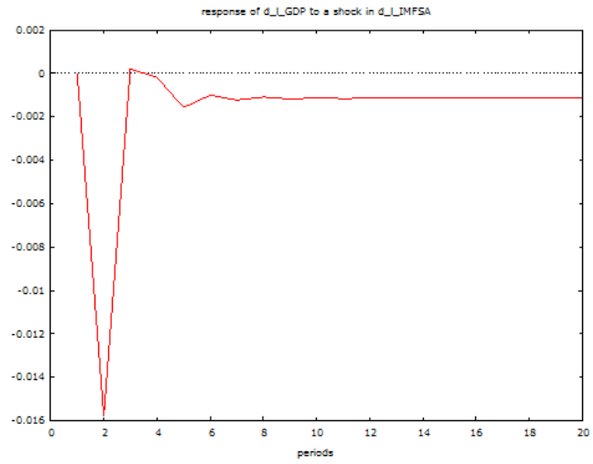


Fig-25. Response of GDP to shock in imports from S/Africa

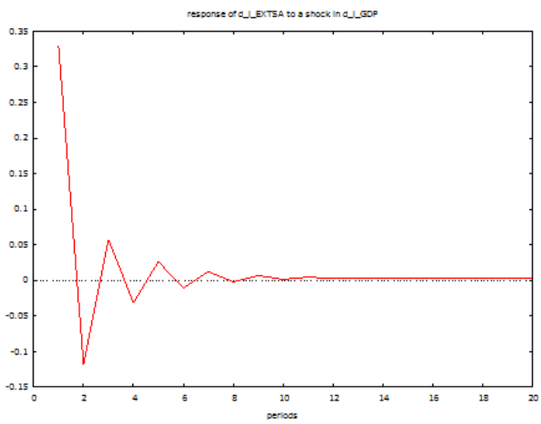


Fig-26. Response of exports to S/Africa_to a shock in GDP

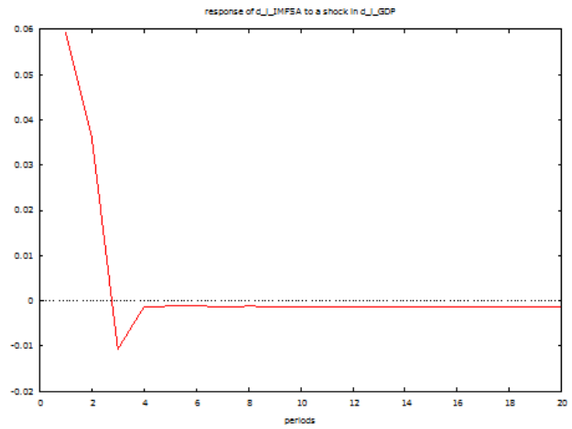


Fig-27. Response of imports from S/Africa_to a shock in GDP

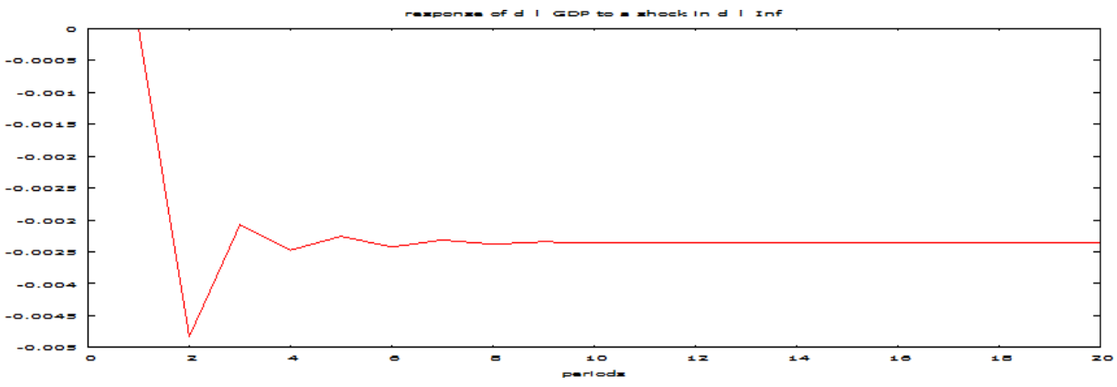


Fig-28. Response of GDP to a shock in domestic inflation

5.3.3. Variance Decomposition Analysis

Appendix C provides the results of the variance decomposition analysis for the trading relationship between Nigeria and South Africa. From Table 1, own effect explains average 91% of the variation in Nigeria's GDP while import from South Africa is responsible for 3.8%. In addition, exports to South Africa explain 3.7% of the variation in Nigeria's GDP while inflation explains the least variation of average 1.8%. Similarly, the highest variation in Nigeria's exports to South Africa is explained by own shock of 93%, while GDP accounts for 5.9%. Imports from South Africa and the domestic inflation rate explain less than 1% of the variation in exports to South Africa. Also, own shock explains the highest variation of average 68% in Nigeria's imports from South Africa while GDP is responsible for 17% and then exports to South Africa explains 10%. The domestic inflation rate explains the least variation of 4% in Nigeria's imports from South Africa. With respect to how other variables in the equation explain the variation in the domestic inflation rate, Table 4 indicates that own shock accounts for approximately average 86% of the variation, while imports from South Africa explains 9.3% followed by GDP 1.2% and exports to South Africa 0.06%.

5.3.4. Diagnostic Tests

