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# An Assessment of the Role of Real Exchange Rate on Economic Growth in South Africa

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**ABSTRACT**

Despite periods of seemingly improved trade and economic growth in Africa, the continent remains lagging behind in trade competitiveness, internationally, as exchange rate variability intensifies. Consequently, the choice of a weak or strong currency is at the centre of the debate in developing economies as exchange rates play a vital role in a country's level of economic growth. The article assessed the impact of real exchange rates on economic growth in South Africa from 1994 first quarter to 2015 fourth quarter. Time-series data was used, in which Augmented Dickey Fuller and Philip Peron tests for stationarity, co-integration test, and Vector Error Correction Model (VECM) approach for the long run relationship were employed. VECM results revealed that real exchange rate has a negative impact on economic growth both in the short and long run in South Africa. The inference of this article, thus, is that currency revaluation (exchange rates appreciation) can be an effective expansionary monetary instrument in improving economic growth. A strong currency is, therefore, good for economic growth in both the short and long run, as a strong currency attracts foreign investments while also resulting in stable prices in international trade and functioning as a good instrument for controlling imported inflation. Based on the findings, that floating exchange rate system adopted in South Africa, in 2000 should be revoked and replaced by a fixed exchange rate system. Additionally, a strong currency is a good instrument for clearing external debts and for companies which are exporting.

***Key phrases***

*Economic growth; exchange rates; currency and South Africa*

## 1. INTRODUCTION

South Africa, although one of the leading exporting countries in Africa for the last two decades, has also been subjected to much negative financial practices in the last five years. As reported by the International Monetary Fund (IMF) (2015:2) despite seemingly increase in trade, in this country, during the last decade, net exports have been performing at a decreasing rate. Politicians in South Africa are blaming the political unrest as a major cause of this trend in net exports (Moghalu 2014:1, Godfrey 2016:5, Cilliers & Aucoin 2016:4). On the other hand, economists across the globe are pointing at the exchange rate regime adopted in 2000 (Free floating exchange rate system) as major cause of this drastic decrease in net exports (Sibanda 2012:35, Saville 2014:1, Moghalu 2014:1, Godfrey 2016:6). These contradicting views have steered an on-going debate on what could be the major cause for the poor international trade in South Africa and how low or high exchange rates can be used to improve trade in South Africa (European Parliamentary Research Services 2016:2).

The lack of substantial evidence to support the use of either a weak or strong currency as a stimulus for competitive trade has made this a highly contentious issue which needs further investigation. The debate on policy implementation to weaken or strengthen currencies under a floating exchange rate regime has been a grim task in the monetary policy fraternity, in South Africa. There is no clear and comprehensive understanding to date, on whether to advocate a weak or strong currency in developing economies. This debate has divided the Monetary Policy fraternity, especially in emerging or transition economies. Dani (2007:1) posits that economists around the globe have long discovered that poorly managed exchange rates can be disastrous for economic growth. Furthermore, Habib, Mileva and Stracca (2016:389) mention that the persistent debate among various economic agencies and politicians on maintaining a weak or strong currency is fast becoming a major concern that needs immediate consensus, as finding an answer would have far-reaching implications on trade as an instrument of economic growth (Habib *et al*. 2016:390). It is, therefore, necessary to assess the role of exchange rate on economic growth in developing economies, such as South Africa. South Africa provides an interesting case study because, even though it is regarded as one of the most developed economies in Africa, the country is plagued with an unstable currency.

