Trade Intensity Analysis of South Africa-BRIC Economic Relations

Ekor, Maxwell and Adeniyi, Oluwatosin and Saka, Jimoh

June 2015

Trade Intensity Analysis of South Africa-*BRIC* Economic Relations

Maxwell Ekor* Jimoh Saka++ Oluwatosin Adeniyi+@

* University of the West of Scotland, United Kingdom

+ Department of Economics, University of Ibadan, Nigeria

++ Department of Economics, Lagos State University, Nigeria

Abstract

The study broadly focused on examining the trade and investment relationship between South Africa and the BRIC, using both descriptive and vector autoregressive estimation approaches. Specifically, the key objective is to investigate the impact of trade shocks between South Africa and the individual countries of the BRIC bloc. The findings illustrate that South Africa's trade was more intense with India in the review period followed by trade with China. The impulse-response outcome showed that South Africa's GDP reverts faster to equilibrium in the event of a shock in exports to and imports from Brazil. Also, when there is a shock to GDP, South Africa's imports from Brazil reverts faster to equilibrium. The results of the variance decomposition indicate that inflation accounted for the highest variation in South Africa's exports to and imports from both Brazil and China. Similarly, inflation explained the greatest variation in the GDP, while the greatest variation in the domestic inflation rate is explained by its own shock. In conclusion, South Africa showed considerable trade intensity with most BRIC Countries. In policy terms, this implies that South Africa can benefit substantially from policies targeted at broadening the scope of its international trade connections with the BRIC bloc with particular emphasis on Brazil and China.

JEL Codes: C32; C51; F5; F33

Keywords: Trade flows; Impulse response; Variance decomposition; BRIC; South Africa

@ Corresponding author: maxwellekor@gmail.com

1. Introduction

The idea of the BRIC (Brazil, Russia, India and China) started in 2001 but it was not until 10 years later that South Africa became involved in the activities of the group, resulting in the new acronym BRICS. The highlight of the country's participation in the group was the hosting of the 5th BRICS Summit in Durban, South Africa, in March 2013 where far reaching proposals such as the setting up of a development bank were put on the table. Therefore, both policy makers and analysts have been watching activities around the group with keen interest. These countries

account for about 43 percent of global population, 18 percent of international trade and 25 percent of the world's gross domestic product (GDP) in 2011 based on purchasing power parity (Basadien, 2012). Besides, the relevance of the group in global economic governance has not gone unnoticed with its view that there is need for a more equitable global order, especially with respect to the running of the international multilateral institutions, such as the International Monetary Fund (IMF) and the World Bank.

Apart from global governance issues, the involvement of South Africa in the BRICS setting has also been seen in some quarters as boosting the group's relevance to the sub-Saharan African (SSA) continent. This view is premised on the rising importance of South-South relationships as against the traditional North–South model of development. This is because more South–South cooperation is expected to continue to play a key role in the future development of poor nations through partnerships, knowledge exchange, and finance.

Given South Africa's involvement in the group and the expectation in some quarters that this will rob off positively on the entire SSA, this study attempts to probe the country's trading relationship with the individual BRICs. The rationale for this is to present evidence of the bilateral relationships which may be important for South Africa within the group. It is important to note that most of the initial studies on the group's relationship included only the original BRICs, leaving out South Africa, and this is understandable given that the country joined the group only in 2011.

Following from the above, the research questions of interest are as follows: (i) What is the level of trade intensity between South Africa and the individual BRICs? (ii) How does South Africa's gross domestic product (GDP) respond to shocks to its exports to and imports from the individual BRICs? (iii) How do South Africa's exports to the BRICs and imports from the BRICs respond to shocks to the country's GDP?

The rest of the study is organized as follows: Section 2 presents the literature review and section 3 discusses the methodology. Section 4 presents the data and empirical analysis, while section 5 concludes and provides policy implications of the findings.

2. Brief empirical literature review

Earlier attempts in the literature initially included only the original BRICs, leaving out South Africa as the country only joined the group in 2011. While some of these studies dwell on the relationship between the BRICs and the European Union (EU), others focused on the relationship with Low Income Countries (LICs) while others analyzed the linkages among the BRICs.

Leal-Arcas (2008) applied interdisciplinary qualitative approach of law, international political economy and international relations in analysing the BRICS and the EU. The study argued that the EU's objective of engaging with the BRICs on trade matters is to establish peace, security

and prosperity. Havlik *et al.* (2009) also analyzed trade, Foreign Direct Investment (FDI) and knowledge flows between the BRICs and the EU, positing that the EU plays a more important role in the BRICs trade than vice versa. Also, De Castro (2012) analyzed the intensity of bilateral trade flows among the BRICs on one hand as well as between the BRICs and the EU on the other. A key result from the study is that of all the BRICs, Russia is the most intensive trade partner of the EU.

Due to the increasing acceptance and belief in the South-South developmental strategy, some studies have analyzed the relationship between the BRICs and other developing economies. One of such studies is Mwase and Yang (2012) that examined the flow of development financing as well as trade and investment from the BRICs to LICs. They found that most of the financing has been concentrated in the infrastructure sector to support productive activities while trade offers important benefits to the LICs as it does to the BRICs. Also, focusing only on FDI flows between the BRICs and the LICs with the spotlight on China, Mlachila and Takebe (2011) found that the BRICs FDI inflows to LICs have grown rapidly with the Chinese FDI stock increasing by 20-fold between 2003 and 2009.

Some studies have also focused on the relationship between the BRICs and specific countries. For example, the relationship between the BRICs and Nigeria was analyzed by Alao (2011) in the areas of economics, diplomacy, cultural, social dealings and military collaborations. The study concludes that despite the efforts to portray a smooth relationship between Nigeria and the BRICs, there are areas of difficulty because among the BRICs, there appears to be the subtle struggle for the core of the Nigerian market.

Mustafa and Kabundi (2011) examined the trade linkages between the BRICs, South Africa and 32 other countries by applying a global vector autoregressive model to investigate the degree of trade linkages and shock transmission. The results suggest that shocks from each BRICs country have considerable impact on South Africa's real imports and output.

Another strand of the literature concentrated on the relationship among the BRICs as well as on individual BRICs. For example, Gaaitzen *et al.* (2011) studied structural transformation and its implications for productivity growth in the BRICs countries and found that for China, India and Russia, reallocation of labour across sectors contributed to aggregate productivity growth, whereas in Brazil it did not. However, when a distinction is made between formal and informal activities, the result is overturned since increased formalization of the Brazilian economy appears to be growth-enhancing, while in India the increase in informality after the reforms is growth-reducing.

Abramova and Fituni (2012) examined the relationship between the BRIC and Africa and posed the question of whether the arrangement will work as a partnership or set in motion competition. In other related studies, Alao (2011) and Chaturvedi and Halla (2012) investigated the Nigeria-

BRIC linkage and South-South cooperation respectively. Meanwhile, Bird (2005), Bird and Cahoy (2007) and Bird (2012) deal expressly with issues bordering intellectual property rights and taxation implications of the BRICS arrangement. Hence, the literature remains scanty on the one hand and empirical enquiry into the potential economic effects of the BRIC on the South African economy is imperative on the other hand. The present study attempts to plug this gap in knowledge.

In conclusion, the review of the literature on the BRICs clearly shows that there have been diverse focus areas in available studies. Hence, this study focuses on South Africa and its trading relationship with the BRIC. Beginning with the next section, which provides the methodological approach, the rest of the paper details on the route to achieving this objective.

3. Methodology

3.1 Descriptive approach

A graphic discussion of the trading and investment relationship is first provided in order to provide an insight into the bilateral relationship between South Africa and each of the BRIC. Following from this and taking the approach of De Castro (2012) who looked at trade intensity between the BRICs and EU, the section proceeds to estimating the level of trade intensity between South Africa and each of the BRICs. The trade intensity between exporter *i* and importer *j* is defined as:

$$\text{Trade Intensity} = \frac{Xij}{Xi} \Big/ \frac{Xwj}{Xw}$$

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

In this study, the Johansen (1991) multivariate vector autoregression (VAR) cointegration technique which assumes that all the variables are endogenous is applied. A VAR with p lags is stated in the form below;

$$q_t = \tau + H_1 q_{t-1} + H_2 q_{t-2} + \ldots + H_p q_{t-p} + \varepsilon_t \qquad (1)$$

where q_t is a K × 1 vector of endogenous variables, τ is K × 1 vector of parameters, $H_1 - H_p$ 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 cointegrating vectors is determined using the trace test and the maximum-eigenvalue test.

Following from the above, we estimate the following equation;

$$GDP_t = (EXTi_t, IMFi_{t,} INF_{t,}) \quad (2)$$

where;

GDP$_t$ = S/Africa's gross domestic product at time t
EXT$_{it}$ = S/Africa's exports to each of the BRICs
IMF$_{it}$ = S/Africa's imports from the individual BRICs
INF$_t$ = S/Africa's domestic inflation rate

The rationale for wanting to ascertain the level of interaction among the variables in equation 2 is that, theoretically, there is a relationship between a country's trade balance (frequently measured as the ratio of exports and imports to GDP) and the size of the economy. Also, from the literature, the trade channel is seen as an important direct channel of transmission from the BRICs to other countries. In addition, inflation is important because it affects country's trade competitiveness, capital inflow/outflow and ultimately economic growth.

