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The Impact of Exchange Rate and Exports on Economic Growth of South Africa

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Abstract: South Africa is currently running at a very low phase of economic growth and this raised major concerns to different stakeholders in the country. A balanced exchange rate together with export promotion is viewed as the key instruments that can be used to improve the growth rate of the economy. This paper is aimed at determining the impact of exchange rate and exports on economic growth of South Africa. The Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) tests were employed to determine the unit root of the time series data. Johansen cointegration procedures and vector error correction model (VECM) were used to capture the short-run and long run relationship between the variables. The Engle-Granger causality test was also employed to determine the degree of influence amongst the variables. Furthermore, the paper carried out the impulse response function (IRF) to plot the difference between time series process without a shock and the time series with a shock. The results indicate that there is a significant positive relationship between exports and economic growth. The results further indicate that there is a significant negative relationship between exchange rate and economic growth. This implies that a depreciation of the rand in the foreign exchange market can contribute positively to the home country, because more of the domestically produced products could be sold in the international market. Measures to promote exports and balanced exchange rate are therefore recommended.

Keywords: Economic growth, exchange rate, exports, Johansen cointegration, Vector error correction model, Impulse response function

1. Introduction

South Africa is currently running at a very low phase of economic growth and this raised major concerns to different stakeholders in the country. According to Statistics South Africa (2016), Gross Domestic Product (GDP) was reported at -1.2% during the first quarter of 2016 and 0.2% during the third quarter of 2016. This proves the fact that the South African economy is growing below the target of between 2 to 3 percent per quarter. The exchange rate between the Rand (South African currency) and the US dollar was trading at roughly R13.01 per US dollar in February 2017 (SARB, 2017). This also proves the fact that the Rand is not doing well in the foreign exchange market.

Expansion and openness to foreign markets was viewed as a key determinant of economic growth because of the positive externalities it provides. Helpman and Krugman (1985) indicated that firms in a thriving export sector can enjoy the benefits of efficient resource allocation, greater capacity utilization, exploitation of economies of scale, and increased technological innovation stimulated by foreign market competition. Exports can also provide foreign exchange that allows for more imports of intermediate goods which in turn raises capital formation and thus stimulate output growth. It is also possible to have growth-led exports (GLE) which has the reverse causal flow from economic growth to exports growth. This can be stipulated by productivity gains caused by increases in domestic levels of skilled labour and technology (Awokuse, 2007).

The exchange rate plays a vital role in a country's level of trade and other transactions with economic agents in other countries. It is very much important in the world economy because countries need foreign currencies to perform international transactions for goods and services. South African industries or households who are willing to buy goods and services from other countries need to convert their home currency (Rand) into the foreign currencies which the goods and services are coming from. On the other hand, foreign citizens or companies which are interested in buying goods and services from South Africa also need to convert their home currencies into South African Rands.

This whole process helps in the smooth running of transactions between countries. The most important question been asked by trading parties is how much to spend from one currency in order to get another country's currency. This brings to the idea of stabilising the exchange rate because of the role it plays on economic growth and stability in the economy. Since the South African Reserve Bank (SARB) adopted the free-floating exchange rate system, the country's exchange rate has turned to be more volatile. This could be a risk to the growth of international trade and macroeconomic stability because of the presence of hedging facilities that could be employed to protect entities against exchange rate risks (Nyahokwe & Ncwadi, 2013).

In essence, the ultimate aim of this paper is to determine the impact of exchange rate and exports on economic growth of South Africa. The paper has been structured as follows: section 2 contains the literature review; section 3 contains the methodology applied in the paper; section 4 presents the results and findings of the paper and lastly section 5 concludes the paper.

2. Literature Review

This section presents both theoretical framework and empirical literature.

2.1 Theoretical Framework

This section incorporates and discusses the theories that link to this paper, which includes; the stage theory, Adam Smith's theory of absolute advantage and the purchasing power parity (PPP theory).

2.1.1 The Stage Theory

The stage theory suggests that internationalization is a gradual process that requires the acquisition, integration, and also the use of knowledge with regard to foreign markets. The accumulation of resources, exploitation of economic of scale, and building excess capacity is viewed as a result of a growing firm. These resources allow management to direct more efforts to exports when compared to smaller firms (Bonaccorsi, 1992). The theory contains elements of learning that takes place over time as owners and managers develop intellectual capital used in the development of internationalisation strategies and resource allocation (Orser, Spense, Riding & Carrington, 2008). The holding of this theory purports and confirms that exports are larger, more established, and run by more experienced managers.