An exchange rate, at which one currency can be traded for another, plays an important role in price stability and economic growth (European Central Bank 2016:1). The fact that South Africa adopted a flexible exchange rate regime since 2000 means that the economy is facing complications due to currency movements. A devalued Rand has many unfortunate knock-on consequences for local consumers in South Africa. Inflation targeting using interest rate as the nominal anchor and a flexible exchange rate system adopted in 2000 has rendered monetary policy interventions impractical. As the Rand weakens, the interest rates rise because of inflationary pressure from a weak currency. As a result, small businesses, home owners and indebted citizens suffer. For these reasons, this article assesses the role of real exchange rate on economic growth in South Africa from 1994 to 2015 on a quarterly basis. After a sharp deterioration of the Rand against major currencies such as United States Dollar (USD) particularly from 2011, the Rand hiked to a double-digit rate. This was caused by an on-going myriad of structural and political problems which intensified exchange rate variability. Against this background, this article attempts to increase scientific knowledge on the topic by covering the period from 1994-2015 as the real exchange rate is still oscillating. From 2013 to 2016, the Rand to USD oscillated between R10.853 and R15.41 (Standard Bank 2017:1). This marked the period when the economy was experiencing sluggish economic growth post 1994, especially in the year 2000 during the Asian and the 2008 global financial crisis periods. A consideration of other phenomenon control variables, such as Fixed Capital Formation (FCF), Foreign Direct Investment (FDI) and prime rate in the article is, therefore, pragmatic. The gap and paucity of information in the literature justifies further enquiry on this study.

## 2. LITERATURE REVIEW

Evidence presents different conclusions with respect to the role exchange rate plays on economic growth. Mtenga (2015:138) reveals that the most popular argument, in favour of exchange rate devaluations, is the increase in exported goods and services, mostly under fixed exchange rate system. The logic behind the exchange rate devaluation is that it makes domestic manufactured goods and services relatively cheap compared to foreign manufactured goods, leading to an increased demand for domestic goods (Galebotswe & Andrias 2009:88). The increased demand for domestic goods and services triggers increases in production, which ultimately boosts exports hence increasing real gross domestic product (GDP) in the short run. The traditional explanation by Yiheyis (2006:33) is that exchange rate depreciation increases real exports volumes and reduces the import volumes, consequently providing expansionary effects on aggregate output in the economy, from the demand side. Contrary, however, to exchange rate depreciation and its advantages, Sibanda (2012:87) posits that exchange rate depreciation has a sluggish effect on economic growth and leads to inflationary economic environment, in the long run. As such, exchange rate devaluation (depreciation) tends to raise the price of locally manufactured goods and services, thus invokes imported inflation (Mukher 2014:2). If prices for exports and imports are inelastic, exchange rate devaluation might negatively affect international terms of trade through creating an inflationary pressure on local prices (Galebotswe & Andrias 2009:89). Exchange rate revaluation is, thus, a favourable monetary policy instrument if prices are inelastic since the country receives more in real exports and pays less for each unit imported. At the same time, inflation is likely to increase from a devalued currency because imports will become more expensive causing cost-push inflation from capital importing industries (Pettinger 2014:1). On the other hand, exports become cheaper, hence demand-pull inflation from the international markets is likely to be the aftermath. Consequently, pass through effects, from exchange rate devaluation, is likely to be the case in most developing economies (Acar 2000:36).

There are contradicting empirical evidence on the role of exchange rate on economic growth in developing economies. For instance, Polodoo (2010:2) and Habib *et al*. (2016:391) reveal that exchange rate appreciation (weak or strong currency) results in an increase in the level of economic growth. On the contrary, Masunda (2011:10) and Bottechia, Gomes, Holland and Vieira (2013:2) argue that there is a negative link between exchange rate movements and economic growth. Authors such as Chipote and Makhetha-Kosi (2014:78) also reveal that real exchange rates do not affect economic growth. This shows that there is no consensus on the role of exchange rates on economic growth; this justifies the need for an intensive investigation, particularly for emerging economies whose growth are hindered by exchange rate variations.

## 3. METHODOLOGY

This investigation will apply the co-integration and vector error correction modelling (VECM) of Johansen (1990) as cited by (Kazanas 2015:2). The maximum likelihood estimation was applied to a vector error correction (VEC) model to simultaneously determine the short run and long run causal effect of the dependent variable in a model. Firstly, time series data were integrated so that they are of the same order as is advised by Gujarati and Porter (2010:12) after who's unit root tests were used to examine stationarity of data sets. The Augmented Dickey-Fuller (Dickey-Fuller 1997:428) and Philips-Peron (1990:155) unit root test were used to test for the unit root properties of the time series data. Secondly, diagnostic tests such as heteroscedasticity, residual normality test autocorrelation tests and Ramsey test were performed to validate the parameter estimation outcomes achieved by the estimated model. The data used were quarterly data covering the period 1994-2015 that were sourced from South African Reserve Bank (2013:1), South African Department of Statistics (2016:1), World Bank (2016:3) and Trading Economics (2014:4).