Given that the main limitation of the VAR is the lack of a strong theoretical basis for estimated coefficients, the focus after estimating equation 2 is to ascertain how South Africa's GDP responds to shocks to its exports to and imports from the BRICs. This is carried out using the impulse response function and the variance decomposition analysis. However, prior to these the Augmented Dickey–Fuller (ADF) test will be used to test the time series properties of the variables while the appropriate lag length will be determined using the Akaike Information Criterion [AIC], the Bayesian Information Criterion [BIC] and the Hannan Quinn Criterion.

3.3 Data type and source

For reasons of data availability, the descriptive analysis uses annual data between 1995 and 2011 to discuss trends in the trading relationship between South Africa and the individual BRICs as well as in the estimation of the trade intensity index. Following from this, quarterly data between 2003Q1 and 2012Q1 which are transformed to their natural logarithms are applied in the empirical estimation leading to the impulse-response and variance decomposition analysis.

While the trade variables (exports and imports) are sourced from UNCTAD, the GDP and inflation variables are obtained from the World Development Indicators (WDI) database.

4. Data presentation

4.1 Overview of the South Africa economy

The South African economy, with an estimated GDP of $586 billion in 2011 as shown in Figure 1, is one of the biggest in SSA and the 24th largest in the world according to the World Bank. This means that the size of the economy has increased by approximately 410% from $115 billion in 1980 to the 2011 level. The country has witnessed average 3.3% growth in real GDP between 1961 and 2011 as shown in Figure 2. The economy has had unstable growth given the fluctuation in real GDP growth, with negative growths recorded in some years in the early 1980s and early 1990s.

Fig. 1: S/Africa's Real GDP Size (million)

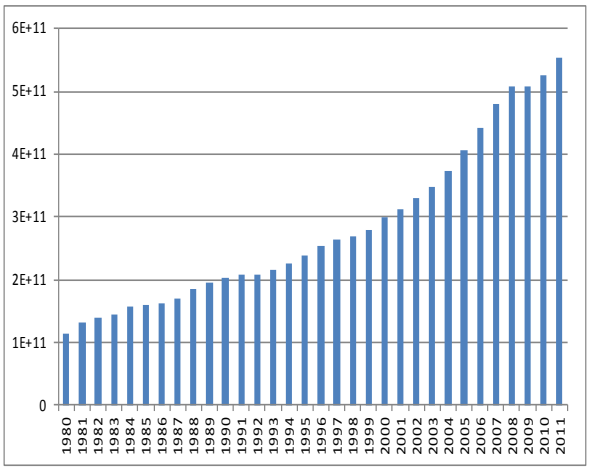
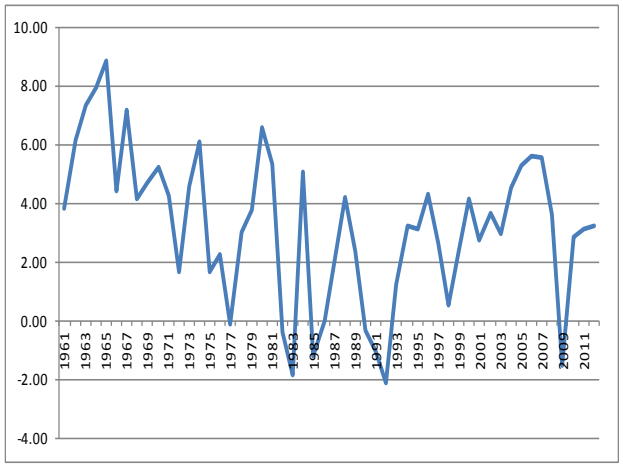


Fig. 2: S/Africa's Real GDP Growth (%)

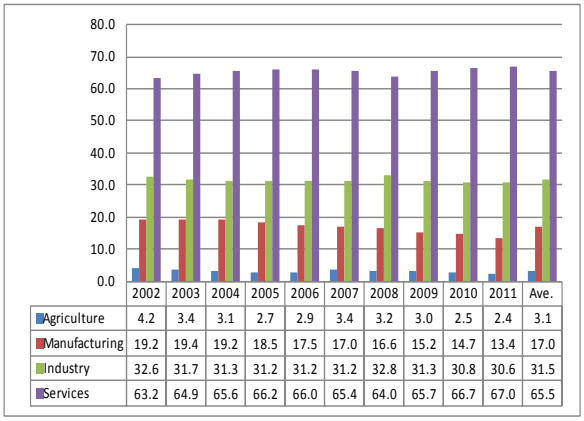


Source: World Development Indicators

The composition of the GDP as shown in Figure 3 indicates that the economy is mainly service driven. While the service sector contributed an average of 65.5% to the GDP between 2002 and 2011, agriculture had the least contribution of 3.1% in the period. The industrial sector is the second highest contributor to GDP with an average of 31.5% and manufacturing sector share averaged 17%.

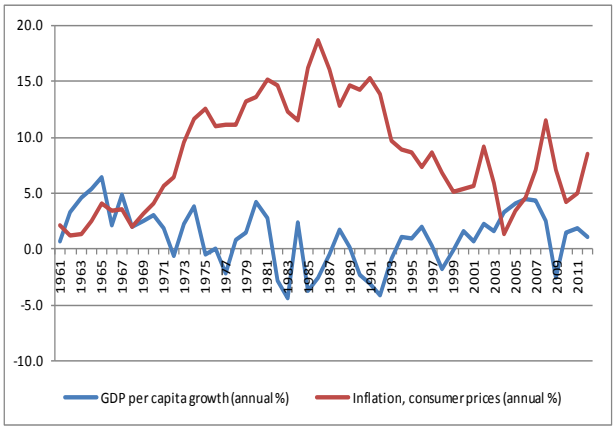
With respect to welfare, Figure 4 shows that the growth in GDP per capita in South Africa averaged 1.1% between 1960 and 2011, by far lower than average inflation rate of 8.5% in the period. The implication of this is that in real terms, the income per head of the population has been relatively low as a result of inflation.

Fig. 3: S/Africa's GDP Composition (%)



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Ave.
Agriculture	4.2	3.4	3.1	2.7	2.9	3.4	3.2	3.0	2.5	2.4	3.1
Manufacturing	19.2	19.4	19.2	18.5	17.5	17.0	16.6	15.2	14.7	13.4	17.0
Industry	32.6	31.7	31.3	31.2	31.2	31.2	32.8	31.3	30.8	30.6	31.5
Services	63.2	64.9	65.6	66.2	66.0	65.4	64.0	65.7	66.7	67.0	65.5

Fig. 4: Growth in GDP per capita and inflation (%)



Source: World Development Indicators

The external sector position of South Africa is captured in Figures 5 and 6. While Figure 5 shows that trade balance (% of GDP) was highest in 1980, it averaged 53% between 1960 and 2011, implying that on average, the economy has maintained a steady integration with the global economy. The country has, however, operated a negative current account balance (% of GDP) as shown in Figure 6 since 2005. This implies that the South African economy has been witnessing more outflows when compared with its inflows.

Fig. 5: S/Africa's Trade Balance (% of GDP)

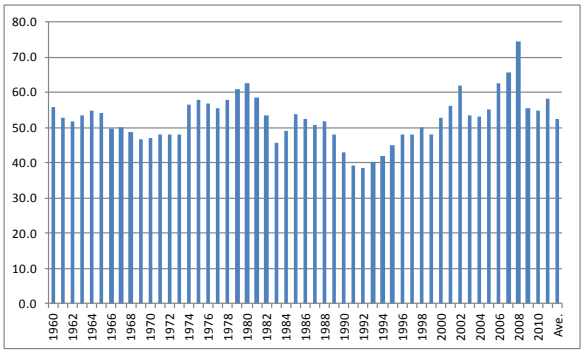
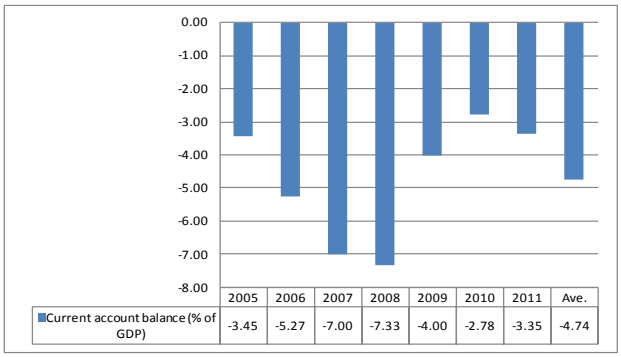


Fig. 6: S/Africa's Current Account Balance (% of GDP)



	2005	2006	2007	2008	2009	2010	2011	Ave.
Current account balance (% of GDP)	-3.45	-5.27	-7.00	-7.33	-4.00	-2.78	-3.35	-4.74

Source: World Development Indicators

4.2 South Africa's trading relationship with the individual BRICs

The graphical illustration of the trading relationship between South Africa and the individual BRICs in the period 1995 to 2011 is provided in Figures 7 – 10. Figure 7 shows that total exports of South Africa to Brazil averaged $385.6 million while imports from Brazil averaged $864.1million. This implies that in the period under review, South Africa recorded average trade

deficit of $478.5 million with Brazil. The trading relationship with Russia as shown in Figure 8 indicates that South Africa's volume of trade with Russia was lower when compared with Brazil. While exports averaged $147.2 million, imports averaged $141.1 million, implying that South Africa recorded a trade surplus of $6.1 million with Russia during the period.