2.1.2 Adam Smith's Theory of Absolute Advantage

The theory of absolute advantage was based on the notion that the national's wealth is reflected by its production capacity, not necessarily in holding of precious metals. Adam Smith believed that it is the division of labour that may leads to the greatest improvement in the productive powers of labour. He based his argument on the fact that the advancement of labour will lead to more output that can be produced with the same amount of labour. Nonetheless the division of labour will leads to quantitative and qualitative production improvements. This will result in an increased output, stimulation of technological development, and workers' skills and productivity will enhance. As a result, economic growth is promoted and also national wealth increases.

Smith argued that domestic and international trade are determined by the same rules. In other words, the division of labour works internationally the same way it does domestically. He also emphasized that a nation tends to buy scarce goods from abroad and specialises in the production of some other goods. This implies that a nation would produce and export the commodities that they can produce more cheaply as compared to other nations and import those which it cannot produce. This whole situation will lead to each country specialising in the production of goods that they produce the best (Schumacher, 2012).

2.1.3 The Purchasing Power Parity (PPP Theory)

The Purchasing Power Parity (PPP theory) explains the movements in the exchange rate. It is originated from the work of British economist David Ricardo. This theory takes its starting point from the law one price, which states that under conditions of free completion and absence of transportation costs and trade barriers, identical goods should have one price in any given country. PPP is an extension of the law of price. This theory asserts that the exchange rate between currencies of two countries equals the relation between the price levels of these two countries. Only in this way the purchasing power of currencies in both countries is the same.

There are two versions of PPP, absolute and relative, the former is considered quite restrictive since it will be valid when financial markets are efficient and baskets of goods are identical, which does not occur due to market imperfections, transaction costs, product differentiation and international trade restrictions. However, relative PPP states that prices and exchange rates vary maintaining a constant ratio in the purchasing power of the domestic currency of each country regarding other currencies. Thus, the country with a higher inflation differential should raise the exchange rate of its currency regarding the other one, that is, it should recognize the loss of value of its currency (depreciation); being this raise in the exchange rate same as the difference between both inflation types.

The PPP allows one to estimate what the exchange rate between two currencies would have to be in order for the exchange rate to be at par with the purchasing power of the two countries' currencies. Observed deviations of the exchange rate from PPP are measured by deviations of the real exchange rate from its PPP value of 1 (Mcknight & Sanchez, 2014).

The PPP exchange rates help to minimize misleading international comparisons that can arise with the use of market exchange rates. For example, suppose that two countries produce the same physical amount of goods in two different years. Since market exchange rates fluctuate substantially, when the GDP of one country measured in its own currency is converted to the other country's currency using market exchange rates, one country might be inferred to have higher real GDP than the other country in one year but lower in the other year. Both of these inferences can fail to reflect the reality of their relative levels of production. However, if each country's GDP is converted into the other country's currency using PPP exchange rates instead of observed market exchange rates, the false inference will not occur (Spaho, 2015).

2.2 Empirical Literature

Using the vector autoregressive (VAR) model and Granger-causality method, Ghartey (1993) studied the relationship between economic growth and export in Taiwan, United State and Japan. The results indicated that exports lead to growth in Taiwan and economic growth Granger-causes export growth in United State. Furthermore, it was also pointed out that there is existence of causal relationship between exports and economic growth in Japan. Heitger (1987) and Lussier (1993) concluded that exports is a vital determinant of economic growth after using ordinary least square method to study the relationship between exports and economic growth. Kravis (1970) and Michaely (1977) employed the Spearman rank method to determine whether export is an important determinant of economic growth. Their results were the same as those of Heitger (1987) and Lussier (1993).

Colombatto (1990) used 70 country samples to determine if exports lead to economic growth. The results rejected the null hypothesis of export-led growth. Jung and Muturi (1993) applied the Granger-causality test to analyse the relationship between export growth and economic growth for 37 developing countries. The results also rejected the null hypothesis of export-led growth. Ahmed, Butt, and Alarm (2000) employed a trivariate causality framework to study causality between export and economic growth. The results also rejected the null hypothesis of export-led growth. From the literature reviewed, evidence point out that there are mixed results on the question of whether indeed export can contribute positively to economic growth. This whole process makes it interesting to see what we can get from the South African economy.

3. Research Design and Methodology

This paper employed Johansen cointegration test and vector error correction model (VECM) to capture the relationship between the variables. The Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) tests are also used to determine the unit roots for time series data. The Engle-Granger causality test is also employed to determine the causality effect amongst the variables. Diagnostic tests will also be performed to check the existence of serial correlation and heteroscedasticity in the time series. Furthermore, the paper performs stability tests to determine whether the model is correctly specified. In conclusion, the paper will carry out the impulse response function. This section is structured as follows; Model specification will be presented first, followed by the discussion of Data. In conclusion, the section will discuss the estimation techniques which include the following: unit root tests, Johansen cointegration test, VECM, the Engle-Granger causality test, diagnostic testing, Stability tests and the Impulse Response Function (IRF).