# 4. MODEL SPECIFICATION

To assess the role of exchange rate on economic growth in South Africa, the growth model developed by Chipote and Makhetha-Kosi (2014) was used which specifies that the endogenous variable (Growth Rate) is a function of Real Exchange Rate (RER), Foreign Direct Investment (FDI), Fixed Capital Formation (FCF), Interest Rates (INT) and Money Supply (MS) as follows:

$$y = f(RER, MS, FDI, FCF, INT) \quad \ldots\ldots\ldots 1$$

Where; Y: real GDP; RER: Real Exchange Rates; MS: Broad Money Supply, FDI: Foreign Direct Investments; FCF: Fixed Capital Formation; INT: Prime Lending Rate.

The dependent variable was the Economic Growth (y) that was explained by the movements in other variables which are Real Interest Rate (INT), Fixed Capital Formation (FCF), Broad Money Supply (Ms), INT (Prime Interest Rate) and the main explanatory variable which is Real Exchange Rates (RER). The econometric form of equation 1, above was then stated as follows:

$$y = \beta_0 + \beta_1 RER + \beta_2 FDI + \beta_3 FCF + \beta_4 INT + \beta_5 Ms + \varepsilon \quad \ldots\ldots\ldots 2$$

Where:

$\beta_0$: the intercept and $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$: the coefficients of the explanatory variables
$\varepsilon$ denotes the error term which represents omitted variables in the specified model.

To obtain elasticity coefficients and remove the effects of outliers, the variables of the article were transformed into logarithms.

$$Ln\, y = \beta_0 + \beta_1 \ln RER + \beta_2 Ln FDI + \beta_3 \ln FCF + \beta_4 \ln INT + \beta_5 \ln Ms + \varepsilon \quad \ldots\ldots\ldots 3$$

# *5.* PRESENTATION AND ANALYSIS OF RESULTS

## 5.1 Descriptive statistics of the variables

The goodness of fit of the model as well as the descriptive statistics results to summarize features of the investigated results are presented in Table 1. The results indicate that the mean and median values each of the variables Y_GROWTH, FCF, INT and RER_EXCHANGE are approximately equal. For example, the Y_GROWTH RATE has a mean 3.04 median of 3.25.

Similarly, RER exchange has a mean of 7.08 and a median of 7.08, and INT has 13.7 mean and a 13.2 median. This implies that the time series matched a normal distribution. For Jarque-Bera, the J-B probability results show that the J-B statistic is greater (absolute term) than the observed value under the null hypothesis of a normal distribution. A small J-B probability value (less than 0.05) leads to the rejection of the null hypothesis of a normal distribution.

**Table 1: Descriptive statistics**

| | Y_GROWTH | FCF | FDI | INT | M3 | RER_EXC |
|---|---|---|---|---|---|---|
| Mean | 3.047619 | 0.168718 | 0.054563 | 13.6667 | 0.451623 | 7.08943 |
| Median | 3.25 | 0.164243 | 0.047773 | 13.25 | 0.384564 | 7.0844 |
| Maximum | 7.1 | 0.228735 | 0.133415 | 25.5 | 0.897716 | 11.5467 |
| Minimum | -2.6 | 0.001432 | 0.00041 | 1.5 | 0.002771 | 3.4535 |
| Std.Dev | 1.797151 | 0.037622 | 0.040042 | 4.343728 | 0.26017 | 2.091731 |
| Skewness | -0.612578 | -1.665684 | 0.363356 | 0.274227 | 0.226142 | 0.181656 |
| Kurtosis | 3.713797 | 8.789129 | 1.956515 | 2.825054 | 1.627399 | 2.557964 |
| Jarque-Bera | (7.036802) | (156.1421) | (5.659401) | (1.159923) | (7.31008) | (7.036802) |
| Probability | 0.209647 | 0.00000 | 0.059031 | 0.04992 | 0.02586 | 0.029647 |
| | | | | | | |

Source: Results compiled by Author from Eviews output. (Jarque-Bera Probability statistics are in parenthesis.