South Africa – BRICs Trade Relationship

Fig. 7: S/Africa – Brazil Trade Balance

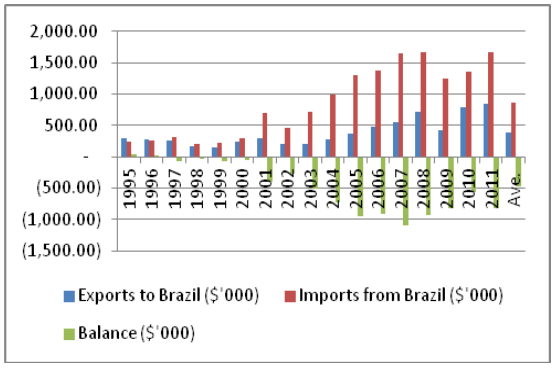


Fig. 8: S/Africa – Russia Trade Balance

Fig. 9: S/Africa – India Trade Balance

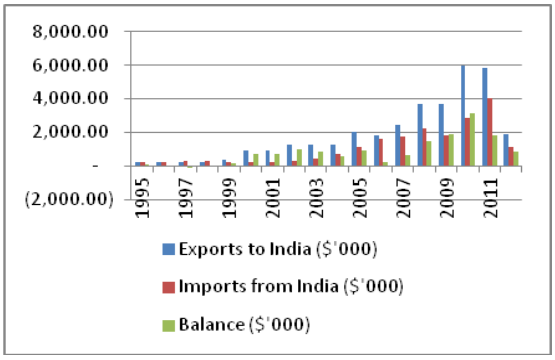
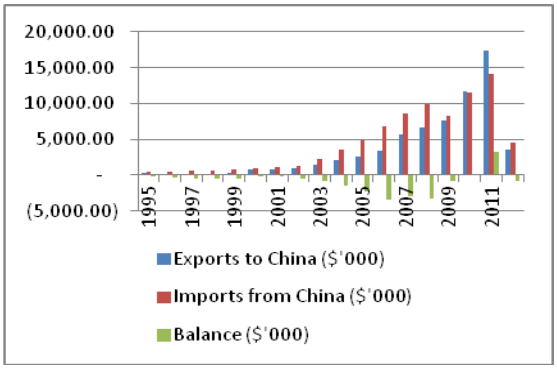


Fig. 10: S/Africa – China Trade Balance

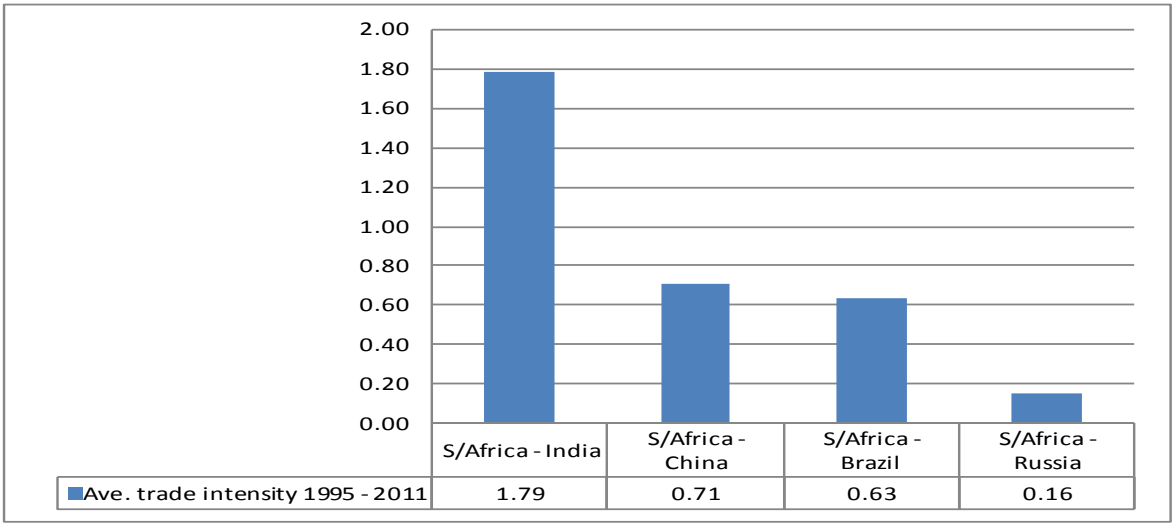


Source: UNCTAD

As is the case with Russia, Figure 9 shows that South Africa recorded positive trade balance with India as exports averaged $1,905.4 million, imports $1, 093 million, giving a positive trade balance of $812 million. The trading relationship between South Africa and China as shown in Figure 10 indicates that a negative trade balance was recorded as exports averaged $3,653.5 million and imports $4,511 million, giving a negative trade balance of $857.6 million.

With respect to the level of trade intensity, Figure 11 shows that trade between South Africa and India was more intense with an index of 1.79 followed by trade with China at 0.71. Also, while a trade intensity index of 0.63 was recorded between South Africa and Brazil in the period, the intensity index of 0.16 with Russia was the least.

Figure 11: South Africa – BRICs Average Trade Intensity, 1995 - 2011



Source: Authors' estimates

5. Empirical results

This section presents the empirical results with respect to the trading relationship between South Africa and Brazil on one hand and between South Africa and China on the other. Due to data limitations, the empirical analysis with Russia and India are left out in what follows.

5.1 South Africa and Brazil

5.1.1 Unit root, lag length and cointegration test

Using data from 2003Q1 to 2012Q2, the first step in the estimation process is to conduct a unit root test for the South Africa's GDP, exports to Brazil (EXTBR), imports from Brazil (IMFBR) and the domestic inflation rate (INF). Table 1 shows that the variables have unit root at level but become stationary after first differencing, meaning that they are I (1) series.

Table 1: Augmented Dickey Fuller Test

	P-value at Level	P-value at First Difference
GDP	0.4723	2.457e-007
EXTBR	0.4256	0.008323
IMFBR	0.9281	2.552e-009
INF	0.1403	7.075e-015

Following the determination of the time series properties of the variables, Table 2 indicates that the appropriate lag length to be used in the estimations should be 1 as suggested by the AIC, BIC and HQC criterion.

Table 3: Lag length selection

Lags	loglik	p(LR)	AIC	BIC	HQC
1	124.62005		-6.154121*	-5.256262*	-5.847925*
2	138.85486	0.02777	-6.050286	-4.434139	-5.499134

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

Next in the estimation process is to ascertain if there are cointegrating vectors in the estimated equation. The presence of cointegrating vectors means that the Vector Error Correction Model (VECM) is estimated, otherwise, the VAR will be carried out. Table 4 shows that using the eigenvalue and trace tests, there is at least one cointegrating vector in the equation. This means that the VECM is estimated with the eventual goal of conducting the impulse response and variance decomposition analysis.

Table 4: Johansen Co-integration Test

Rank	Eigenvalue	Trace test	P-value
0	0.79465	129.73	0.0000
1	0.62756	74.319	0.0000
2	0.48476	39.750	0.0000
3	0.37662	16.541	0.0000

Source: Authors' estimations

5.1.2 The impulse response analysis

Figure 12 shows that the response of South Africa's GDP to a one-standard error disturbance to exports to Brazil is positive but unstable in the first few quarters. However, from Q5 the instability reduced while the effect became flat from Q9. With respect to the response to a one-standard error shock to imports from Brazil, Figure 13 shows that South Africa's GDP recorded a sharp positive response between Q1 and Q2, became negative in Q3 and then positive in Q4. The effect of the shock to imports on the GDP starts to reduce from Q8 and remained flat from Q10 at a positive but low level. The implication of this is that South Africa's GDP reverts back to equilibrium faster when there is a shock to its exports to Brazil as against its imports from Brazil.