3.1 Model Specification

The model of the study consists of three variables with annual time series data. The variables are economic growth (*EG*), exchange rate (*EX*) and Exports (*EP*). In the model, Economic growth is being regarded as the dependent variable, with exchange rate and exports been regarded as the independent variables. The equation of this model can be expressed as follows:

$$EG = f(EX, EP) \quad (1)$$

and as a linear equation,

$$EG_t = \beta o + \sigma_1 EX_t + \sigma_2 EP_t + \varepsilon_t \quad (2)$$

where:

βo	=	Constant
EG	=	Economic Growth
EX	=	Exchange rate
EP	=	Exports
σ	=	Parameters of the model with all real numbers
ε	=	Error term

3.2 Data

The time series data for all the variables is collected from the World Bank. The time series data covers the period 1962 until 2016. The data for exchange rate is presented as the annual percentages of the real effective exchange rate against the US dollar. The US dollar was chosen simply because it serves as the central reserve in the foreign exchange market. For economic growth, the annual percentage of real GDP was used. Furthermore, the annual percentage time series data for export performance was used for exports. The time series data for all the variables is presented in annual percentages.

3.3 Estimation Techniques

3.3.1 Unit Root Tests/Stationarity Tests

Johansen's Cointegration method, VECM and Granger causality involves initial testing of the time series to ensure the order of integration of the variable by means of testing for unit roots. As the model contains economic variables of a time series nature, the empirical analysis will start by examining their statistical properties. The essence of analysing these properties is to determine if the variables in the model are stationary, so as to avoid spurious regression which might lead to a high R^2 and thus, misleading results (Asteriou and Hall, 2011). To get reliable results from the analysis of econometric models, it is required that the time series data under consideration should be stationery.

This paper will perform two different tests of unit roots, namely; informal test and formal test. Informal test results will be in the form of visual inspections presented in the form of graphs or figures. Formal test results will be presented in the form tables. In order to validate the characteristics in the time series data, the study utilises two different formal unit root tests, namely the ADF and PP tests. These tests are employed to determine the non-stationarity assumptions as well as to ensure that spurious results, problems of autocorrelation and heteroscedasticity are avoided (Dickey & Fuller, 1979). In general, these tests are consistent with each other; however, the study included both of them to ensure accuracy regarding the unit root test conclusion.

When running the ADF and PP tests, the main focus will be on the probability values, critical values and the t-statistics values. If the critical values are lower than the values of the t-statistics at different levels of significance, the null hypothesis is not rejected. Meaning there is a unit root or the time series data is not stationery. However, if the critical values are greater than the t-statistics at different levels of significance, the null hypothesis is rejected. Meaning there is no unit root. If variables are stationary in a model, they will tend to have a constant variance and some elements of autocorrelation over time (Noula, 2012). If a series is not stationary, it may become stationary only after differencing.

3.3.1.1 The Augmented Dickey-Fuller (ADF) Test

The ADF test can be performed using three different kinds of regressions, namely; without intercept and deterministic time trend, with intercept and with both intercept and deterministic time trend. The lag length on these extra terms is either determined by the Akaike Information Criterion (AIC) or Schwartz Bayesian Criterion (SBC), or more usefully by the lag length necessary to whiten the residuals.

The equation for ADF is given by:

$$\Delta y_t = \alpha_0 + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + ... + \delta_{p-1} \Delta y_{t-p+1} \quad (3)$$

where α is the constant, β, the coefficient on a time trend and p is the lag order of the autoregressive process. In order to select the optimal lag length for the model, the log-likelihood function must be maximised (Maggiora & Skerman, 2009).

3.3.1.2 Phillip-Perron (PP) Test

According to Asteriou and Hall (2011) Phillip-Perron (PP) test is a generalization of ADF test that allows for fairly mild assumption concerning the distributions of errors. The distribution theory supporting the Dickey-Fuller tests is based on the assumption that the error terms are statistically independent and have a constant variance. When using the ADF methodology, we have to make sure that the error terms are uncorrelated and that they really have a constant variance. The main reason this study conducts the PP as well is because the ADF test loses power for sufficiently larger values of p or the number of lags (Gujarati, 2004). The regression of PP is as follows:

$$Y_t = b_0 + b_1 Y_{t-1} + \mu_t \quad (4)$$

3.3.2 Johansen Cointegration Test

The paper employed Johansen cointegration approach to determine the long-run relationship amongst the variables. According to Gujaratti (2004), Johansen's method takes a starting point from the VAR representation of the variables:

$$\Delta \mathrm{Y}_t = \mu + \Pi \mathrm{Y}_{t-1} + \sum_{i=1}^{p-1} \Gamma_j \Delta \mathrm{Y}_{t-1} + \varepsilon_1 \quad (5)$$

where Y_t is an $nx1$ vector of variables that are integrated of order of one-commonly denoted by I(1) and ε_t is an $nx1$ vector of innovations. If the coefficient matrix Π has a reduced rank $r<n$, then there exist nxr matrices α and β each with rank r such that $\Pi = \alpha\beta^1$ and $\beta^1\mathrm{Y}_t$ is stationary, whilst r is the number of cointegrating relationships.

