South Africa-BRIC-SADC trade alliances' and the South African economy

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Abstract

This article discusses the implications of South Africa-BRIC-SADC's trade alliances on South Africa's economic growth. The analysing follows the periods in which South Africa is mired by fluctuating exchange rate and rising cost of living, as denoted by the rising consumer price index. In order to understand the implications, an autoregressive redistributive modelling was utilised on quarterly data from 2005 quarter 1 to 2017 quarter 3, regressing South Africa's growth against South Africa-BRIC and South Africa- SADC trade balances, the main variables of interest. The empirical results identify a significant long run relationship of the selected variables. However, the results review a negative contribution of South Africa-BRIC trade on South Africa's economy, while the South Africa-SADC trade produced positive results. Trade composition remains a major challenge for South Africa-BRIC trade. Continued innovation and research and development will shift reliance on primary commodities for exports to mechanised products, hence increasing gains from the lucrative BRICS trade and the non-utilised SADC trade.

Key Words: BRICS; SADC; Trade; Economic growth; South Africa

1. Introduction

Marred by challenges in access to development finance and bias within the Bretton Woods institutions (IMF and World Bank) towards equitable access to development resources, prominent emerging super-powers (BRICS) Brazil-Russia-India-China-South Africa (BRICS) formed an alliance officiated in 2010 with the aim of advancing their economies through job creation, export competitiveness (trade), technological innovation, research and development, food security, good governance and access to development finance.

South Africa aimed for BRICS trade to help the nation to gain access to improved technologies, investment in infrastructure, production efficiencies and access to foreign markets (SAG, 2013; Prinsloo, 2017). The new endogenous growth theory of Romer (1986) which holds that investment in human capital, innovation, and knowledge are significant contributors to economic growth supports the decision taken by South Africa in becoming a BRICS member, as such major tariffs were removed such that the conditions prevailing to BRICS were almost similar to those of the Southern African Development Committee (SADC), in which South Africa has strong bilateral ties dating back to the early 90's.

The study analyses the development of the South Africa-BRIC-SADC relations amidst the economic instability of South Africa, heralded by fluctuating exchange rate, rising inflation, unemployment, dumping incidences, export basket of mainly primary commodities, and continued trade deficit. An autoregressive redistributive model will be used on quarterly data from 2005 quarter 1 to 2017 quarter 3 to capture South Africa-BRIC and South Africa-SADC trade implications on growth. Trade balances are used as regressants of growth. The model is commendable for its ability to deal with small samples on both stationary and non-stationary variables (Pesaran and Shin, 1999) Prior models have utilised panel data models on annual data with imports, exports or total trade, producing inconclusive or biased estimates thereof.

Data is sourced from the International Trade Centre, and is presented as trade balances between South Africa and BRIC, and South Africa and SADC. Other variables of interest are real effective exchange rate and consumer price index. These variables have a common thread in export performance and foreign demand of commodities, and are sourced from the South African Reserve Bank The first section reviews literature on trade and growth in BRICS' and SADC economies. The data and econometric approach, analysis of results and conclusions are offered in preceding sections three, four and five.

2. Literature Review

Many factors in trade are important as catalyst for growth in host countries but with different significance. New trade theories are useful to unearth the modern dynamism of free trade. These theories have a common thread in intra-industry trade, increasing returns to scale, product differentials, technological innovations and imperfect competition. The gravity model is mostly used (Tinbergen, 1962). The model can be recalibrated to predict future, making it ideally suitable for modelling international trade relations where the future is not known (Tinbergen, 1962).

The New trade theories have a common thread with new growth theories. Romer's New Endogenous Growth theory, (1983), dominates modern growth studies. The theory emphasises on the role of savings and investments in the development of world economies. Trade is a catalyst for various forms of investments, making the model equally important for recent growth studies.