Figure 12: Response of South Africa's GDP to a shock in exports to Brazil

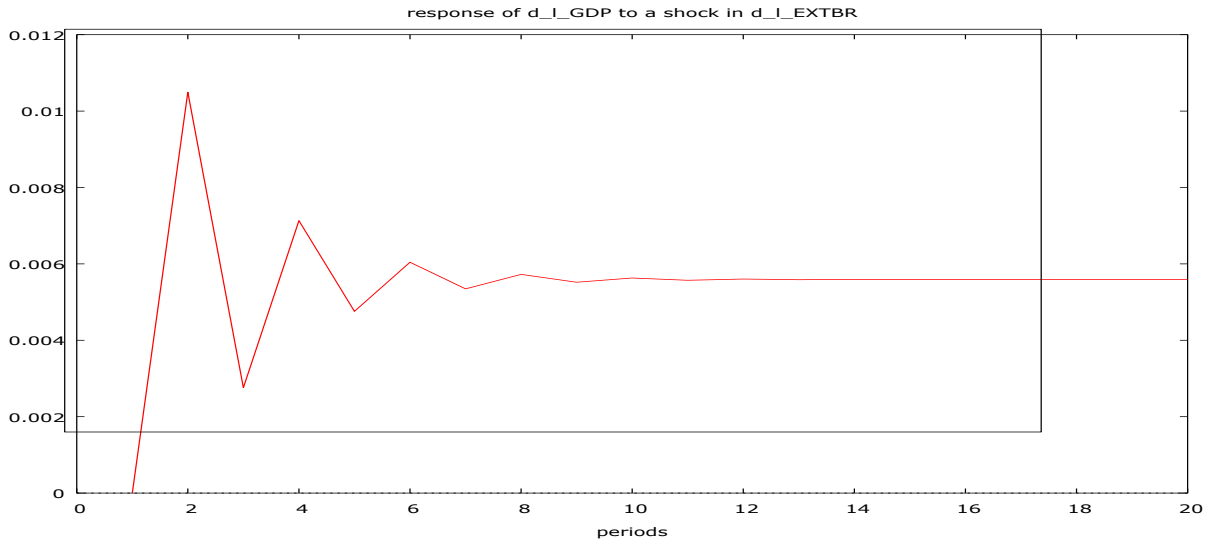
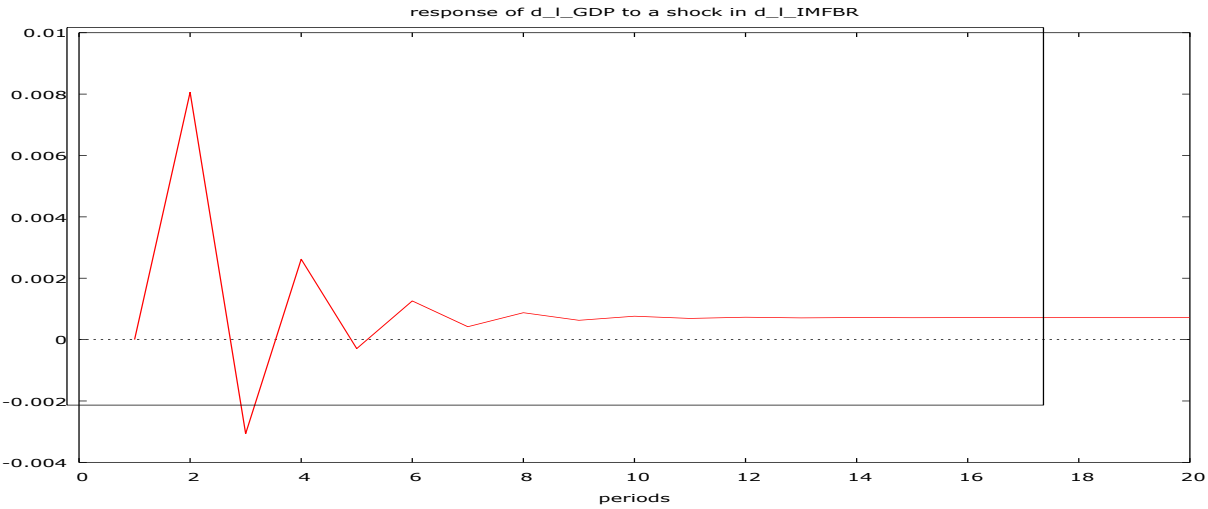


Figure 13: Response of South Africa's GDP to a shock in imports from Brazil



When a shock to the GDP is considered, Figure 14 indicates that exports to Brazil respond in a positive but unstable manner in the first few quarters but becomes flat from Q9. On the contrary, the response of imports from Brazil to a shock to the GDP as depicted in Figure 15 shows that it is relatively stable in the first few quarters but becomes flat from Q8. It therefore implies that South Africa's imports from Brazil reverts faster to equilibrium when there is a shock to the GDP when compared with the response of exports to Brazil which becomes flat from Q9.

Figure 14: Response of South Africa's exports to Brazil to a shock in GDP

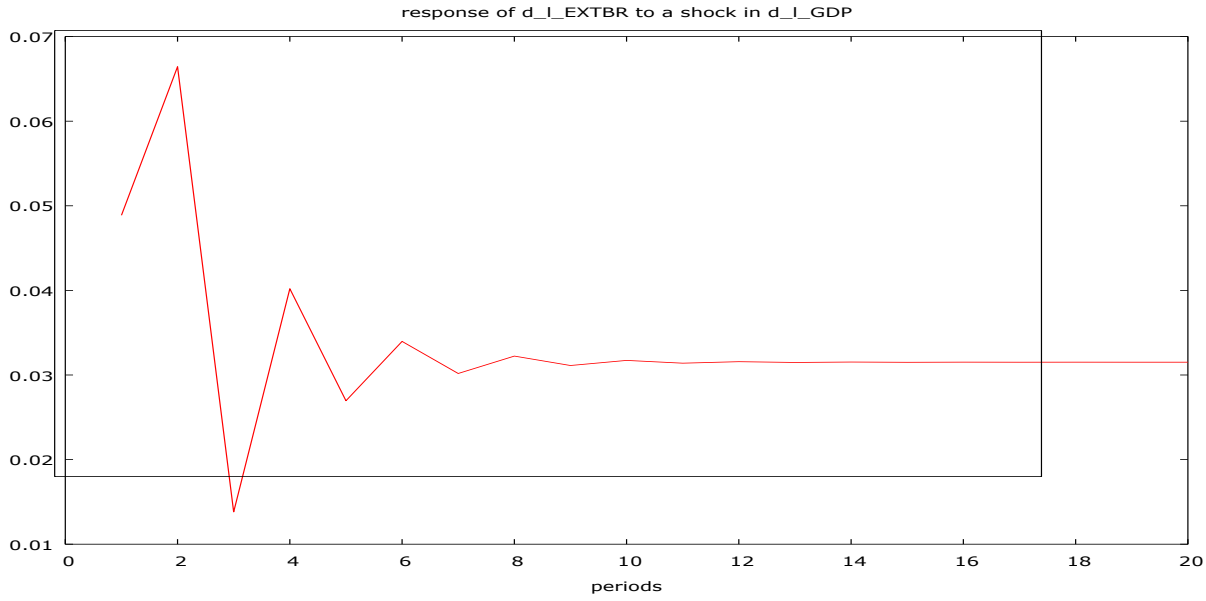
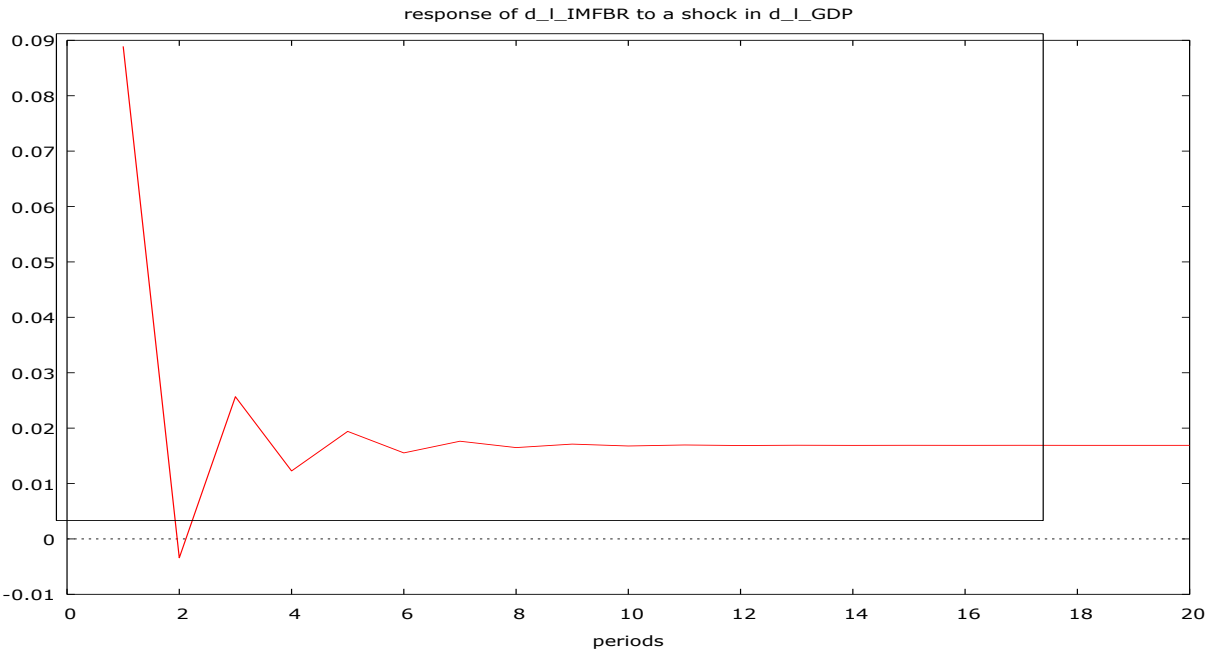
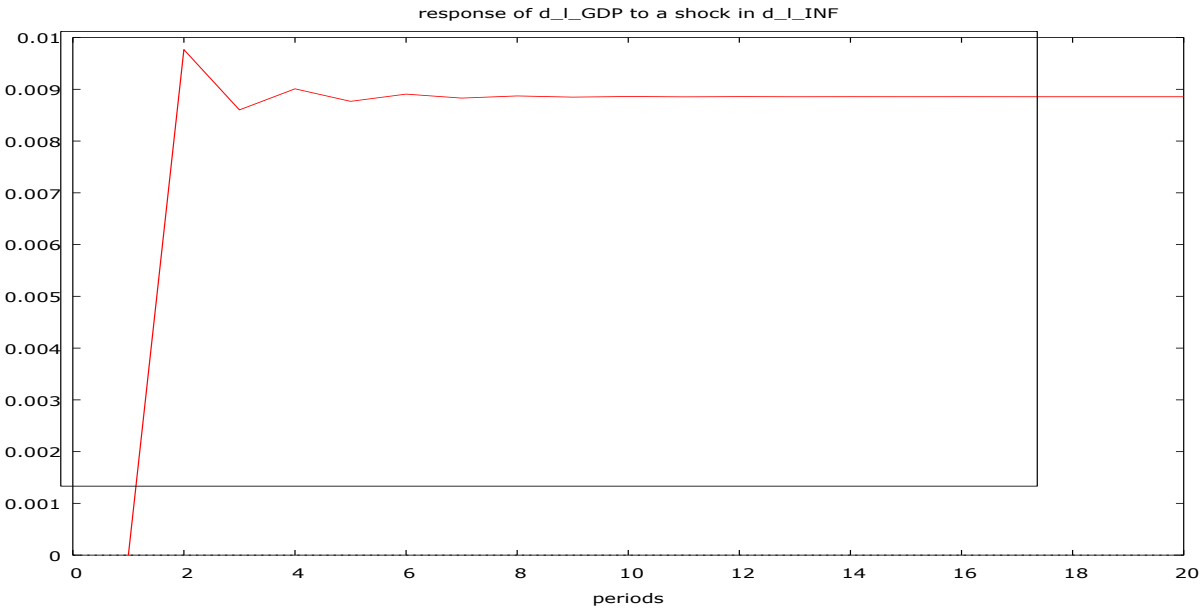