The Johansen cointegration approach depends on two different likelihood ratio tests of the reduced rank of the matrix; namely, the trace test and the maximum eigenvalue test.

The Trace test is given by:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} 1n(1 - \hat{\lambda}_{r+1}) \quad (6)$$

The maximum eigenvalue test is given by:

$$\lambda_{\max}(r, r+1) = -T1n(1 - \hat{\lambda}_{r+1}) \quad (7)$$

where:

T is the sample size, and $\hat{\lambda}_I$ is the *ith* largest canonical correlation.

β^1, represent the matrix of cointegrating vectors

α, represent the speed of adjustment coefficients

r, represent the number of cointegrating relationships

Π, determines the extent to which the system is cointegrated and is called the impact.

3.3.3 VECM

The purpose of the vector error correction model in this study is to determine the short-run relationship between the variables. The VECM will only be carried out if there is cointegration between the variables from the Johansen cointegration test.

Model specification:

$$\Delta X_t = \beta_{x0} + \beta_{xx1}\Delta_{t-1} + \beta_{x11}\Delta P^1{}_{t-1} + \beta_{x21}\Delta P^2{}_{t-1} + v^x{}_t \quad (8)$$

$$P^1{}_t = \beta_{10} + \beta_{1x1}\Delta_{t-1} + \beta_{111}\Delta P^1{}_{t-1} + \beta_{121}\Delta P^2{}_{t-1} + v^1{}_t \quad (9)$$

$$\Delta P^2{}_t = \beta_{20} + \beta_{2x1}\Delta_{t-1} + \beta_{211}\Delta P^1{}_{t-1} + \beta_{221}\Delta P^2{}_{t-1} + v^2{}_t \quad (10)$$

Where: ΔX_t represent the economic growth variable, $\Delta P^1{}_t$ represent the exchange rate variable and $\Delta P^2{}_t$ represent the exports variable. β Represent the coefficients of the variables, $t-1$ represent the tests for unit root, while $(v^x{}_t, v^1{}_t, v^2{}_t)$ represents the VECM error terms.

3.3.3.1 The Lag Length Selection Criteria

An important preliminary step in model building is the selection of VAR lag order. Estimating the lag length of autoregressive process for a time series is a crucial econometric exercise in most economic studies. This paper will apply some commonly used lag-order selection criteria to choose the lag order, such as Akaike Information Criterion (AIC), Hannan-Quinn (HQ), Schwartz Criterion (SC) and Final Prediction Error (FPE).

Using Akaike Information Criterion to choose lag order:

$$AIC = -2\left(\frac{\log L}{T}\right)\frac{2K}{T}$$

Using Schwartz Criterion to choose lag order:

$$SC = -2\left(\frac{\log L}{T}\right) + \frac{K \log T}{T}$$

Using Hannan-Quinn to choose lag order:

$$HQ = -2\left(\frac{\log L}{T}\right) + 2K$$

3.3.4 Diagnostic Testing

In order to ensure that the results from the econometric models yield true estimates, the researcher performs diagnostic tests. The paper will carry out the Jarque-Bera test to check if the residuals are normally distributed. This is followed by Breauch-Godfrey and Breauch-Pegan-Godfrey tests to check the existence of serial correlation and heteroscedasticity respectively.

3.3.5 The Engle-Granger Causality Test

The concept of Granger causality starts with the premise that the future cannot cause the past. If event *A* occurs after event *B*, then *A* cannot cause *B*. Granger (1969) applied this concept to economic time series to determine whether one-time series "causes" in the sense of precedes another. However, merely because event *A* occurs before *B* does not mean that *A* causes *B*. Therefore, the Granger causality test will also be used to determine if there is causality between the variables as well as which one actually causes or predicts the other. It is stated that, if the probability value is significant at 5%, then the null hypotheses can be rejected.