Previous studies have drawn on either the new trade theories or the new growth theories to estimate the effects of international trade on growth (Arora and Vamvakidis, 2004; Jordaan and Kanda, 2011). This first group of BRICS and SADC studies regressed imports, exports and total trade on growth, all with expected positive results (Kuboniwa, 2011; Polodoo, Seetanah, Sannasee and Padachi, 2012; Bhatia and Kishor, 2015). The second notable group of studies provided panel data analysis of annual and quarterly exports, imports and total trade from 1980 to 2014. All the results found, positive long run effects of BRICS trade integration. The major conclusions entail that trade integration in BRICS and SADC has positive growth effects (Dinca and Dinca, 2014; Chatterjee, Jena and Singh, 2014; Manzombi, 2015; 2015; Sperlich, 2015 and Matthee and Santana-Gallego, 2017). The third group of studies utilised correlational analysis and granger causality tests to model bilateral trade relations, amongst various trading blocs (Cowan, Chang Inglesi-Lotz and Gupta, 2012; Inglesi-Lotz et al, 2015; Bosupeng, 2017). Findings from the studies indicate that BRICS trade relations improve growth.

This study utilises the autoregressive redistributive model (ARDL) in estimating the South Africa- BRIC and SADC trade relations. The ARDL model is a stochastic process used in statistical calculations in which future values are estimated based on a weighted sum of past values (Pesaran and Shin, 1999). The ARDL is used in recent trade studies, with different variable selection. Major studies concentrated on specific products in an individual country setting, all with expected positive effects (Sousa, Martinez-Lopez and Coelho, 2008; Vieira, et al, 2014, Yin, et al, 2014; Izotor, 2016; Seleteng, 2016 and Bayraktar, 2017. Other studies utilising ARDL models focussed on aggregated output, particularly trade relations of imports, exports and total trade on annual growth of individual countries. The results were positive, with asymmetries in variable selection (Volchkova and Ryabtseva 2013; Gouvea, et al 2013; Mogoe and Mongale, 2014; Bonjec, Ferto and Fogarasi, 2014; Kocourek, 2015; Sharma, 2015; Viera and Gomes da Silva, 2016; Behera and Mishira, 2016).

This research differs from previous studies in that it departs from the general single product ARDL modelling analysis and focuses on the whole commodities section of BRIC and SADC trade relations with South Africa. More so, the application of the model departs from prior ARDL, time series, and panel data models which generalised findings on annual data dating to the 90s and inclusion of at most 3 years after the BRICS agreement. The study stands out on the inclusion of recent recorded quarterly data of the BRIC and SADC trade movements with South Africa, hence explores the trade imbalances ignored by various researchers.

3. Data and Econometric Approach

Bilateral trade relations are necessary for the growth of a nation. In order to investigate the economic performance of South Africa in BRICS trade, the following equation is estimated for the period ranging from 2005 Quarter 1 to 2017 Quarter 3:

$$RGDP\ t = \beta 0 + \beta 1REXCH_t + \beta 2CPI_t + \beta 3BRIC_t + \beta 4\ SADC_t + DUM + \mu t \qquad (1)$$

Where:

RGDP: Gross value added: all industries (US $Millions) (Source: SARB, 2017).

REXCH: Real effective exchange rate of the rand (2005=100) (Source: SARB, 2017).

CPI: Consumer price index: inflation (2006=100) (Source: SARB,2017).

BRIC: Trade balance: South Africa and BRIC (US$ Millions) all products (Source: ITC,2017).

SADC: Trade balance: South Africa and SADC = (US$ Millions) all products (Source: ITC,2017).

It is worth highlighting the following; i) The real effective exchange rate, is the rate at which the rand exchanges with 20 trading partners, particularly, the BRIC and the SADC countries; ii) The CPI measure price changes from one period to another. CPI necessitates formulation of pricing policy for tradable goods and services, amount of inventory and determination of wages and salaries by industry; iii) Trade balances (BRIC and SADC) are calculated as South Africa's exports less imports from BRIC and SADC countries respectively. The SADC variable is used as a benchmark for South Africa-BRIC trade. South Africa has strong bilateral ties in SADC since 1994; iv) Dummy variable (DUM) shows two periods 0 prior to BRICS membership (2005 -2010) and 1 after BRICS membership.