Figure 15: Response of South Africa's imports from Brazil to a shock in GDP



With respect to the response of South Africa's GDP to the domestic inflation rate, Figure 16 shows that prior to the effect becoming flat and stable from Q10, the initial response was a sharp and positive reaction in Q1. Between Q2 and Q9, the effect varied gradually until it peters out from Q10.

Figure 16: Response of South Africa's GDP to a shock to inflation



5.1.3 Decomposition of variance analysis

The information in Appendix A explains the variance decomposition of South Africa's GDP, its exports to Brazil, imports from Brazil and the inflation rate. Table 1 shows that exports to Brazil explains average 19.1% of the variation in GDP while imports from Brazil explains only 5% of the variation in the GDP. Specifically, the effect of exports to Brazil on the GDP increases over time given that in Q1 exports did not account for any variation in GDP. However, from Q2 exports to Brazil accounted for higher variation until it was able to explain approximately 23% of the variation in GDP by Q20. The effect of imports from Brazil on GDP on the contrary declined consistently from its 8.9% effect in Q2 to only 3.1% in Q20. While own effect explains average 37% of the variation in GDP, inflation accounts for the greater variation of average 38% in South Africa's GDP.

The variance decomposition analysis for exports to Brazil as shown in Table 2 explains that 43% of the variation is explained by own effect. Specifically, this own effect which is very strong at 92.4% in Q1 declines over time to 32.9% by Q20. The effect of GDP in explaining the variation in exports to Brazil is unstable with the effect increasing from 7.6% in Q1 to 15% to Q2 but declined to 8.6% in Q20. The highest variation in exports to Brazil is explained by inflation which accounts for average 45.3% of the variation.

Similar to the variation in exports to Brazil, Table 3 shows that inflation accounts for the highest variation in imports from Brazil. The effect of inflation increases gradually from Q2's level of 12.2% to 50.6% in Q20 and averaged 36.7% in the period. The second highest variation in imports from Brazil is explained by own effect which averaged 26.6% , while GDP explained the third

highest variation of 20% and exports from Brazil explained the least variation of 16.5%. With respect to the variation in inflation rate, Table 4 shows that own effect explained the highest variation in inflation rate followed by exports to Brazil and then GDP. Imports from Brazil accounted for the least variation in South Africa's inflation rate.

5.1.4 Diagnostic tests

We conduct some diagnostic tests in order to provide support for the empirical results. Table 5 shows that while we fail to accept the null hypothesis that the error is normally distributed, the autocorrelation and heteroskedasticity tests indicate otherwise. In other words, we fail to reject the null hypotheses of no presence of autocorrelation and heteroskedasticity.

Table 5: Diagnosis tests

	Null hypotheses	P-value
Normality	Error is normally distributed	0.0213
Autocorrelation	Autocorrelation not present	0.9950
Heteroskedasticity	No presence of heteroskedasticity	0.3212

5.2 South Africa and China

5.2.1 Unit root, lag selection and cointegration

The unit root test as shown in Table 6 indicates that for the sample period 2005Q1 and 2012Q1, all the variables, GDP, exports to China (EXTCH), imports from China (IMFCH) and domestic inflation rate (INF) are stationary after the first differencing, denoting that all the series are I (1).

Table 6: Stationarity test

	P-value at level	P-value at First difference
GDP	0.3409	0.0000
EXTCH	0.9837	0.0009
IMFCH	0.3121	8.444e-009
INF	0.2773	3.613e-007

Table 7 indicates that the appropriate lag length to be used in the estimations should be 1 as suggested by the AIC, BIC and HQC criterion.

Table 7: Lag length selection

Lags	loglik	p(LR)	AIC	BIC	HQC
1	91.92101		-7.991223*	-7.001922*	-7.854812*
2	98.69430	0.63245	-6.966033	-5.185289	-6.720492

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

Table 8 shows, using the eigenvalue and trace tests, that there is at least one cointegrating vector in the equation. This means that the VECM is estimated with the goal of tracing out the response of South Africa's GDP to shocks to its exports to China, imports from China as well as to the domestic inflation rate.

Table 8: Johansen Co-integration Test

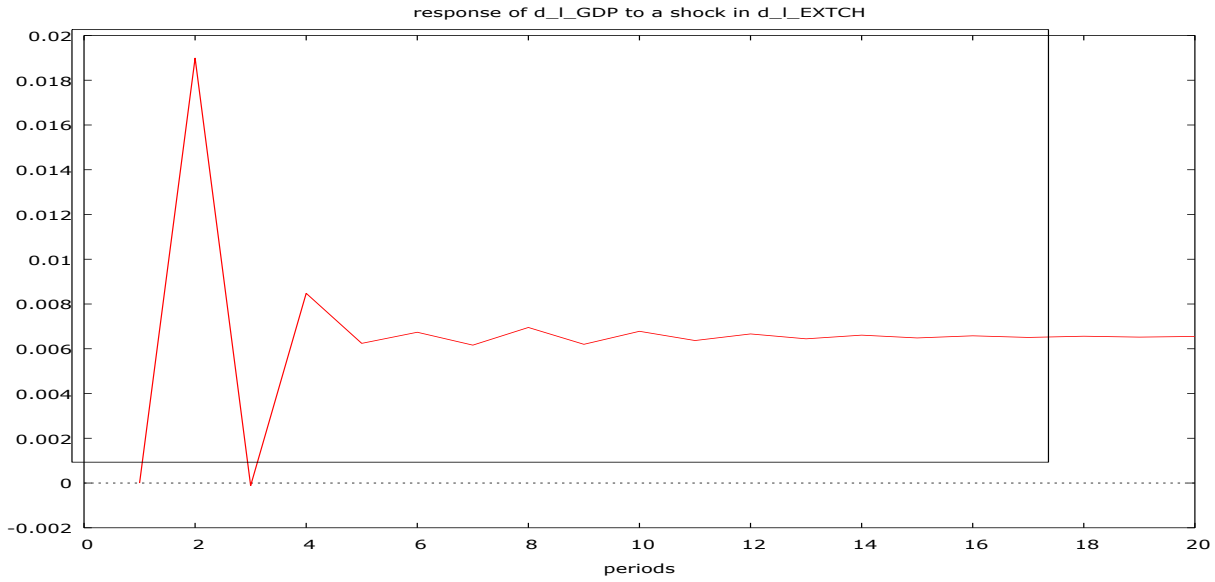
Rank	Eigenvalue	Trace	P-value
0	0.95087	111.78	0.0000
1	0.78008	54.524	0.0000
2	0.59630	25.749	0.0008
3	0.36117	8.5142	0.0035

Source: Authors' estimations

5.2.2 Impulse response analysis

The response of South Africa's GDP to a one standard error shock to its exports to China is depicted in Figure 17. The sharp positive response from Q1 to Q2 gave way for a corresponding decline in Q3. The positive response in Q4 was not as rapid as the initial jump in Q1 while the effect became flat and gradually dies out from Q12.