Model specification:

$$EG_t = \sum_{i=1}^{n} \alpha_i EG_{t-i} + \sum_{j=1}^{n} \beta_j EX_{t-j} + \sum_{k=1}^{n} \beta_k EP_{t-k} + u_t \quad (11)$$

$$EX_t = \sum_{i=1}^{n} \alpha_i EX_{t-i} + \sum_{j=1}^{n} \beta_j EG_{t-j} + \sum_{k=1}^{n} \beta_k EP_{t-k} + u_t \quad (12)$$

$$EP_t = \sum_{i=1}^{n} \alpha_i EP_{t-i} + \sum_{j=1}^{n} \beta_j EX_{t-j} + \sum_{k=1}^{n} \beta_k EG_{t-k} + u_t \quad (13)$$

where: EG_t = Economic Growth

EX_t = Exchange Rate

EP_t = Exports

U_t = Error term

3.3.6 Stability Test

The paper employed the Cusum and Cusum squares for stability tests. The purpose of these tests is to determine whether the model is stable.

3.3.7 The Impulse Response Function

More generally, an impulse response refers to the reaction of any dynamic system in response to some external change. Impulse response function (IRF) of a dynamic system is its output when presented with a brief input signal, called an impulse. The study employed the impulse response function to trace out the response of the current and future values of each of the variables to a one-unit increase in the current value of one of the VAR errors. It shows the effects of an exogenous shock on the whole process over time. The impulse response sequence plots the difference between time series process without a shock and the time series with a shock. The study will first perform the impulse response function using the vector error correction model. To confirm the results, the study will also perform the impulse response function using the VAR model.

A VAR was vector MA (∞) form as:

$$y_t = \mu + \varepsilon_t + \Psi_1 \varepsilon_{t-1} + \Psi_2 \varepsilon_{t-2} + \ldots.$$

Thus, the matrix ψ_s has the interpretation:

$$\frac{\partial y_{t-s}}{\partial \varepsilon'_t} = \Psi_s$$

that is; the row I, column j element of ψ_s identifies the consequences of one unit increase in the jth variable's innovation at date $t(\varepsilon_{jt})$ for the value of the ith variable at time $t + s$ (Y_{it+s}), holding all other innovations at all dates constant. The equation:

$$\frac{\partial Y_{it+s}}{\partial \varepsilon'_{jt}}$$

as a function of S is called the impulse response function. It describes the response of Y_{it+s} to a one-time impulse in Y_{jt} with all other variables dated t or earlier held constant.

4. Emperical Results and Discussions

4.1 Unit Root Tests

The results from ADF and PP tests indicate that the null hypothesis of a unit root process for the series economic growth, exports and exchange rate cannot be rejected because they exhibit the presence of a unit root at level form. However, all the time series data appears to be completely stationery after having been differenced once.

4.2 Johansen Cointegration Test

The Trace test and Maximum Eigenvalue test were carried out to determine cointegration amongst the variables. Tables 2 and 3 present the results from the Trace test and Maximum Eigenvalue test. The trace test indicates that there is no cointegration amongst the variables, meaning there is no relationship between the variables. However, the maximum eigenvalue test indicates that there is one cointegration equation amongst the variables, meaning the variables are related in one way. This implies that the null hypothesis of no cointegration between the variables can be rejected.

Table 1: Summary of Unit Root Tests (ADF and PP Tests)

VARIABLES		ADF		PP	
		Levels	1st Difference	Levels	1st Difference
ECONOMIC GROWTH	Intercept	-3.514532**	-7.477819***	-3.359372	-7.043379***
	Trend & Intercept	-3.868826*	-7.433385***	-3.614204**	-7.408771***
	None	-2.362458**	-7.509819***	-1.386866**	-7.345269***
EXCHANGE RATE	Intercept	-1.198466	-6.178606***	-1.083255	-6.598811***
	Trend & Intercept	-3.570680	-6.132068***	-3.105936**	-6.549254***
	None	-1.612867**	-6.110415***	-2.535619**	-6.034560***
EXPORTS	Intercept	-2.554744	-6.467164***	-2.796617*	-6.581388***
	Trend & Intercept	-2.691829	-6.432577***	-2.905752	-6.545047***
	None	-0.300908	-6.530990***	-0.239910	-6.666418***

* denotes the rejection of the null hypothesis at 10% level of significance
** denotes the rejection of the null hypothesis at 5% level of significance
*** denotes the rejection of the null hypothesis at 1% level of significance

Source: Authors' calculations

Table 2: Summary of the Trace Test

Hypothesized No. of CE (s)	Eigen Value	Trace Statistic	Critical Value @ 5%	Prob.**
None	**0.344260**	**29.28808**	**29.79707**	**0.0571**
At Most 1	0.096958	7.766521	15.49471	0.4907
At Most 2	0.049055	2.565277	3.841466	0.1092

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Authors' calculations

Table 3: Summary of the Maximum Eigen Value Test

Hypothesized No. of CE (s)	Eigen Value	Max-Eigen Statistic	Critical Value @ 5%	Prob.**
None	**0.344260**	**21.52156**	**21.13162**	**0.0441**
At Most 1	0.096958	5.201294	14.26460	0.7163
At Most 2	0.049055	2.565277	3.841466	0.1092