The empirical framework underpinning the study is based on the Autoregressive Distributive Model (ARDL). The model was developed by Pesaran and Shin (1999) and Pesaran et al (2001). The model is preferred over Engle and Granger (1987), Johansen and Juselius (1990). Vector Auto-Regressive and Vector Error Correction models due to its ability to produce non-biased cointegration estimates from non-stationary data. More so the ARDL model is capable of estimating long-term relationship in small samples, in our particular case, BRICS data sample, irrespective of whether the test variables are stationary 1(0), non –stationary 1(1) or mutually cointegrated (Pesaran and Shin, 1999). Issues such as endogeneity amongst the test variables is unlikely to have an effect on the ARDL model, as long as the errors are serially uncorrelated (Giles, 2014). The Lagrange Multiplier test will be used to carter for serial correlation or independence. The ARDL model is super-consistent in the presence of cointegration (Giles, 2014), and is presented as follows;

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 X_{t-1} + v_t \qquad (2)$$

Where, Y_t is the dependent variable, $\alpha_1 Y_{t-1}$ is the explanatory variable and X_{t-1} is a stochastic explanatory variable distributed independently of the disturbance term v_t.

The dependent variable *Yt* represent South Africa's growth and is regressed against REXCH, CPI, BRIC, and SADC. An innovative outlier dummy named BREAK will be utilised to demarcate for period prior and after BRICS membership.

A prerequisite for ARDL model estimation is that no variable in the empirical model should be 1(2). This is utilised by employing the ADF-MAX breakpoint unit root tests. This condition being fulfilled, Johansen cointegration tests can be employed to test on cointegration of variables, of which similar results are portrayed by the bounds test.

Following will be the estimation of an Error Correction Model (ARDL-ECM) based on the following specification;

$$\Delta RGDP_t = \beta_0 + \sum^{pi=0} \beta_1 \Delta REXCH_{t-1} + \sum^{pi=0} \beta_2 \Delta CPI_{t-1} + \sum^{pi=0} \beta_3 \Delta BRIC_{t-1} + \sum^{pi=0} \beta_4 SADC_{t-1} + \sum^{pi=0} \beta_5 DUM_{t-1} + \mu t \quad (3)$$

Where; Δ is the first difference of logarithms for the respective variables, β1, β2 …... β5 are coefficients to be estimated, DUM is a dummy variable prior and after BRICS formation and µt is the error term. Time variant *t* applies to all aggregates.

Prior to short and long-run dynamic estimates, diagnostic checks are performed on the ARDL model to assess the performance of the estimates. These diagnostic checks include the Breusch-Godfrey tests for serial independence, Cumulative sum of recursive residuals (Cusum) and the Cumulative sum of squares of recursive residuals (CusumsQ) for stability of estimated regressions. The model is said to be stable if the Cusum and CusumsQ lines are within two red lines drawn at 5 percent level of significance (Pesaran, 2001).

After accounting for serial correlation and dynamic stability, the Bounds test for cointegration is employed, to test on the long-run relationship between variables. The Bounds test is derived from the F and t-statistics in estimating the relationship between the dependent and the independent variable in a univariate equilibrium correction set-up. The bounds test draws from the Wald test. The critical values of the Wald test do not have standard asymptotic distribution for any order of integration under the null hypothesis of no cointegration (Hamuda, 2014; Giles, 2013). As a result, Pesaran (2001); Narayan (2004) provide bounds on the critical values for the F statistics. The lower bound is based on the stationarity assumption of all variables and non-cointegration. The upper bound is tabulated on the assumption that all variables non-stationary, that is, there is cointegration. The test is inconclusive if the F- statistic fall between the bounds.