Figure 29 is a combined residual plot for the results of the trading relationship between Nigeria and South Africa. Given that the residuals are stationary this implies that the results obtained from the estimated model are valid.

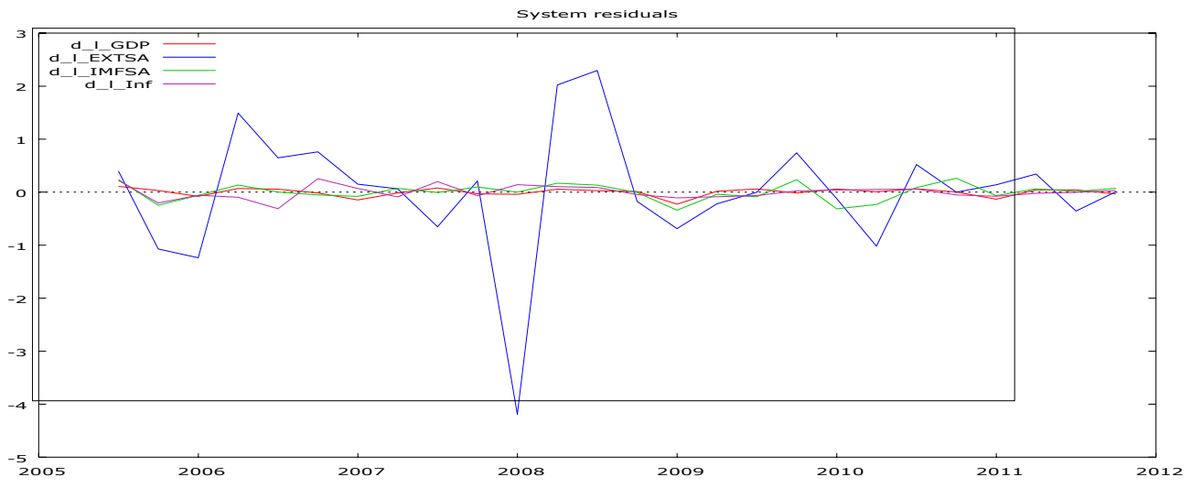


Figure-29. Combined Residual Plot

Table 12 also shows that the results of other diagnostic tests. From the results, while we fail to accept the null hypothesis that the errors are normally distributed, the null hypotheses of no presence of autocorrelation and heteroskedasticity are not rejected.

Table-12. Post estimation tests

	Null hypotheses	**P-value**
Normality	Error is normally distributed	0.0005
Autocorrelation	Autocorrelation not present	0.6410
Heteroskedasticity	No presence of heteroskedasticity	0.2640

Source: Authors' estimations

6. Policy Implications of Findings

The findings in this study have a number of policy implications:

a) Nigeria's trade intensity is highest with Brazil while on the average, the intensity index with Brazil, India and South Africa is above 1, implying that an improved relationship between the BRICS and Nigeria will be beneficial. However, the downside and general perception is that the individual BRICS are pursuing a bilateral as opposed to a joint approach in their dealings with key countries in Africa, including Nigeria.

b) The finding that Nigeria's GDP reverts faster to equilibrium when there is a shock to exports to and imports from Brazil further confirms the growing bilateral ties between Nigeria and Brazil when compared with other BRICS members. However, the fact that the equilibrium adjustment of Nigeria's exports to Brazil and South Africa is at the same period when there is a shock to the GDP also implies the growing relevance of the bilateral relationship between Nigeria and South Africa.