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-Michelis (1999) p-values

Source: Authors' calculations

Table 4: Normalised Cointegrating Equation

Normalised cointegrating coefficient (Standard error in parentheses)		
Economic Growth (EG)	**Export Promotion (EP)**	**Exchange Rate (EX)**
1.000000	-0.236115	0.029050
	(0.13967)	(0.01203)

Source: Authors' calculations

Table 5: Summary of VECM Estimates

Variables	Coefficients	Standard error	t-statistics
D (EG)	-0.148993	0.15045	-0.99031
D (EX)	0.114550	0.03683	-0.66631
D (EP)	0.368024	0.15507	2.37321
CointEq1	-0.522341	0.14527	-3.59556
Constant	0.023223	0.30821	0.07535
R-squared = 0.465126 Adj. R-squared = 0.378053			

Source: Authors' calculations

Economic growth (EG) normalised to unity as the endogenous variable of the regression. With the estimated cointegrated vector, the associated coeffients represent the long-run equilibrium relationship. The cointegrated vector is expressed as follows:

$$EG + EX + EP = 0 \qquad (14)$$

Thus:

$$EG + 0.029050EX - 0.236115EP = 0 \qquad (15)$$

$$EG = - 0.029050EX + 0.236115EP = 0 \qquad (16)$$

Equation 16 postulates the existence of a long-run negative relationship between economic growth and exchange rate. It estimates that a 1% appreciation in the value of the South African Rand can lead to 0.03% decrease the rate of economic growth. In the same logic, a 1% depreciation of the Rand can lead to 0.03% increase in growth rate. It also appears that economic growth is positively related to export promotions. Based on equation 16, it is estimated that a 1% change in exports lead to 0.23% change in economic growth.

4.3 VECM

VECM corrects the long-run disequilibrium through short-run adjustments, leading the system to short-run equilibrium. This paper established VECM considering 1 cointegrating vector derived from Johansen cointegration test, with lags interval of 1 to 2. The estimates of VECM are presented in Table 5 above.

Since VECM is a system of equations, the error term of the Cointegrating equation 1 is negative (-0.522341) and significant. This implies that 52% of disequilibrium is corrected annually. The coefficient of correlation (R-squared of around 47%) of the series reveals that the VECM significantly translate short-term adjustments in all three variables and it explains adjustments in all series according to short-run changes. Based on the overall VECM results, the error correction terms indicate that economic growth, exchange rate and exports substantially adjust to long-run shocks affecting natural equilibrium.

4.4 The Engle-Granger Causality Test

The results of the Engle-Granger causality test are presented in Table 6 on the next page and they indicate that there is no causality amongst all the variables.

4.5 Diagnostic Testing

The diagnostic tests in Table 7 on the following page indicates that residuals are normally distributed.

Table 6: The Engle-Granger Causality Tests

Pairwise Granger Causality Tests Date: 07/06/17 Time: 10:27 Sample: 1962 2015 Lags: 2			
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
EX does not Granger Cause EG	52	2.53356	0.0902
EG does not Granger Cause EX		1.09643	0.3425
EP does not Granger Cause EG	52	0.00160	0.9984
EG does not Granger Cause EP		2.05402	0.1396
EP does not Granger Cause EX	52	2.96164	0.0615
EX does not Granger Cause EP		0.31742	0.7296

Source: Authors' calculations

Table 7: Summary of Diagnostic Testing

TEST	Ho	P-VALUE	CONCLUSION
Jarque-Bera	Risiduals are normally distributed	0.205716	Do not reject Ho since PV is > 5% L.O.S
Breusch-Godfrey	No serial Correlation	0.4054	Do not reject Ho since PV is > 5% L.O.S
Breusch-Pegan-Godfrey	No Heteroskedasticity	0.6309	Do not reject Ho since PV is > 5% L.O.S
PV = Probability Value L.O.S = level of significance > = Greater than < = Less than			

Source: Authors' calculations

This is indicated by the probability value of 0.205716, which is greater than 5% level of significance. The results further indicate that there is no serial correlation and heteroskedasticity. This is indicated by the probability values of 0.4054 and 0.6309 respectively, which is greater than 5% level of significance.

4.6 Stability Test

Figures 1 and 2 on the following page present the results for the Cusum Test and the Cusum squares respectively. Both figures indicate that the model is fairly stable as the cumulative sum moves inside the critical lines. This movement between the lines of significance at 5% level of significance is therefore an indication of stability.