The final stage is on estimating the long run equilibrium coefficient, as well as the ECM for the long-term adjustment speed for the explained variable towards equilibrium. Three model selection criteria, namely; Schwarz Bayesian, Adjusted Likelihood Ratio and the Akaike Information will be used to determine the lag structure of the ECM.

4. Estimation and Analysis of Results

4.1 ARDL Breakpoint Unit Root Test

A necessary preliminary step before conducting ARDL cointegration analysis is the pre-testing of integration order of variables. This is so as to avoid inclusion of 1(2) variables. Utilising Eviews, (2015) (software version 9), a dummy variable BREAK with the value 1after 2010Q1 and 0 from 2005Q1 to 2009Q4 was added to normalise structural breaks in data emanating from South-Africa-BRICS inclusion. The BREAK termed ADF-MAX Breakpoint unit root test developed by Leybourne (1995), was used to provide robust statistics towards structural breaks in data series.

An additive outlier break was used over the Schwarz Criterion in intercept for best linear unbiased estimator (BLUE) estimates.

The ADF-MAX Breakpoint unit root tests results are shown in Table 1.

Table 1: ADF Breakpoint unit root test results

ADF Test	**Intercept**		**Intercept & Trend**	
Variable	**T- statistic Level**	**T- statistic 1st Difference**	**T- statistic Level**	**T-Statistic 1st Difference**
RGDP	-4.615882**	-5.707733	-2.959028	-6.116559***
REXCH	-3.306979	-8.225940***	-3.618689	-8.095788
CPI	-0.883662**	-5.68863***	-5.114198	-5.835208***
BRIC	-5.151617***	-9.408124***	-5.932743***	-9.408124***
SADC	-4.354274*	-8.491902***	-6.422968***	-8.491902***

******, **, **** *denotes significance at 1%, 5% and 10% levels*.

Source: Own table drawn from Eviews 9 iterations

The null hypothesis confer non- stationarity, which is the presence of a unit root against the alternative of stationarity, which is the absence of unit root. The critical values are based on MacKinnon (1996).

REXCH is unstationary at level1(0), and become stationary in first differences 1(1). CPI, SA-BRIC and SA-SADC are stationary at both levels and first differences 1(1). RGDP is stationary at both levels and first differences. The inclusion of both 1(0) and 1(1) variables is necessary for application of the bounds test.

4.2 Residual Diagnostic Tests

4.2.1 LM Test

One of the assumptions of the ARDL model is for the serial independents of the parameter estimates. Serial dependence or correlation causes inconsistent parameter estimates. The Breusch-Godfrey LM test validates some of the modelling assumptions inherent in regression analysis and follows to identify instances where lagged values of the regressor were used as regressants. The null hypothesis for serial independence is accepted with a chi-square probability value of 0.0150 at 10 percent significant level.

Table 2: Breusch-Godfrey LM test

F Statistic	2.126101	Prob. F (8.26)	0.0699
Obs* R-squared	18.98269	Prob. Chi-Square(8)	0.0150

Source: Own table drawn from Eviews 9 iterations

4.3 Stability Diagnostic Tests

4.3.1 Cusum & CusumsQ Tests

The cumulative sum of recursive residuals (Cusum) and the cumulative sum of squares of recursive residuals (CusumsQ) tests intent to empirically analyse the stability of the short- and long run dynamic model’s coefficients (Pesaran and Pesaran, 2001). The model is said to be stable if the Cusum and CusumsQ lines are within two red lines drawn at 5 percent level of significance. Cusum and CusumsQ test results are reported from Figure 2.