Figure 17: Response of South Africa's GDP to a shock in exports to China



With respect to the response to a one-standard error shock to imports from Brazil, Figure 18 shows that GDP recorded a positive response between Q1 and Q2 but the response became sharp and negative in Q3. The unstable and negative response continued till Q14 when the effect became flat and this pattern was maintained throughout the period. When the response of exports to China to a shock to the GDP is considered, Figure 19 indicates that exports to China responds in a positive but unstable manner until it became flat from Q17.

Unlike the unstable response of exports to China to a shock to GDP, Figure 20 shows that the response of South Africa's imports from China to a shock in GDP became flat from Q6 after a sharp decline in Q1 followed by marginal rises in Q2 and Q3. With respect to the response of GDP to a shock in inflation, Figure 21 indicates that the response was sharp and positive between Q1 and Q2 and then the effect gradually diminishes until it became flat in Q10.

The implications of the observed responses are that South Africa's GDP reverts faster to equilibrium in the event of a shock to exports to China as against imports from China. Also, South Africa's imports from China revert faster to equilibrium when there is a shock to GDP when compared with exports to China.

Figure 18: Response of South Africa's GDP to a shock to imports from China

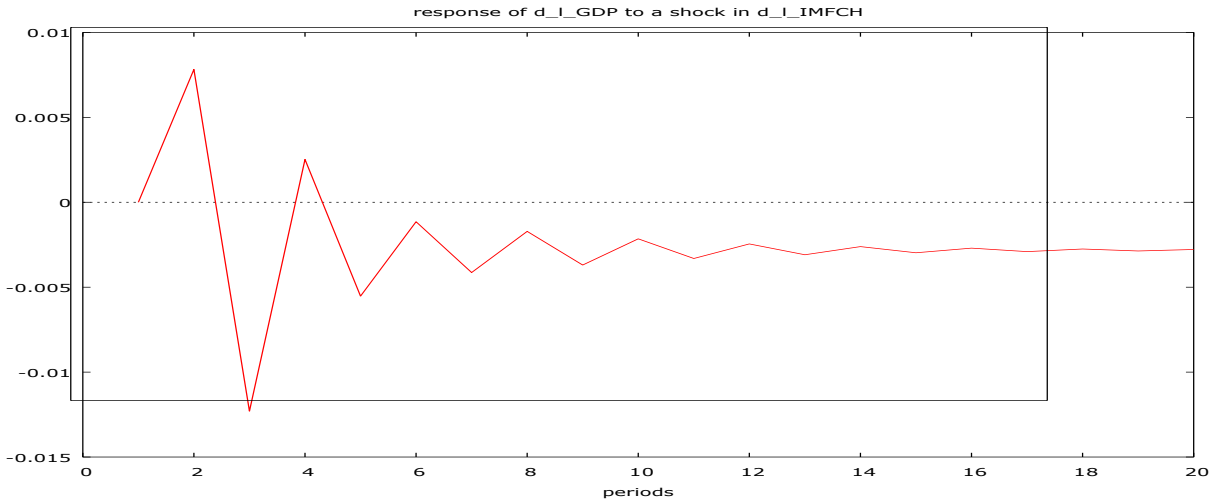


Figure 19: Response of South Africa's exports to China to a shock in GDP

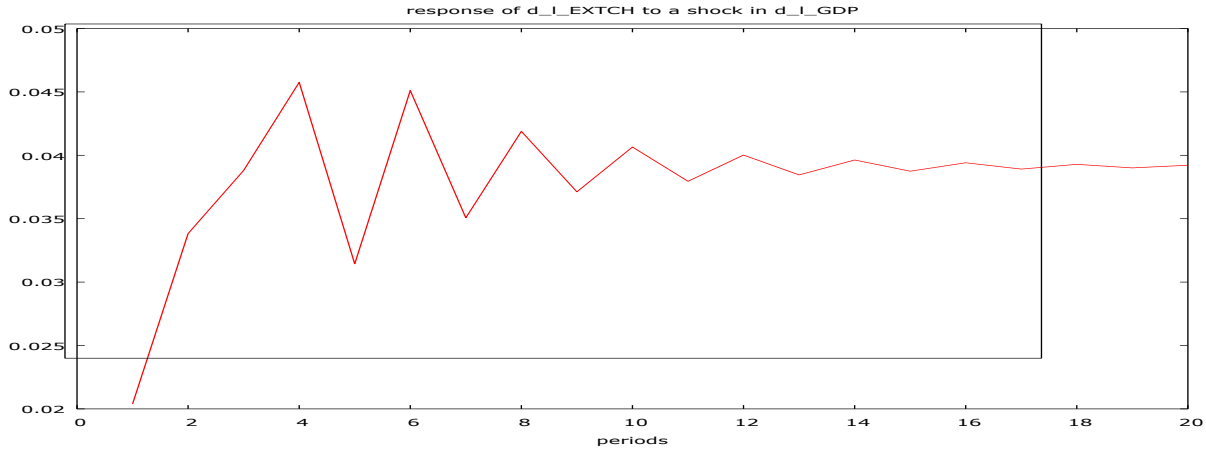


Figure 20: Response of South Africa's imports from China to a shock in GDP

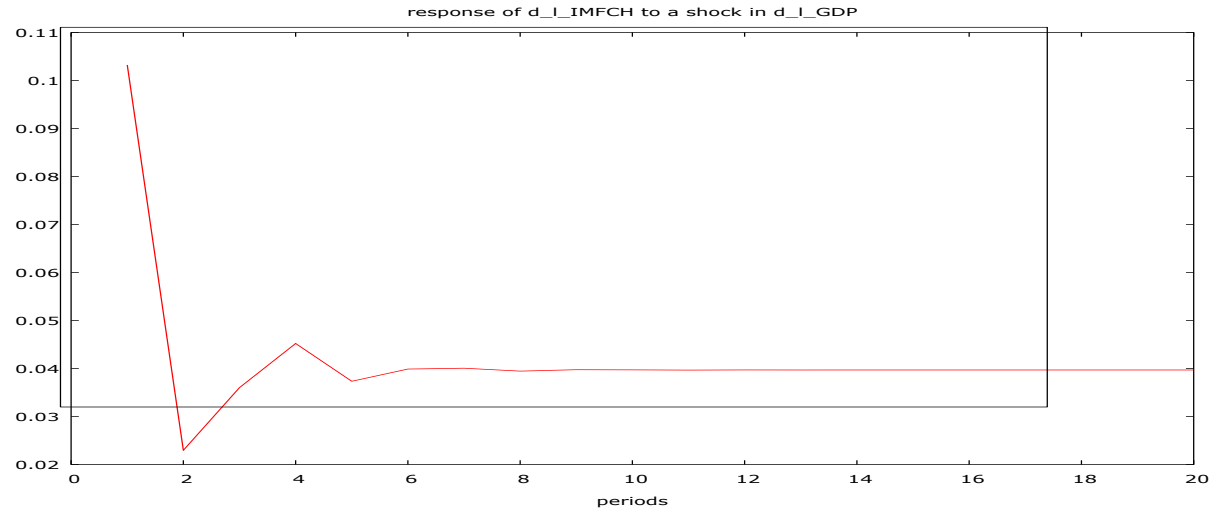
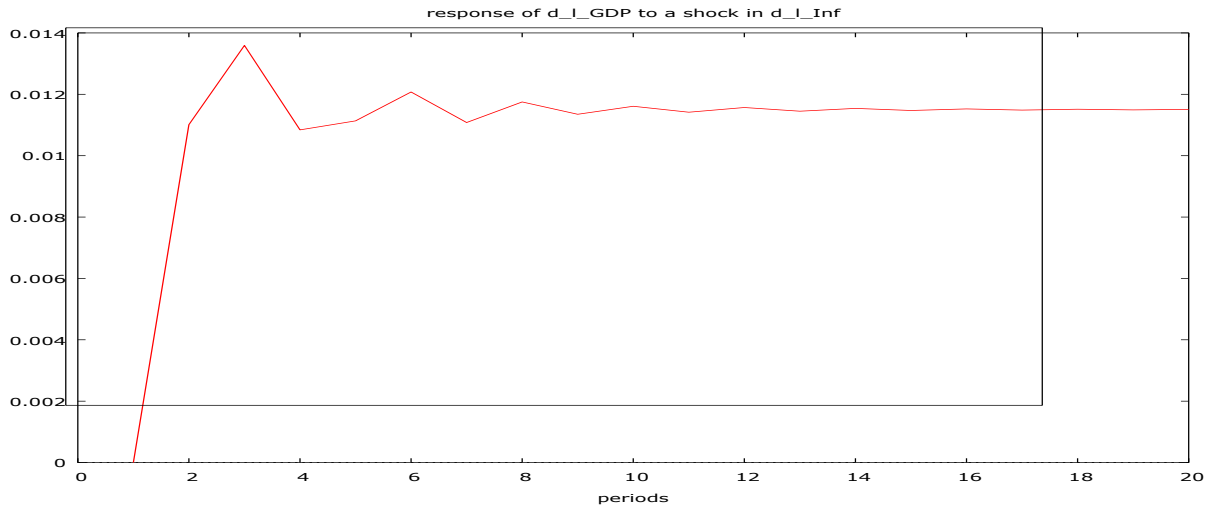


Figure 21: Response of South Africa's GDP to a shock in inflation



5.2.3 Variance decomposition analysis

The result of the variance decomposition analysis of the trading relationship between South Africa and China is presented in Appendix B. Table 1 shows that approximately 40% of the variation in South Africa's GDP is explained by the inflation rate. Exports to China explain 25% of the variation in GDP while own effect accounts for average 24% of the variation. Imports from China explain the least variation of 10.2% in the GDP. Table 2 also shows that the greater variation of 44% in exports to China is explained by the inflation rate while own effect explains 39% of the variation in exports. While the GDP explains 11% of the variation, the effect of imports was lowest as it explains only 6% of the variation in exports to China.