Table 1 shows the results of all variables under consideration and the Y growth and FCF are negatively skewed while INT, FDI, M3, and RER, the exchange is positively skewed. With the exception of FCF, INT and M3, the Y_growth and FCF are normally distributed. In order to check if variables are correlated, the research used the Pairwise Correlation test which is a standard practice for pairwise comparisons with correlated observations.

## 5.2 Unit root/stationarity test results

Gujarati (2004) mentions that a spurious regression is likely to occur when time series data is estimated with non-stationary variables. Therefore, it is important to make use of informal graphical presentation and formal ADF and PP tests of which the Unit root test results are presented in Table 2. Table 2 shows the results for Augmented Dickey-Fuller (ADF) test and Philip-Perron (PP) respectively. PP tests are not- parametric, unlike ADF which selects the level of serial correlation. A PP test, therefore serves as a confirmatory test to ADF to show whether results obtained in ADF are indeed correct. The ADF and Phillip-Perron tests tested for stationarity and both tests revealed that the data series were non-stationary in levels and became stationary when first differenced; therefore, the series are integrated of the same order (1).

**Table 2: Unit Root Test: Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP)**

| Order of integration | Variables | Augmented Dickey-Fuller (ADF) | | | Phillips-Perron Results (PP) | | |
|---|---|---|---|---|---|---|---|
| | | Intercept | Trend and intercept | None | intercept | Trend and intercept | One |
| **LEVEL** | L FCF | 2.8358 | 3.0690 | 0.1132 | 2.0290 | 3.2214 | 0.6125 |
| **1ST DIF** | D FCF | 6.5185*** | 6.4754*** | 6.556 *** | 11.064*** | 11.901*** | 10.210*** |
| **LEVEL** | L RER_exc | 1.8746 | 2.4251 | 1.0614 | 1.5920 | 2.1052 | 1.3101 |
| **1ST DIF** | D RER_exc | 3.631*** | 3.627*** | 3.362*** | 8.142*** | 8.096*** | 7.977*** |
| **LEVEL** | LM3 | 1.544 | 3.085 | 0.539 | 2.333 | 2.010 | 0.138 |
| **1ST DIF** | DM3 | 6.452*** | 6.407*** | 6.385*** | 10.142*** | 10.976*** | 9.041*** |
| **LEVEL** | LINT | 2.169 | 3.326 | 0.629 | 2.814 | 3.010 | 0.610 |
| **1ST DIF** | DINT | 7.567*** | 7.520*** | 7.595*** | 12.348*** | 12.231*** | 11.414*** |
| **LEVEL** | LFDI | 1.371 | 4.550 | 0.051 | 3.039 | 3.069 | 1.287 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1ST DIF** | DFDI | 7.104*** | 7.070*** | 6.861*** | 18.958*** | 18.830*** | 18.634*** |
| **LEVEL** | LY_GROWTH | 2.694 | 2.721 | 1.312 | 2.967 | 3.043 | 1.443 |
| **1st DIF** | LY_GROWTH | 4.952*** | 4.954*** | 4.990*** | 8.302*** | 8.245*** | 8.350*** |
| **1%** | Critical values | 3.512 | 4.074 | 2.593 | 3.512 | 4.074 | 2.593 |
| **5%** | | 2.897 | 3.466 | 1.945 | 2.897 | 3.466 | 1.945 |
| **10%** | | 2.586 | 3.159 | 1.614 | 2.586 | 3.159 | 1.614 |
| ***** represent stationary variables at 1% significance level, ** represent stationary at 5%.** | | | | | | | |

Source: Eviews 9.5. ADF and PP tests, Output by Robert Hall (2016)

If variables become stationary after first differencing it implies that all variables are integrated of the same order (1) (Granger & Newbold 1974:115). Once variables are integrated of the same order, the use of co-integration analysis is justified and the Johansen Approach was used in this research as is presented below.