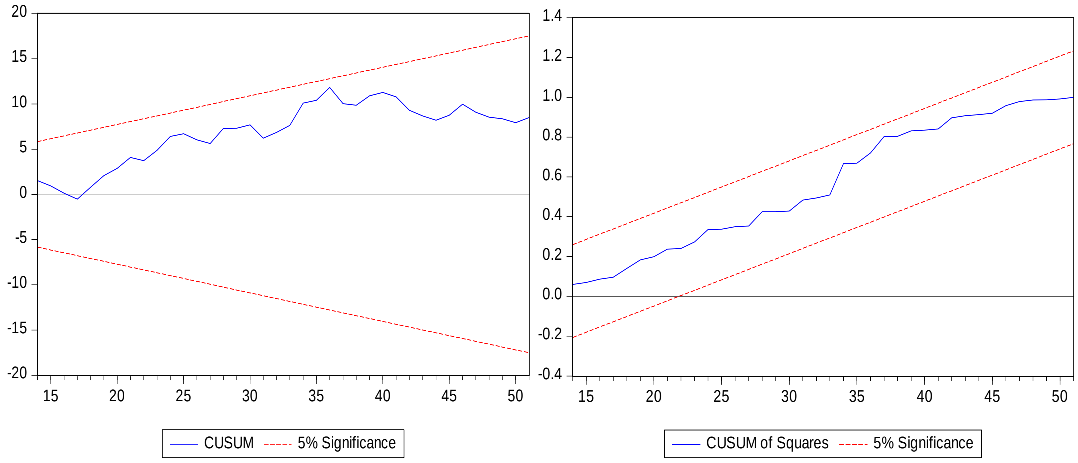

Figure 1: Cusum & CusumsQ Test Results

Source Eviews9 Iterations

Plots of CUSUM and CUSUMSQ results are within the recommended limit. This therefore means the short-run and long-run coefficients of the model are stable.

4.4 Coefficient Diagnostics

4.4.1 Johansen Cointegration Test

The Johansen cointegration test was undertaken as a preliminary for the bounds test, even though not a requirement for the ARDL model. The Johansen cointegration tests were contacted basing on the trace and the eigenvalue tests. The trace test hypothesises that the number of cointegrating equations is greater than the number of variables involved. The null hypothesis fails to be rejected if the test statistic is smaller than the critical values of the trace tests. The maximum eigenvalue test hypothesises the number of cointegrating equations (r) against the alternative hypothesis (r + 1). The null hypothesis is accepted if the test statistic is smaller than the maximum eigenvalue test critical value. The null hypothesis of no cointegrating vectors and at most 1 is rejected since the trace and maximum eigenvalue tests contain at least 2 and 1 cointegrating equations as 5 percent level of significance. Trace and eigenvalue tests are presented in Table 3.

Table 3: Johansen cointegration tests

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE (s)	Eigenvalue	Trace statistic	0.05 Critical Value	Prob.**
None *	0.539623	93.77283	76.97277	0.0015
At most 1*	0.438455	55.76306	54.07904	0.0351
At most 2*	0.286991	27.48692	35.19275	0.2650
At most 3*	0.134934	10.91211	20.26184	0.5506
At most 4*	0.074801	3.809601	9.164546	0.4412

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
*denotes rejection of the hypothesis at the 0.05 level ** MacKinnon-Haug-Michells (1999)-p values

Unrestricted Cointegration Rank Test (Maximum-Eigenvalue)

Hypothesized No. of CE (s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.539623	38. 00976	34.80587	0.0015
At most 1*	0.438455	28.27614	28.58808	0.0351
At most 2*	0.286991	16.57481	22.29962	0.2650
At most 3*	0.134934	7.102508	15.89210	0.5506
At most 4*	0.074801	3.809601	9.164546	0.4412

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
*denotes rejection of the hypothesis at the 0.05 level ** MacKinnon-Haug-Michells (1999)-p values
Source Eviews9 Iterations

The trace statistic of 93.77283 is greater than the critical value of 76.97277 at 5 percent level of significance. Similarly, maximum eigenvalue test is significant at 10 percent level with a test statistic of 38.00976 greater than the critical value of 34.80587.

4.4.2 The ARDL Bounds Test

The Bounds test is derived from the *F* and t-statistics in estimating the relationship between the dependent and the independent variable in a univariate equilibrium correction set-up.