Similar to the variation in exports to China, Table 3 shows that inflation was responsible for average 42% of the variation in imports from China, while GDP accounts for average 25% of the variation and exports for 23%. Own effect explains the least variation of 10.3% of the variation in the imports from China. With respect to inflation, while own effect explains average 60% of the variation, exports to China explains average 17% and imports from China explains 3%. GDP explains the second highest variation in the inflation rate with an average of 18%.

5.2.4 Diagnostic tests

Diagnostic tests are also conducted in order to confirm the validity of the results of the empirical estimations of the trading relationship between South Africa and China. Table 15 depicts that we fail to reject the null hypotheses that autocorrelation and heteroskedasticity are not present, while the Doornik-Hansen test for normality shows that the errors are not normally distributed.

Table 15: Diagnosis tests

	Null hypotheses	P-value
Normality	Error is normally distributed	0.0213
Autocorrelation	Autocorrelation not present	0.4330
Heteroskedasticity	No presence of heteroskedasticity	0.3212

6. Summary of findings and policy implications

The study examined the trading relationship between South Africa and the individual BRIC using a combination of descriptive and econometric techniques. The results show that trade between South Africa and India was more intense between 1995 and 2011 followed by trade with China and then Brazil. The trade intensity was least with Russia.

South Africa's GDP reverts faster to equilibrium in the event of a shock to exports to Brazil as against the imports from Brazil. However, exports to Brazil revert slower to equilibrium in the event of a shock to GDP as against the response of imports from Brazil. With respect to the decomposition of variance for the GDP, domestic inflation accounts for the highest variation in the GDP, followed by own shock and then exports to Brazil, while imports from Brazil explain the least variation in GDP. The decomposition of variance for exports to Brazil shows that the highest variation is explained by inflation followed by own effect and then GDP. Similarly, inflation explain the greatest variation in imports from Brazil followed by own effect and then the GDP. The highest variation in the domestic inflation rate is explained by own effect followed by exports to Brazil and then the GDP.

South Africa's GDP reverts faster to equilibrium in the event of a shock to exports to China as against imports from China. Imports from China revert faster to equilibrium when there is a shock to GDP when compared with exports. Domestic inflation explains the highest variation in GDP followed by exports to China and then own effect. Similarly, the domestic inflation explains the largest variation in exports to China followed by own effect. The highest variation in imports from China is explained by the inflation rate followed by the GDP and then own effect. The highest variation in the domestic effect is explained by own effect followed by the GDP and then exports to China.

The results have a number of policy implications. First, South Africa should consolidate its trading relationship with India and China given that it experienced the highest trade intensity with these two countries. This consolidation could also boost the flow of investments from these countries into South Africa. Also, given that low trade intensity is observed with Brazil and Russia, South Africa may initiate efforts to improve the bilateral relationship with both countries. This is particularly important given that Brazil has a relatively good share of its investments

flowing into Africa. Second, the domestic inflation rate explains relatively high variation in exports to Brazil and China. This implies that for South Africa to maintain its competitiveness with these countries, efforts must be taken to ensure that average inflation rate is low and stable. Third, the finding that South Africa's GDP reverts back to equilibrium faster in the event of a shock to exports to Brazil and China, underscores the strategic importance of exports to these two countries. Fourth, South Africa can strengthen its involvement in the BRICS if it consolidates its trade linkages with the other members of the bloc.

Looking ahead, subsequent studies can attempt to better understand the key drivers of trade flows between South Africa and the BRIC bloc through the deployment of econometric analysis. This approach will offer quantitative estimates of the impacts of each explanatory factor on trade volumes and such information will be useful for policy to good purpose.

References

Abramova, I., and Fituni, L. (2012) 'Russia, BRICS and Africa: Relations of Partnership and Competition' *http://www.transnationalstudies.org/Article/58*. Accessed August 12th 2012

Alao, A. (2011) 'Nigeria and the BRICs: Diplomatic, Trade, Cultural and Military Relations' *SAIIA Occasional Paper, No. 101*

Basadien, M. (2012) 'BRICS Secretariat position paper presented at the KZN Export Week on 30th October 2012' Department of International Relations and Cooperation (DIRCO).

Bird, R. (2012) 'Subnational Taxation in Large Emerging Countries: BRIC Plus One' *IMFG Papers on Municipal Finance and Governance, No. 6*

Bird, R. and Cahoy, D. (2007) 'The Emerging BRIC Economies: Lessons from Intellectual Property Negotiation and Enforcement' *Northwestern Journal of Technology and Intellectual Property, Vol. 5, No. 3*

Bird, R. (2005) 'Defending Intellectual Property Rights in the BRIC Economies' *http://ssrn.com/abstract=807844*

Chaturvedi, S., and Halla, T. (2012) 'BRICS and South-South Cooperation in Medicine: Emerging Trends in Research and Entrepreneurial Collaborations' *Research and Information System for Developing Countries Discussion Paper No. 177*

De Castro, T. (2012) 'Trade Cooperation Indicators: Development of BRIC Bilateral Trade Flows' *International Review of Business Research Papers, Vol. 8. No. 1, pp. 211 - 223*

Gaaitzen J., Abdul A., Marcel P., Ilya B., and Harry, X. (2011) 'Deconstructing the BRICs: Structural Transformation and Aggregate Productivity Growth' *Basic Research Program Working Papers Series 04*

Havlik, P., Stollinger, R., Pindyuk, O., Hunya, G., Dachs, B., Lennon, C., Riberiro, M., Ghosh, J., Urban, W., Astrov, V., and Christie, E. (2009) 'EU and BRICs: Challenges and opportunities for European competitiveness and cooperation' *Industrial Policy and Economic Reform Papers No. 13*

Leal-Arcas, R. (2009) 'The European Union and the BRIC Countries in Strategic Trade Policy Areas' *http://www.asil.org/files/ielconferencepapers/leal-arcas.pdf*. Accessed August 12th 2012

Mlachila, M., and Takebe, M. (2011) 'FDI from BRICs to LICs: Emerging Growth Driver? *International Monetary Fund Working Paper No. 178*

Mwase, N., and Yang, Y. (2012) 'BRICs' Philosophies for Development Financing and Their Implications for LICs' *International Monetary Fund Working Paper No. 74*

Mustafa, Y., and Kabundi, A. (2011) 'Trade Shocks from BRIC to South Africa: A Global VAR Analysis' *http://ideas.repec.org/p/rza/wpaper/250.html*, Accessed August 12th 2012

Appendix A

Table 1: Decomposition of Variance for South Africa's GDP

Period	GDP	EXTBR	IMFBR	INF
1	100.0000	0.0000	0.0000	0.0000
2	62.5853	15.2355	8.9838	13.1954
3	57.6799	13.7863	8.7024	19.8313
4	49.6819	16.9563	8.1655	25.1962
5	45.9510	17.2293	7.3227	29.4970
6	41.8418	18.4653	6.7185	32.9744
7	39.0052	18.9734	6.1467	35.8747
8	36.3653	19.6489	5.6962	38.2895
9	34.2513	20.0977	5.2958	40.3552
10	32.3679	20.5467	4.9595	42.1259
11	30.7621	20.9053	4.6626	43.6699
12	29.3368	21.2362	4.4043	45.0226
13	28.0841	21.5207	4.1746	46.2205
14	26.9639	21.7784	3.9706	47.2871
15	25.9617	22.0073	3.7874	48.2437
16	25.0569	22.2147	3.6223	49.1061
17	24.2375	22.4022	3.4727	49.8877
18	23.4912	22.5731	3.3364	50.5993
19	22.8089	22.7293	3.2119	51.2499
20	22.1827	22.8727	3.0975	51.8471
Ave.	**37.9308**	**19.0590**	**4.9866**	**38.0237**