## 5.3 Tests for co-integration (Johansen Approach)

After establishing that all variables were stationary and integrated of the same order, the next procedure performed was co-integration tests to determine whether there exists a long-run relationship amongst the variables. As suggested by Asteriou and Hall (2007:37), it was found to be of vital to determine whether there exists a long-run equilibrium relationship amongst the variables, if the variables are integrated of the same order. If there exists a stationary linear combination of non-stationary random variables, all the variables combined are said to be co-integrated (Khondker, Bidisha & Razzaque 2012:77). Thus, the Johansen co-integration was used to examine the long-run relationship between the dependent variable (economic growth) and control variables (money supply, interest rates, real exchange rate, fixed capital formation and foreign direct investment). To test for the existence of long-run co-integrating relationships among the variables in the model as recommended by Gujarati (2004:25), the Johansen approach was applied using the estimation of a Vector Auto-Regressive (VAR) equation; thus, the first step was to test for the appropriate lag length in a VAR.

A Lag Order selection criterion was used, and the results are presented in Table 3. It is a condition for the use of the Johansen technique to indicate the lag order and the deterministic trend assumptions of the VAR. To choose the lag order for the Johansen technique, the Akaike Information Criterion (AIC) was applied. AIC measures the robustness of the statistical model as was also recommended by Asteriou and Hall (2007:39). The AIC, thus, was used for model specification as it offers a relative estimate of the information lost when a given model is used to represent the process that creates the data. The model was also helped with the trade-off between the goodness of fit of the model and the intricacy of the model. Table 3 presents the lag lengths selected by different information criteria.

**Table 3: Lag Order Selection Criteria**

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| 0 | -335.910944 | NA | 0.000152 | 8.238818 | 8.413674 | 8.309065 |
| 1 | -56.461855 | 511.7622 | 4.33e-07 | 2.372575 | 3.596566* | 2.864306* |
| 2 | -16.919228 | 66.69841 | 4.03e-07 | 2.287210 | 4.560338 | 3.200426 |
| 3 | 23.525211 | 62.37215 | 3.75e-07 | 2.180115 | 5.502378 | 3.514815 |
| 4 | 57.689388 | 47.74753 | 4.18e-07 | 2.224352 | 6.595751 | 3.980535 |
| 5 | 122.561356 | 81.28536* | 2.33e-07* | 1.528642* | 6.949176 | 3.706309 |

Source: Eviews 9.5. VAR Lag Order Selection Criteria. Output by Hall (2016:1)

* indicates lag order selected by the criterion

LR: sequentially modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

In line with Hall (2016:1) output suggestions, the lower the Akaike Information Criterion (AIC), the better the model, so the results for lag order selection presented in Table 3 confirmed that the criteria selected 5 lags. From Table 3, 1.528642 under lag 5 is the lowest AIC. For that reason, 5 lags for VAR were chosen and used in the Johansen co-integration test. Having identified the number of lags to use, the Johannsen co-integration test was carried out and the results are presented in Table 4.

**Table 4: Co-Integration Rank Test (Trace results and Maximum-Eigen results**

| Hypothesized No. of CE(s) | 6. Trace results | | | | 7. Maximum-Eigen results | | | |
|---|---|---|---|---|---|---|---|---|
| | Eigen Value | Trace Statistic | 0.05 Critical Value | Prob.** | Eigen value | Max-Eigen Statistic | 0.05 Critical Value | Prob.** |
| None * | 0.4355 | 109.1645 | 95.7537 | 0.0043 | 0.4355 | 45.7511 | 40.0776 | 0.0104 |
| At most 1 | 0.2640 | 24.5209 | 33.876 | 0.1458 | 0.2639 | 24.5210 | 33.8770 | 0.4181 |
| At most 2 | 0.2400 | 38.8921 | 47.8921 | 0.2646 | 0.2400 | 21.9557 | 27.5843 | 0.2226 |
| At most 3 | 0.1420 | 16.9355 | 29.7971 | 0.6448 | 0.1498 | 12.2533 | 21.1316 | 0.5229 |
| At most 4 | 0.0555 | 4.6821 | 15.4947 | 0.8416 | 0.0554 | 4.5664 | 14.2646 | 0.7953 |
| At most 5 | 0.0015 | 0.1157 | 3.8415 | 0.7337 | 0.0014 | 0.1157 | 3.84145 | 0.7337 |

Source: Eviews 9.5. Results compiled by Author from Eviews output.