Table 4: ARDL Bounds test results

Test Statistic	**Value**	**k**
F-statistic	3.181149**	5

Critical Value Bounds	**I0 Bound**	**I1 Bound**
10%	1.81	2.93
5%	2.14	3.34
2.5%	2.44	3.71
1%	2.82	4.21

Source: Own table drawn from Eviews 9 iterations

Using the two sets of asymptotic critical values proposed by Pesaran et al (2001); Narayan (2004) reported from table 4, the intercept and trend F statistic of 3.181149 is greater than the upper bound value of 2.93 at 10 percent significant level confirming the presence of a long-run cointegration relationship amongst our regressors.

4.5 ARDL Model Specification

The Adjusted R-squared was used as the basis for determining the lag orders for the regressors. A consideration of 12500 models was made for our model choice at 8 lags. The dummy variable (BREAK), REXCH, CPI, BRIC and SADC were entered as regressors on an intercept no trend estimation pattern.

Results of the model test using Heteroscedasticity and Autocorrelation consistent standard errors and covariance chose ARDL model (2; 3; 2; 0; 0; 2) as the most appropriate for our regression analysis.

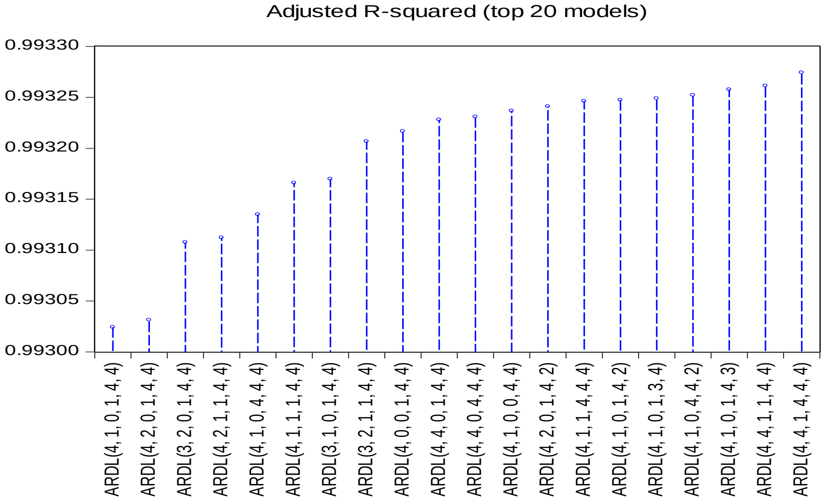

Figure 2: Model Test Results

Source: E views 9 Iterations

4.5.2 ARDL Cointegrating and Long-Run Form

Cointegration is defined as the level relationship between the dependent and independent variable (Figure 3). The bounds test was performed to determine the presence of long run equilibrium relationship between our test variables. The bounds test results were positive and significant, which is an indication of a stable long run relationship between the dependent variable RGDP and independent variables (REXCH, CPI, BRIC and SADC).