Table 2: Decomposition of Variance for South Africa's exports to Brazil

Period	GDP	EXTBR	IMFBR	INF
1	7.6380	92.3620	0.0000	0.0000
2	15.0373	66.2975	2.4850	16.1802
3	11.6618	58.3607	2.1789	27.7985
4	11.8433	51.8456	1.7976	34.5135
5	10.8341	48.2548	1.6839	39.2273
6	10.5805	45.1731	1.4891	42.7573
7	10.1469	43.0392	1.3836	45.4302
8	9.9178	41.2400	1.2761	47.5661
9	9.6758	39.8377	1.2001	49.2864
10	9.5034	38.6498	1.1314	50.7154
11	9.3446	37.6653	1.0766	51.9136
12	9.2161	36.8187	1.0284	52.9369
13	9.1018	36.0921	0.9875	53.8187
14	9.0039	35.4570	0.9515	54.5877
15	8.9169	34.8995	0.9200	55.2635
16	8.8404	34.4050	0.8921	55.8625
17	8.7718	33.9641	0.8672	56.3970
18	8.7104	33.5681	0.8448	56.8768
19	8.6548	33.2107	0.8246	57.3099
20	8.6045	32.8864	0.8063	57.7029
Ave.	**9.8002**	**43.7014**	**1.1912**	**45.3072**

Table 3: Decomposition of Variance for South Africa's imports from Brazil

Period	GDP	EXTBR	IMFBR	INF
1	37.1342	2.9349	59.9309	0.0000
2	30.0033	9.0391	48.8094	12.1482
3	28.5412	9.9416	42.9468	18.5704
4	25.6322	12.4370	38.1372	23.7936
5	24.1188	13.4991	34.4057	27.9765
6	22.4793	14.8111	31.3099	31.3996
7	21.3075	15.6837	28.7453	34.2635
8	20.2185	16.5312	26.5688	36.6814
9	19.3332	17.2031	24.7048	38.7590
10	18.5414	17.8130	23.0884	40.5572
11	17.8607	18.3329	21.6738	42.1326
12	17.2538	18.7987	20.4256	43.5219
13	16.7175	19.2092	19.3158	44.7575
14	16.2359	19.5784	18.3228	45.8629
15	15.8033	19.9097	17.4290	46.8580
16	15.4114	20.2101	16.6202	47.7583
17	15.0553	20.4829	15.8849	48.5770
18	14.7300	20.7321	15.2135	49.3244
19	14.4319	20.9605	14.5980	50.0097
20	14.1576	21.1706	14.0317	50.6401
Ave.	**20. 2484**	**16.4639**	**26.6081**	**36.6796**

Table 4: Decomposition of Variance for South Africa's inflation rate

Period	GDP	EXTBR	IMFBR	INF
1	0.0025	1.5551	3.4591	94.9832
2	1.8084	12.5498	2.2261	83.4157
3	3.8494	15.7657	1.7841	78.6008
4	4.4656	18.1720	1.5224	75.8399
5	5.0808	19.4850	1.3178	74.1164
6	5.4172	20.5274	1.1932	72.8622
7	5.7114	21.2435	1.0911	71.9540
8	5.9165	21.8227	1.0170	71.2438
9	6.0900	22.2698	0.9558	70.6844
10	6.2260	22.6400	0.9072	70.2269
11	6.3414	22.9439	0.8663	69.8485
12	6.4374	23.2016	0.8321	69.5290
13	6.5200	23.4210	0.8027	69.2563
14	6.5911	23.6110	0.7774	69.0205
15	6.6533	23.7767	0.7552	68.8147
16	6.7080	23.9227	0.7358	68.6335
17	6.7566	24.0521	0.7185	68.4728
18	6.8000	24.1678	0.7031	68.3292
19	6.8389	24.2717	0.6892	68.2002
20	6.8742	24.3656	0.6767	68.0836
Ave.	**5.5544**	**20.6883**	**1.1515**	**72.6058**

Appendix B

Table 1: Decomposition of Variance for South Africa's GDP

Period	GDP	EXTCH	IMFCH	INF
1	100.0000	0.0000	0.0000	0.0000
2	30.6739	46.0371	7.8126	15.4763
3	22.6490	31.7314	18.6938	26.9258
4	23.1069	30.9401	15.6535	30.2995
5	21.6594	29.1207	15.4015	33.8184
6	21.3407	27.8297	13.4965	37.3331
7	20.8568	26.7953	12.9323	39.4156
8	20.5968	26.1979	11.7583	41.4471
9	20.2746	25.4606	11.2849	42.9799
10	20.1051	25.0330	10.5219	44.3400
11	19.8879	24.5471	10.1126	45.4524
12	19.7536	24.2099	9.5890	46.4476
13	19.6015	23.8620	9.2490	47.2875
14	19.4929	23.5960	8.8677	48.0434
15	19.3794	23.3324	8.5880	48.7002
16	19.2908	23.1181	8.2973	49.2938
17	19.2024	22.9112	8.0659	49.8205
18	19.1292	22.7351	7.8362	50.2994
19	19.0582	22.5681	7.6430	50.7307
20	18.9969	22.4214	7.4563	51.1254
Ave.	**24.7528**	**25.1224**	**10.1630**	**39.9618**

Table 2: Decomposition of Variance for South Africa's exports to China

Period	GDP	EXTCH	IMFCH	INF
1	1.7132	98.2868	0.0000	0.0000
2	3.8029	59.1158	0.3859	36.6955
3	6.3254	50.7974	6.0901	36.7871
4	8.4475	47.1723	5.6864	38.6938
5	8.7662	42.0629	8.4226	40.7483
6	10.2264	39.7923	7.4039	42.5774
7	10.6457	37.5128	7.8956	43.9459
8	11.4338	35.9565	7.1945	45.4152
9	11.8260	34.4720	7.2527	46.4493
10	12.3401	33.3952	6.7977	47.4669
11	12.6558	32.3350	6.7355	48.2737
12	13.0218	31.5182	6.4342	49.0259
13	13.2787	30.7307	6.3353	49.6553
14	13.5512	30.0862	6.1267	50.2359
15	13.7622	29.4759	6.0244	50.7375
16	13.9738	28.9558	5.8720	51.1984
17	14.1486	28.4677	5.7773	51.6064
18	14.3184	28.0396	5.6606	51.9814
19	14.4648	27.6398	5.5763	52.3191
20	14.6044	27.2817	5.4834	52.6304
Ave.	**11.1653**	**38.6547**	**5.8578**	**44.3222**

Table 3: Decomposition of Variance for South Africa's imports from China

Period	GDP	EXTCH	IMFCH	INF
1	59.2682	12.3437	28.3881	0.0000
2	34.0755	35.2601	15.5669	15.0975
3	28.2382	26.3760	16.1472	29.2386
4	27.5493	26.5106	13.5987	32.3414
5	25.6876	25.7137	12.1580	36.4408
6	24.7035	24.5710	11.1714	39.5542
7	23.9654	24.1000	10.2750	41.6596
8	23.2999	23.6029	9.6087	43.4885
9	22.7907	23.1863	9.0613	44.9617
10	22.3624	22.8659	8.5973	46.1744
11	21.9964	22.5829	8.2106	47.2101
12	21.6859	22.3424	7.8774	48.0944
13	21.4160	22.1350	7.5892	48.8598
14	21.1800	21.9530	7.3370	49.5300
15	20.9720	21.7926	7.1148	50.1206
16	20.7871	21.6502	6.9172	50.6455
17	20.6217	21.5227	6.7406	51.1150
18	20.4730	21.4080	6.5816	51.5374
19	20.3384	21.3043	6.4379	51.9194
20	20.2161	21.2101	6.3072	52.2666
Ave.	**25.0814**	**23.1216**	**10.2843**	**41.5128**

Table 4: Decomposition of Variance for South Africa's Inflation rate

Period	GDP	EXTCH	IMFCH	INF
1	26.5408	1.8160	1.3796	70.2636
2	23.0376	16.1070	2.6232	58.2321
3	20.4515	17.2236	2.1298	60.1952
4	19.7282	16.7276	3.6839	59.8603
5	19.4854	17.8690	3.1348	59.5108
6	19.0109	17.7931	3.6732	59.5229
7	18.9149	18.1230	3.4445	59.5176
8	18.7044	18.1845	3.6225	59.4886
9	18.6209	18.3517	3.5219	59.5055
10	18.5035	18.3992	3.5991	59.4982
11	18.4425	18.5025	3.5502	59.5048
12	18.3665	18.5433	3.5861	59.5041
13	18.3201	18.6094	3.5623	59.5082
14	18.2677	18.6445	3.5793	59.5085
15	18.2310	18.6900	3.5676	59.5114
16	18.1927	18.7193	3.5759	59.5121
17	18.1632	18.7527	3.5700	59.5140
18	18.1339	18.7771	3.5741	59.5149
19	18.1099	18.8027	3.5712	59.5163
20	0.9155	18.0866	3.5732	59.5171
Ave.	**18.4071**	**17.3361**	**3.3261**	**60.0353**