Trace test indicates 1 co-integrating Eqn(s) at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

**Mackinnon-Haug-Michelis (1999) p-values

Table 4 shows the results for Johansen Approach for co-integration for both Trace test and Max-Eigen test. The rule of thumb states that, if the test statistic is greater than the critical value at 5%, the null hypothesis which claims that there is no co-integration equation is rejected. Trace test results presented in Table 4 reflect that at least one co-integrating equation exists at 5% level of significance. The trace statistic value at none* is greater than critical value at 5% significance level (109.1645 > 95.7537) and p-value (0.0043) is less than 5% level of significance. Therefore, the null hypothesis which claims that there is no co-integrating equation is rejected. Using a similar rule of thumb, at most 1 co-integrating vector exists since the trace statistic value at most 1 is less than the critical value (24.5209 < 33.876) and the p-value (0.1458) is greater than 5 % level of significance. For that reason, the Trace statistic specified 1 co-integrating relationship at 5% significance level.

The Max-Eigen test in Table 5 also rejected the null hypothesis at none* which indicates that there was no co-integrating vector. The null hypothesis at most 1 co-integration vector is not rejected as the Max-Eigen statistic value (40.0776) is less than the critical value (45.7511) and the probability value is greater than 5%, therefore, it can be concluded that there is one significant long run relationship between the given variables (using the trace test). Since variables can either have short or long run effects, Error correction model (ECM) and vector error correction model (VECM) were used to disaggregate these effects. The co-integration vector represents the deviations of the endogenous variable from its long-run equilibrium level. The Co-integration vector results show that over the period 1994: Q1 to 2015: Q4, the deviations of economic growth from equilibrium were stationary and this is critical in its use as an error correction model.

## 5.4 Error correction model (ECM)

### Table 5: Error Correction Model results

| Variable | Coefficient | Standard error | t-statistic | Probe |
|---|---|---|---|---|
| LNRER_EXCHANGE | -4.017227 | 0.762598 | -5.267808 | 0.0000 |
| LNINT | -0.387820 | 0.405869 | -0.955529 | 0.3422 |
| LNM3 | -0.405327 | 0.397235 | -1.020369 | 0.3106 |
| LNFDI | 1.046545 | 0.322106 | 3.249066 | 0.0017 |
| LNFCF | -0.888499 | 0.472679 | -1.879710 | 0.0638 |

| | | | |
|---|---|---|---|
| RESID01(-1) | 0.794793 | 0.071508 | 11.114693 0.0000 |
| | | | |
| | R-squared 0.87375; F-statistic 29.3163; DW stat 1.68814 | | |

Source: Results compiled by Author from Eviews output.

The results in Table 5 show that at least two variables (LNRER-EXCHANGE and LNFDI) are statistically significant since their probabilities are less than 5%. The coefficient RESID01 (-1) of 0.79 which measures the speed of adjustment shows approximately 79 percent of the imbalance is corrected in the first quarter as the condition in the economy resorts back to its equilibrium. This indicates strong pressure on economic growth in re-establishing long run equilibrium every time there is a shock in the economy.

Furthermore, the results in Table 5 show that there is negative relationship between real exchange rates and economic growth. The results imply that 1 % increase in real exchange rates (which is a depreciation of the South African Rand) decreases economic growth by approximately 4.017%. Exchange rate depreciation may be a quick fix in the short run, but not sustainable in the long run as it might cause imported inflation.

Foreign direct investment in the short-run has a positive impact on growth as a 1% increase in FDI increases growth by approximately 1.047%. An increase in the foreign direct investment in the short run increases capital injections and production in the country and GDP increases. In the long run, the case cannot be different as more and more capital injections lead to more production, hence, the economy develops and grows. Real exchange rates and foreign direct investment are statistically significant in explaining economic growth in South Africa in the short-run since their respective absolute t-values are above two. The other variables FCF, INT, and M3 are statistically insignificant since the t-values are less than 2.