4.7 The Impulse Response Function

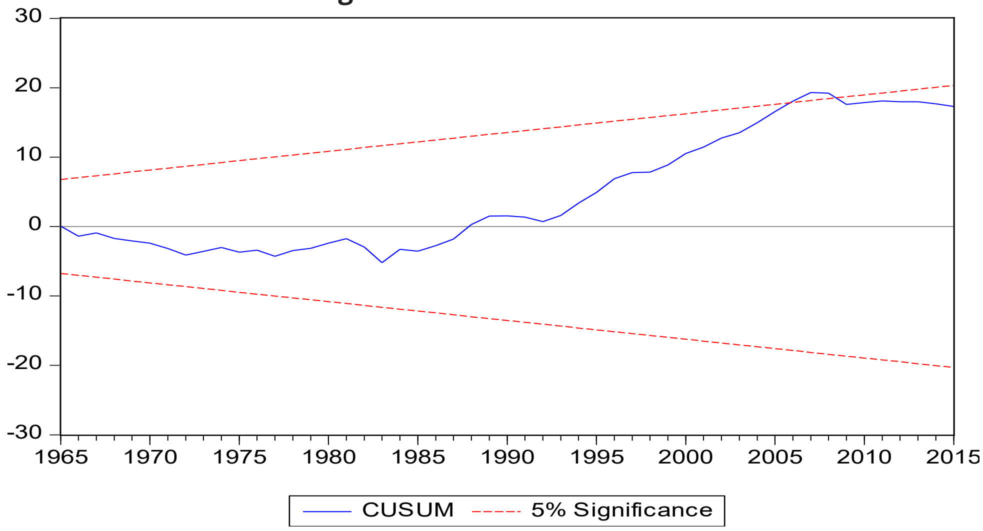
The impulse response function shows how one variable responds over time to a single innovation in itself or another variable. Figure 3 on page 363 presents the results of the impulse response function

Based on Figure 3, economic growth responds positively to a shock on itself from period 1 until period 12. The results further indicate that economic growth responds positively on an increasing rate to a shock on exchange rate from period 1 to 2, decline positively from period 2 to 3 and start increasing positively from period 4 until the end period. Furthermore, it is also indicated that economic growth start by responding positively to a shock on exports from period 1 to 3, and then become negative from period 5 until the end period.

5. Concluding Remarks

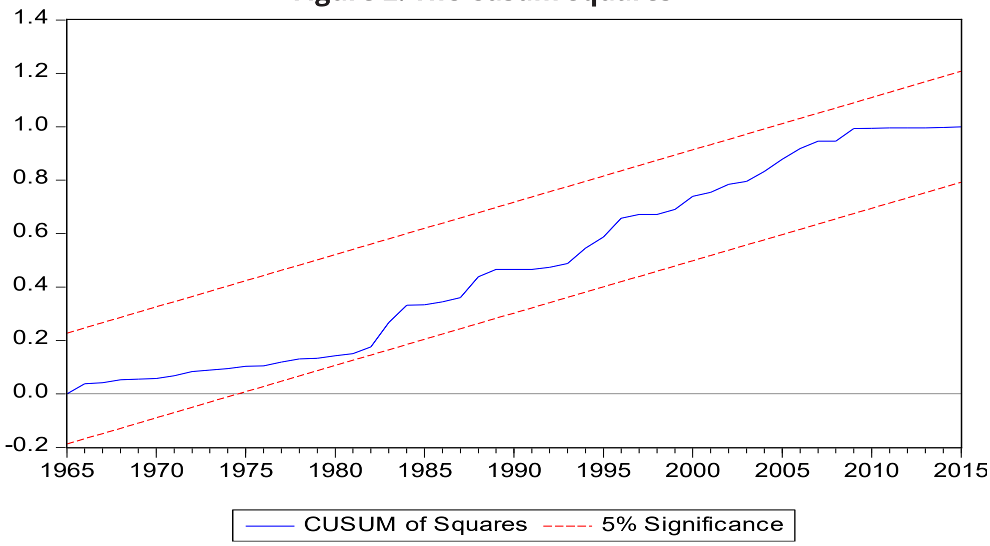
The primary aim of this paper was to determine the impact of exports and exchange rate on economic growth of South Africa. The paper adopted Johansen cointegration procedures to determine