c) The relatively strong link between the Nigerian economy and Brazil is explained by the fact that apart from own effect, imports from Brazil and exports to Brazil are responsible for the second and third highest variations in Nigeria's GDP. Similarly, the rising bilateral relevance with South Africa explains why import from and exports to South Africa are responsible for the second and third highest variation in Nigeria's GDP when the trading relationship between both countries is considered.

d) Given that the GDP explains the second highest variation in Nigeria's exports to South Africa, it implies that a growing Nigerian economy may result in increased exports to South Africa in the future. This scenario may be different for Brazil and China as the inflation rate explains the second highest variation in Nigeria's exports to the two countries. In other words, Nigeria may only maintain its competitiveness with increased trading with Brazil and China if inflation is low and stable.

e) A growing Nigerian economy may experience more imports from China given that the highest variation in Nigeria's imports from China is explained by the GDP.
f) There is no threat of imported inflation from China into Nigeria given that imports from China explain the least variation in Nigeria's inflation rate. However, this threat is not misplaced in the case of South Africa given that Nigeria's imports from South Africa explain the second highest variation in Nigeria's inflation rate.

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Appendix-A. Nigeria and Brazil

Table-1. Decomposition of Variance for Nigeria's GDP

Period	GDP	EXTBR	IMFBR	INF
1	100.0000	0.0000	0.0000	0.0000
2	89.4179	2.7213	7.8572	0.0036
3	87.6937	2.6976	9.4993	0.1094
4	87.2655	2.7096	9.8340	0.1909
5	86.9457	2.9344	9.8650	0.2549
6	86.8476	2.9311	9.8847	0.3366
7	86.7060	3.0155	9.8722	0.4063
8	86.6200	3.0294	9.8678	0.4828
9	86.5124	3.0770	9.8556	0.5551
10	86.4207	3.1030	9.8468	0.6296
11	86.3213	3.1405	9.8357	0.7025
12	86.2270	3.1711	9.8258	0.7761
13	86.1302	3.2055	9.8152	0.8491
14	86.0353	3.2375	9.8051	0.9221
15	85.9396	3.2708	9.7947	0.9949
16	85.8447	3.3032	9.7845	1.0676
17	85.7497	3.3360	9.7742	1.1401
18	85.6550	3.3685	9.7641	1.2124
19	85.5605	3.4011	9.7539	1.2846
20	85.4663	3.4335	9.7437	1.3566
Ave.	**87.1680**	**2.9543**	**9.2140**	**0.6638**

Source: Authors' estimates

Table-2. Decomposition of Variance for Nigeria's exports to Brazil

Period	GDP	EXTBR	IMFBR	INF
1	2.5209	97.4791	0.0000	0.0000
2	2.3072	94.6609	1.5630	1.4688
3	2.2222	93.5693	2.2025	2.0060
4	2.2197	92.3060	2.6082	2.8661
5	2.1917	91.6461	2.6261	3.5361
6	2.1726	90.8580	2.6722	4.2971
7	2.1462	90.2341	2.6386	4.9811
8	2.1237	89.5594	2.6301	5.6869
9	2.0994	88.9435	2.6013	6.3557
10	2.0768	88.3178	2.5827	7.0226
11	2.0541	87.7199	2.5584	7.6676
12	2.0322	87.1268	2.5379	8.3031
13	2.0105	86.5511	2.5158	8.9226
14	1.9894	85.9847	2.4953	9.5305
15	1.9687	85.4317	2.4747	10.1249
16	1.9485	84.8893	2.4548	10.7075
17	1.9286	84.3584	2.4350	11.2780
18	1.9092	83.8379	2.4159	11.8371
19	1.8901	83.3280	2.3970	12.3849
20	1.8715	82.8281	2.3785	12.9219
Ave.	**2.0842**	**88.4815**	**2.3394**	**7.0949**

Source: Authors' estimates

Table-3. Decomposition of Variance for Nigeria's imports from Brazil

Period	GDP	EXTBR	IMFBR	INF
1	15.2295	4.2953	80.4752	0.0000
2	15.5809	6.6001	77.6241	0.1949