### 5.5 Vector error correction model (VECM)

Vector autoregression (VAR) described by Gujarati and Porter (2010:44) was used to characterize the joint dynamic behaviour of recollection of variables without requiring strong restrictions to identify underlying structural parameters. Vector Error Correction Model was used to check for long-run dynamics between the variables in question. The confirmation to use VECM led to the distinction between the long and short-run impacts of variables which were then used to determine the level and the direction of influence that real exchange rates have on economic growth. The VECM results are shown in Table 6. The variables being co-integrated at the same order, suggested a long-run relationship among the variables under consideration. The long-run relationship between economic growth and control variables for one co-integration vector for South Africa in the period 1994: Q1 – 2015: Q4 is estimated next:

Y_GROWTH RATE = - 9.098092- 4.647566 RER_EXCHANGE - 6.144545 M3 + 3.160810 INT + 11.37790 FCF + 0.064924 FDI ……………………………………….4

### Table 6: Long Run Co-integration results

| Variable | Coefficient | Standard error | t-statistic |
|---|---|---|---|
| Constant | 9.098092 | . | . |
| Y_GROWTH RATE | 1.000000 | . | . |
| LNRER_EXCHANGE | 4.647566 | 2.14489 | 2.16681 |
| LNM3 | 6.144545 | 1.22233 | 5.02691 |
| LNINT | -3.160810 | 1.54691 | -2.04331 |
| LNFCF | -11.37790 | 1.94268 | -5.85682 |

Source: Results compiled by Author from Eviews output.

Equation 4 was formulated using the variables in VAR results as presented in Table 6. After reversing the signs for VAR results to formulate equation 4, RER_EXCHANGE negatively impacted economic growth. A unit increase in RER_EXCHANGE which is a depreciation of the ZAR against the USD decreases economic growth by 4.6. The long-run relationship with exchange rate differs with the short-run relationship since in the short-run, exchange rate depreciation boosts exports, hence total output. In the long-run, exchange rate depreciation is inflationary, thus exerting contractionary effects on economic growth; therefore, exchange rate depreciation in South Africa has expansionary effects on economic growth in the short-run and contractionary effects, in the long-run.

The results showed that money supply has a negative long-run relationship with economic growth. A unit increase in money supply decreases economic growth by approximately 6.1 in the long-run. Increasing money supply, in the long-run, stimulates demand to pull inflation and inflation discourages investments. The decrease in investments has a contractionary effect on economic growth. INT was also found to be positively related to economic growth in this report. A unit increase in INT increases economic growth by 3.1. High interest rates on savings encourage more investments on liquid assets which in turn induce more capital. The higher rate of return on investment in an economy increases capital formation.

## 5.6 Diagnostic Checks

Diagnostic tests were conducted to confirm the validity of the parameter estimates obtained in the economic growth model. To test the fitness of the growth model, several tests, including normality, serial correlation, autoregressive conditional heteroscedasticity, and stability were performed on the model. If there is, any problem in the residuals from the estimated model, it makes the model inefficient and the estimated parameters will be biased; for this reason, the VAR model was subjected to diagnostic checks. Table 7 presents the diagnostic test results, which assisted in checking for normality, serial correlation, and heteroscedasticity. All diagnostic checks were established on the null hypothesis that there was no serial correlation for the LM test; there was no heteroscedasticity for the White heteroscedasticity test and there was normality for the Jarque-Bera test.

**Table 7: Diagnostic check results**

| Test | Null hypothesis | t-statistic | Probability |
|---|---|---|---|
| Lagrange Multiplier (LM) | No Serial correlation | 6.590109 | 0.100801 |
| White (Ch-sq.) | No conditional heteroscedasticity | 0.799664 | 0.553310 |
| Jarque-Bera (JB) | There is a normal distribution | 7.451251 | 0.240980 |

Source: Results compiled by Author from Eviews output.