Figure 1: The Cusum Test



Source: Authors' calculations

Figure 2: The Cusum Squares



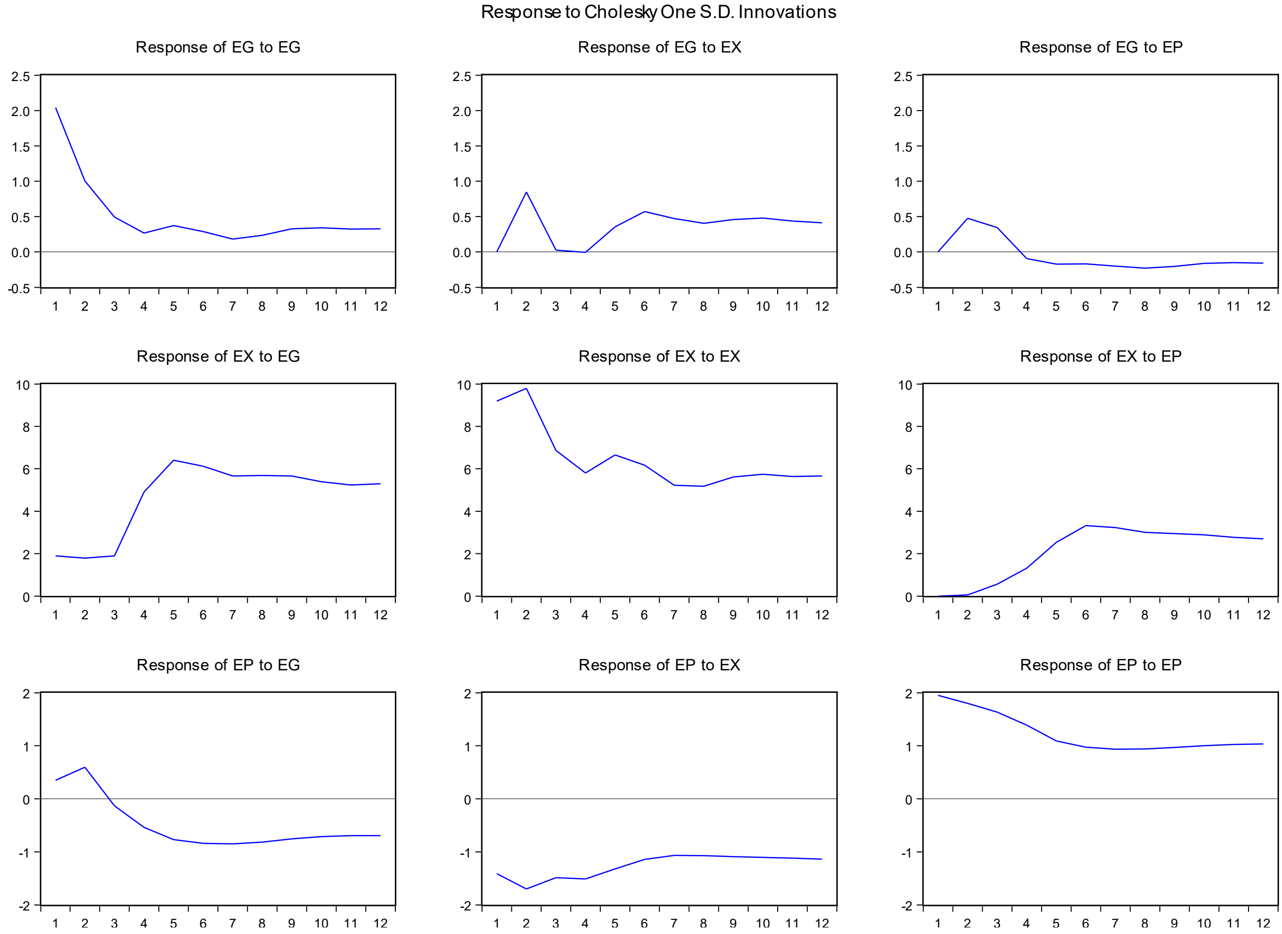
Source: Authors' calculation

the long-run equilibrium relationship between the variables. The results pointed out the existence of 1 cointegrating equation, meaning that the variables were integrated in one way. The nature of the relationship showed that economic growth is positively related to exports. These results are in line with the findings of Ghartey (1993), who used the vector autoregressive (VAR) model for Taiwan, United States and Japan. Heitger (1987) and Lussier (1993) also concluded that exports are a vital determinant of economic growth after using ordinary least square method. Most of the studies reviewed pointed out that exports serves as an important determinant of economic growth. Even though, there are few studies like Colombatto (1990) who rejected the null hypothesis of export-led growth after analysing the sample of 70 countries.

The direction of the relationship further indicates that economic growth is negatively related to exchange rate. These results can be supported by economic theory on the perception that a strong Rand will make domestically produced goods expensive in the international market. The main idea is that if the value of the South African Rand is affordable in the foreign exchange market, more of the domestically produced products will be bought in the international market. This can contribute positively to economic growth.

Theory and empirical literature has proven that exports and exchange rate plays an important role on the level of GDP in the South African economy. It is therefore recommended to policy makers in South Africa to adopt policies that will promote

Figure 3: The Impulse Response Function



Source: Authors' calculations

exports and balanced exchange rate in the country. This can be achieved by implementing policies that are aimed at increasing the level of production in the country.

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