3	15.3391	7.5675	76.6307	0.4626
4	15.0705	8.9279	75.4137	0.5880
5	15.0111	8.9405	75.2391	0.8093
6	14.9279	9.2697	74.8307	0.9718
7	14.8927	9.2617	74.6782	1.1674
8	14.8420	9.3942	74.4212	1.3426
9	14.8042	9.4292	74.2384	1.5282
10	14.7606	9.5140	74.0191	1.7063
11	14.7211	9.5680	73.8238	1.8872
12	14.6797	9.6384	73.6170	2.0649
13	14.6398	9.6987	73.4186	2.2429
14	14.5994	9.7642	73.2172	2.4192
15	14.5596	9.8261	73.0193	2.5950
16	14.5198	9.8895	72.8211	2.7695
17	14.4804	9.9515	72.6248	2.9433
18	14.4411	10.0138	72.4291	3.1160
19	14.4021	10.0754	72.2347	3.2878
20	14.3632	10.1368	72.0412	3.4587
Ave.	**14.7932**	**9.0881**	**74.3409**	**1.7778**

Source: Authors' estimates

Table-4. Decomposition of Variance for Nigeria's inflation

Period	GDP	EXTBR	IMFBR	INF
1	0.4019	24.7439	4.4182	70.4360
2	0.2561	31.0384	2.1466	66.5590
3	0.1805	30.4113	1.9760	67.4322
4	0.1407	31.6554	1.5213	66.6827
5	0.1129	31.5874	1.3758	66.9238
6	0.0952	31.9444	1.2136	66.7469
7	0.0819	31.9981	1.1273	66.7927
8	0.0722	32.1392	1.0474	66.7413
9	0.0645	32.1974	0.9928	66.7454
10	0.0584	32.2705	0.9451	66.7260
11	0.0533	32.3165	0.9082	66.7219
12	0.0492	32.3621	0.8764	66.7123
13	0.0456	32.3968	0.8500	66.7075
14	0.0426	32.4287	0.8271	66.7016
15	0.0400	32.4552	0.8074	66.6975
16	0.0377	32.4789	0.7900	66.6933
17	0.0357	32.4996	0.7748	66.6900
18	0.0339	32.5181	0.7612	66.6868
19	0.0323	32.5346	0.7491	66.6841
20	0.0308	32.5495	0.7382	66.6816
Ave.	**0.0933**	**31.7263**	**1.2423**	**66.9381**

Source: Authors' estimates

Appendix-B. Nigeria and China

Table-1. Decomposition of Variance for Nigeria's GDP

Period	GDP	EXTCH	IMFCH	INF
1	100.0000	0.0000	0.0000	0.0000
2	88.2973	0.2383	10.6027	0.8616
3	86.8884	0.7321	10.4724	1.9072
4	85.2235	1.2732	10.3763	3.1270
5	84.3862	1.2640	10.2663	4.0836
6	83.4597	1.2872	10.1575	5.0956
7	82.5803	1.2980	10.0475	6.0742
8	81.7039	1.3205	9.9382	7.0374
9	80.8569	1.3357	9.8327	7.9747
10	80.0239	1.3527	9.7291	8.8944
11	79.2096	1.3687	9.6276	9.7940
12	78.4118	1.3847	9.5283	10.6752
13	77.6308	1.4001	9.4311	11.5381
14	76.8655	1.4154	9.3358	12.3834
15	76.1157	1.4302	9.2424	13.2116
16	75.3809	1.4448	9.1509	14.0233
17	74.6607	1.4592	9.0612	14.8189
18	73.9546	1.4732	8.9733	15.5989
19	73.2622	1.4869	8.8871	16.3638
20	72.5831	1.5004	1.5004	17.1139
Ave.	**80.5748**	**1.2233**	**8.8080**	**9.0288**

Source: Authors' estimates

Table-2. Decomposition of Variance for Nigeria's exports to China

Period	GDP	EXTCH	IMFCH	INF
1	4.3091	95.6909	0.0000	0.0000
2	6.1423	90.0867	0.4633	3.3077
3	7.2798	88.2793	0.4497	3.9913
4	7.1405	86.9989	0.4757	5.3849
5	7.1287	85.9134	0.4698	6.4881
6	7.0459	84.8081	0.4640	7.6821
7	7.0015	83.7495	0.4592	8.7898
8	6.9407	82.7125	0.4546	9.8922
9	6.8879	81.7042	0.4500	10.9579
10	6.8339	80.7199	0.4455	12.0007
11	6.7823	79.7604	0.4411	13.0161
12	6.7315	78.8241	0.4369	14.0075
13	6.6821	77.9104	0.4327	14.9748
14	6.6338	77.0184	0.4287	15.9192
15	6.5867	76.1473	0.4247	16.8413
16	6.5406	75.2965	0.4208	17.7420
17	6.4956	74.4652	0.4171	18.6221
18	6.4516	73.6528	0.4134	19.4822
19	6.4087	72.8587	0.4097	20.3229
20	6.3666	72.0821	0.4062	21.1450
Ave.	**6.6195**	**80.9340**	**0.4182**	**12.0284**