The test for serial correlation produced LM statistic of 6.590109 with a probability of 0.1008. Jarque-Bera t-statistic 7.451251 and the probability is 0.240980 for the Histogram and Normality Test. The result showed that the Jarque-Bera test statistic is 7.4512511 which means that the t-statistic is insignificant as it was above 5 percent significance level and its corresponding probability was greater than 5 percent. As such the null hypothesis of a normal distribution was not rejected. Heteroscedasticity test gave F-statistic of 0.799664 and the probability of 0.5533 and this meant that the null hypothesis of no heteroskedasticity was not rejected hence the alternative hypothesis of the presence of heteroscedasticity was rejected. Therefore, it has been proven that the residuals are homoscedastic. The diagnostic test results which checked for serial correlation and heteroscedasticity showed that the data is behaving well. The results indicated the presence of non-normal residuals hence; the model is suitable for forecasting.

## 6. CONCLUSION

Unit root test was conducted in the first section in which the Dickey-Fuller test was used as the main test and Philips-Peron tests, for confirmation were used to test for stationary. Both methods revealed that the data series under consideration contain a unit root in levels and become stationary after first differencing. The Pairwise correlation matrix and the lag order selection criteria were also presented in this article and the results indicated that a maximum of 5 lags were used to permit adjustments in the model and realize well-performing residuals. The results show that both the Trace and Maximum Eigenvalue tests rejected at most non-co-integration equation, in favour of at least one co-integration vector and the results were significant at 5 percent level. Also, these results prove that there is a long-run relationship in the variables since the variables are tied together in a single way, in the long-run. The ECM and VECM model were presented in the third and fourth section since the variables can have either short-run or long-run effects. In the short-run, exchange rates showed a negative relationship with economic growth whilst foreign-direct investment showed a positive relationship on economic growth. Additionally, the VECM results show that all the variables had a statistically significant effect on economic growth in South Africa except FCF. The results exhibited that, RER_EXCHANGE and M3 have a positive long-run effect on economic growth, and on the other hand FDI and INT have a have a negative long-run effect on economic growth. In the last section of this research, diagnostic tests were carried out. Three residual diagnostics tests were carried out; all of them revealed the appropriateness of the model. Considering these results, the following policy recommendations are suggested, and limitations, inherent in the research are outlined.

## 7. POLICY RECOMMENDATIONS

The main objective of the investigation was to assess the role of real exchange rate on economic growth in South Africa during the period of 1994 -2015. The hypothesis of this article was that real exchange rates are not statistically significant in affecting economic growth in South Africa. Given the regression results, the null hypothesis was rejected as the results revealed that real exchange rate, statistically plays a role in economic growth both in the short-run and long-run. The report presents policy implications and recommendations in accordance with the findings of the research. From these empirical results, several policy recommendations can be derived. Exchange rates, as a medium of exchange in international trade have been regarded as a significant instrument for boosting trade. Exchange rate devaluation exerts expansionary effects on economic growth both in the short and long-run. As such, if money supply exceeds its demand, prices are forced to go down, hence, the Rand depreciates.

A weak currency, as suggested in the literature, is a good instrument for boosting exports. Nonetheless, contractionary monetary policy should be used in the long run, since excess money in the economy boosts demand which in turn leads to demand-pull inflation. Thus, a strong currency is a good instrument to control inflation and the correction of the balance of payment disequilibrium in the long run. This shows that the real exchange rate plays an important role in economic growth in South Africa and therefore, more considerations should be made with regards to foreign exchange rate support. In addition, factors such as political unrest, export-led economy, good monetary and fiscal policies reforms and industrialised economy influence how strong or weak a currency can be in an economy. For instance, countries such as USA, Britain and China which are considered industrialised and have good monetary and fiscal policies reforms managed to maintain a strong currency at a global level. Thus, South Africa can be able to influence its currency through strong monetary and fiscal policies reforms. Ultimately, international trade policies should be structured in a way to boost exports in order for the economy to become an export-led economy. As such, considering the aforementioned substantial recommendations, it is pragmatic to suggest that the findings in this paper can be used for policy formulation and economic institutions for policy measures.

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