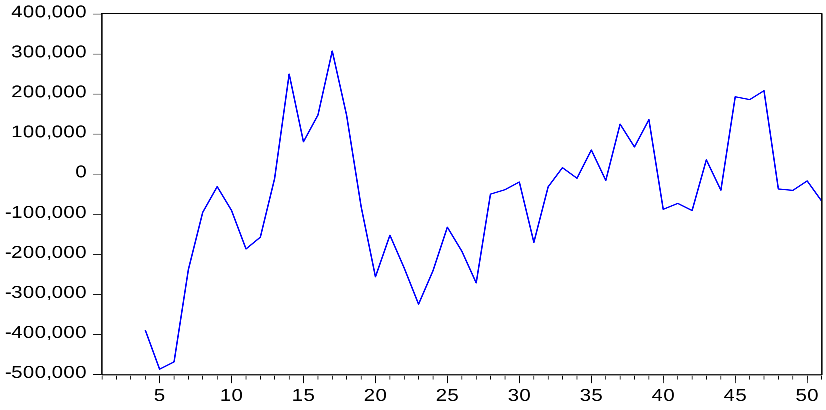

Figure 3: Cointegration graph

Source Eviews9 Iterations

4.5.2.1 Short-Run Cointegration Form

In the presence of long-run equilibrium, any short run disequilibrium can be seen as a process of adjustment to the long run. The ECM coefficient shows the speed of adjustment of a variable towards equilibrium. The short-run coefficient estimates of the ARDL-ECM are reported from Table 5.

Table 5: Estimated short-run Error Correction Model

ECM-ARDL: Short run dynamics ∆RGDP			
Regressor	Coefficient	T-Statistic	P- Value
ECM_{t-1}	0.060895	-4679080	0.0000

Source: Own table drawn from E views 9 Iterations

As expected, the error-correction term (ECMt-1) is negative for all estimations performed (on average ECMt-1 = (-0.060895). It means that, on average, 60 percent of the shock is corrected after the first quarter. The lowest speed of adjustment means that the long-run equilibrium relationship between its variables returns to the steady state very slowly.

4.5.2.2 Long-Run Cointegration Form

After applying the ARDL Bounds test and identifying a cointegrating relationship amongst our variables, we estimate the long-run equilibrium coefficients, reported in Table 6.

Table 6: ARDL Model long-run coefficients

Variable	Coefficient	Probability
REXCH	1284.663	0.0043
CPI	6686.742	0.0190
BRIC	-0.009563	0.0380
SADC	0.003146	0.3053

REXCH and CPI are in index form. BRIC and SADC are interpreted as Z=Z (-1) + D(Z)

Source: Own table drawn from Eviews 9 iterations

The empirical results are significant with positive coefficients for all regressors except BRIC. The BRIC coefficient of -0.009563 (-10%) denotes the effect of a deficit on South Africa's trade balance with the BRIC. The deficit concern was even spelt by the South African

President during the 2017 BRICS summit in Xiamen, China. Positive coefficient of 0.003146 (3 %) is recorded with SADC denoting the long run effect of maintaining a surplus in the balance of trade. The contribution is lower than expected due to the nature of products exported by South Africa to the SADC. Food commodities comprise a large portion of South Africa's export performance with SADC. REXCH and CPI have renowned long run relationship with RDGP, with coefficients of 1284.663 and 6686.742. High volatility of the rand exchange rate determines export performance of commodities. High rates of inflation causes severe fluctuation in the exchange rate, which tends to affect trade and growth.

5. Conclusions and Recommendations

The study analysed how South Africa's economy is benefiting from BRICS in terms of trade. Literature has often found inconclusive results due to data unavailability, variable selection and the methodology used. The study improved all the challenges of prior studies by employing the ARDL model over South Africa- BRIC and South Africa-SADC trade balances on quarterly data from 2005Q1 to 2007Q3. Appropriate model estimations and checks were done to address the study's objectives. The results were conclusive to show the presence of short-and long-run relationship between selected variables and growth.

Results of the study shows that South Africa - BRIC trade has negative effects on growth, South Africa's exports are not competitive in the BRICS market; as such they do not have strong foreign demand. South Africa's exports are mainly mineral products, precious metals, iron and steel products and vehicles, while BRIC exports are mainly electrical machinery and equipment, electrical appliances and vehicles.

The South-Africa-SADC trade relations produced positive growth effects although the contribution is minimal owing to the nature of products traded in the region. Nickel, mineral fuels and ores forms major part of the South-Africa- BRICS trade (ITC, 2017). South Africa is supposed to take advantage of the gradually weakening rand to improve its export performance, but that is not so due to lack of value addition especially in mechanisation and other industrials. Value addition, research development and technological innovation would give South Africa favourable balance of trade with the BRIC and in SADC.

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