Source: Authors' estimates

Table-3. Decomposition of Variance for Nigeria's imports from China

Period	GDP	EXTCH	IMFCH	INF
1	50.4434	3.6157	45.9409	0.0000
2	47.4678	6.7550	44.6818	1.0954
3	46.2972	6.8699	44.1737	2.6592
4	45.7294	6.9525	43.4617	3.8563
5	45.2079	6.8782	42.9319	4.9820
6	44.6604	6.8203	42.3943	6.1250
7	44.1273	6.7742	41.8591	7.2395
8	43.6126	6.7268	41.3393	8.3212
9	43.1103	6.6792	40.8338	9.3766
10	42.6194	6.6333	40.3401	10.4072
11	42.1405	6.5885	39.8581	11.4129
12	41.6729	6.5448	39.3876	12.3947
13	41.2162	6.5020	38.9281	13.3537
14	40.7701	6.4603	38.4792	14.2904
15	40.3342	6.4195	38.0405	15.2058
16	39.9082	6.3796	37.6118	16.1004
17	39.4916	6.3407	37.1926	16.9751
18	39.0843	6.3025	36.7827	17.8304
19	38.6859	6.2653	36.3818	18.6671
20	38.2960	6.2288	35.9895	19.4856
Ave.	**42.7438**	**6.4369**	**40.3304**	**10.4889**

Source: Authors' estimates

Table-4. Decomposition of Variance for domestic inflation

Period	GDP	EXTCH	IMFCH	INF
1	0.0000	0.8554	2.9450	96.1996
2	0.4040	3.4839	1.6270	94.4851
3	1.5604	3.3688	1.0945	93.9763
4	1.8444	3.2318	0.8708	94.0530
5	1.9818	3.1352	0.7161	94.1668
6	2.0831	3.1066	0.6105	94.1998
7	2.1636	3.0745	0.5366	94.2254
8	2.2204	3.0517	0.4812	94.2467
9	2.2648	3.0335	0.4379	94.2637
10	2.3004	3.0194	0.4033	94.2768
11	2.3297	3.0077	0.3750	94.2877
12	2.3540	2.9980	0.3514	94.2967
13	2.3746	2.9897	0.3314	94.3043
14	2.3922	2.9826	0.3143	94.3109
15	2.4075	2.9765	0.2994	94.3165
16	2.4209	2.9711	0.2864	94.3215
17	2.4327	2.9664	0.2750	94.3259
18	2.4432	2.9622	0.2648	94.3298
19	2.4526	2.9584	0.2557	94.3333
20	2.4611	2.9551	0.2475	94.3364
Ave.	**2.0446**	**2.9564**	**0.6362**	**94.3628**

Source: Authors' estimates

Appendix-C. Nigeria and South Africa

Table-1. Decomposition of Variance for Nigeria's GDP

Period	GDP	EXTSA	IMFSA	INF
1	100.0000	0.0000	0.0000	0.0000
2	93.9798	1.5137	4.1207	0.3857
3	92.2790	3.1688	3.1688	0.5295
4	91.4777	3.8171	3.9874	0.7177
5	91.0844	4.0233	4.0089	0.8834
6	90.8203	4.0997	4.0130	1.0670
7	90.6131	4.1212	4.0273	1.2385
8	90.4200	4.1263	4.0372	1.4165
9	90.2377	4.1220	4.0507	1.5896
10	90.0571	4.1160	4.0622	1.7647
11	89.8793	4.1083	4.0750	1.9375
12	89.7020	4.1005	4.0869	2.1106
13	89.5260	4.0924	4.0993	2.2823
14	89.3504	4.0844	4.1113	2.4538
15	89.1757	4.0764	4.1235	2.6244
16	89.0017	4.0684	4.1355	2.7944
17	88.8283	4.0604	4.1476	2.9637
18	88.6557	4.0524	4.1595	3.1324
19	88.4837	4.0445	4.1714	3.3004
20	88.3124	4.0366	4.0366	3.4677
Ave.	**90.5942**	**3.6916**	**3.8311**	**1.8330**

Source: Authors' estimates

Table-2. Decomposition of Variance for Nigeria's exports to South Africa

Period	GDP	EXTSA	IMFSA	INF
1	7.7717	92.2283	0.0000	0.0000
2	6.3879	93.3158	0.1711	0.1251
3	5.9681	93.6439	0.2557	0.1323
4	5.8135	93.7390	0.2489	0.1986
5	5.7691	93.7367	0.2654	0.2288
6	5.7437	93.7103	0.2648	0.2812
7	5.7369	93.6685	0.2741	0.3205
8	5.7301	93.6249	0.2767	0.3682
9	5.7278	93.5781	0.2833	0.4108
10	5.7243	93.5317	0.2874	0.4566
11	5.7222	93.4844	0.2930	0.5003
12	5.7196	93.4375	0.2977	0.5453
13	5.7173	93.3903	0.3029	0.5895
14	5.7149	93.3433	0.3078	0.6341
15	5.7126	93.2963	0.3129	0.6783
16	5.7102	93.2493	0.3178	0.7227
17	5.7079	93.2024	0.3228	0.7669
18	5.7055	93.1555	0.3278	0.8112
19	5.7032	93.1087	0.3328	0.8554
20	5.7008	93.0619	0.3377	0.8995
Ave.	**5.8744**	**93.3753**	**0.2740**	**0.4763**

Source: Authors' estimates

Table-3. Decomposition of Variance for Nigeria's imports from South Africa

Period	GDP	EXTSA	IMFSA	INF
1	14.5471	10.6457	74.8071	0.0000
2	18.0150	10.3120	71.0826	0.5904
3	18.1251	10.6796	70.1096	1.0858
4	18.0178	10.7389	69.6792	1.5641
5	17.9199	10.7093	69.3457	2.0251
6	17.8241	10.6659	69.0150	2.4951
7	17.7356	10.6128	68.6996	2.9521
8	17.6456	10.5592	68.3863	3.4089
9	17.5584	10.5038	68.0796	3.8581
10	17.4713	10.4493	67.7750	4.3044
11	17.3857	10.3947	67.4747	4.7449
12	17.3006	10.3409	67.1769	5.1816
13	17.2167	10.2874	66.8826	5.6133
14	17.1334	10.2346	66.5911	6.0408
15	17.0511	10.1823	66.3028	6.4638
16	16.9696	10.1306	66.0173	6.8825
17	16.8890	10.0793	65.7347	7.2970
18	16.8091	10.0286	65.4549	7.7073

19	16.7301	9.9784	65.1780	8.1135
20	16.6518	9.9287	64.9039	8.5157
Ave.	**17.2499**	**10.3731**	**67.9348**	**4.4422**

Source: Authors' estimates

Table-4. Decomposition of Variance for Nigeria's inflation

Period	**GDP**	**EXTSA**	**IMFSA**	**INF**
1	2.5177	0.2430	4.2599	92.9795
2	1.4792	0.1319	7.4757	90.9133
3	1.3379	0.0917	8.5252	90.0452
4	1.2731	0.0711	8.9443	89.7116
5	1.2252	0.0602	9.2017	89.5129
6	1.1951	0.0522	9.3761	89.3766
7	1.1735	0.0469	9.4989	89.2808
8	1.1574	0.0427	9.5911	89.2088
9	1.1449	0.0395	9.6625	89.6625
10	1.1349	0.0370	9.7197	89.1084
11	1.1267	0.0349	9.7664	89.0720
12	1.1199	0.0332	9.8053	89.0417
13	1.1141	0.0317	9.8381	89.0160
14	1.1092	0.0305	9.8663	88.9941
15	1.1049	0.0294	9.8906	88.9750
16	1.1012	0.0284	9.9120	88.9584
17	1.0979	0.0276	9.9308	88.9437
18	1.0950	0.0269	9.9475	88.9307
19	1.0924	0.0262	9.9624	88.9190
20	1.0900	0.0256	9.9759	88.9085
Ave.	**1.2345**	**0.0555**	**9.2575**	**85.4779**

Source: Authors' estimates