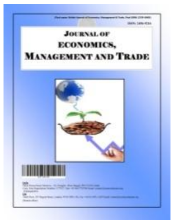

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Analysing the Exchange Rate Volatility Relative to Trade Balance: The Case of SACU Countries

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Authors' contributions

This work was carried out in collaboration between both authors. Author CMH designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author JMN managed the analyses of the study. Both authors read and approved the final manuscript.

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ABSTRACT

The term exchange rate volatility is widely used in the financial market. The exchange rate is determined in the foreign exchange market, which is said to be the largest market in the world and it trades in financial assets. The main focus of this study is to analyse the nature of the relationship between exchange rate and trade balance in the selected member states of the SACU region in which the selected countries are Botswana, Namibia, Swaziland and South Africa. This study uses time series data from the period of 1986 to 2016. The Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model, the impulse response functions and variance decompositions are used in the analysis. Results show that there is a short-run relationship between exchange rate volatility and trade balance. It was found that there is a positive and negative impact between these two variables, with high volatility. Furthermore, this study recommends all Central Banks in the SACU region to intervene in order to mitigate exchange rate volatility.

Keywords: Exchange rate volatility; trade balance; SACU; GARCH.

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1. INTRODUCTION

Exchange rate is a term that is widely used in finance. Ever since the Bretton Woods came to an end in the early 1970's, the relationship between the exchange rate volatility and trade balance, including other macroeconomic variables stirred up a lot of attention to many researchers. Volatility takes place when price movements randomly occur naturally in every market. Statistically it is measured as the sample standard deviation [1]. Volatility found in exchange rate may be caused by changes in money supply, income, interest rates and other market fundamentals.

Many studies state that volatility is very important for making decisions in finance which are based on fluctuations on return. Having a clear understanding on volatility will be a good advantage in asset pricing, managing risk as well as calculating the Value-at-Risk and portfolio allocation. Some of these policy makers want a rapid increase in their exports in hopes of improving their trade and current account balances [2]. It is also important to note that exchange rate volatility is important in determining monetary policy because they have an effect on domestic goods and domestic prices.

Mathematical models can calculate estimates that are of value to financial institutions of their market trend in the future. However, Ladokhin [3] gives an example of how financial volatility exhibits features of clustering and autocorrelation, in which values in the future depend on values of the past.

From the time the Bretton Woods system that ended in 1973, exchange rate volatility has been increasing substantially. Trade balance can be affected by volatility and misalignments. Ramautarsing [4] believes that more attention should be on the real exchange rate than the nominal exchange rate because the real exchange rate is the one that drives international competitiveness. Nainda [5], in reporting a study by Aron et el. (1997) mentions to say that real exchange rate and its stability shows itself as an influence on many important variables such as exports and private investment.

A flexible exchange rate regime has lower exchange rate volatility than a pegged exchange rate regime. A currency that is pegged can still expose a country to fluctuations and cannot eliminate overall exchange rate volatility. A misalignment in the currency that is pegged may cause large discrete changes in the value of the currency.

David, Dikko and Gulumbe [6] recognizes a paper by Engle (1982) as being the first notable study done on volatility modelling of financial time series, which developed an Autoregressive Conditional Heteroscedasticity (ARCH) model to capture significant correlations between observations that are largely apart and time variant. As researchers continued to make use of the ARCH and GARCH models, it became easy for them to simultaneously account for the most prominent features of exchange rate volatility. The three features are that exchange rate volatility is autocorrelated, it displays periodic patterns, and it changes in prices.

Volatility is measured using standard deviation, the historical volatility and the implied volatility. The Historical volatility method is used when volatility is obtained from a series of exchange rate in the past over a given time period [7]. With this type of measure the standard deviation in the changes of every day prices can be calculated and lengthened to annual volatility. The Implied volatility method is used when looking at future estimates.

Abdalla [8] posits out that financial time series such as stock returns, exchange rates and other financial series which are crucial for correct model specification, estimation and forecasting exhibit stylized patterns. The most common stylized facts is the fat tail distribution, volatility clustering and persistence, inter-temporal relations, the leverage effect, regular events, mean reversion, transmission mechanisms, and autocorrelation in absolute and squared returns.

Even though literature on the relationship between exchange rate volatility and trade balance is growing, empirical evidence seems to vary in all parts of the world, be it developing countries or developed countries. However, Musonda [9] contends that a lot of empirical evidence shows that an increase in exchange rate volatility may lead to a decrease in trade balance.

There are different types of models that have been used to model and forecast volatility. The most common models used are naive models, regression-based type models, and the option-based forecasts. Theories on exchange rate and trade balance have been analysed through two different phenomena [2]. The first one is the J-curve effect. This phenomenon states that when a domestic country's exchange rate increases or experiences depreciation, the price of exports in terms of foreign currency will decrease. This will cause the quantity demanded of the domestic country's exports to increase. Imports from foreign countries will become more expensive causing their quantity demanded to decrease. This suggests that output and real income in the economy will expand. This is because there will be an increase in expenditure on domestic outputs.

By implication, an increase in exchange rate is supposed to reduce trade deficit in a country and hence, restore equilibrium in trade balance. However, this all depends on the price elasticity of exports and imports of the country. Trade balance will still have a deficit in the short run, for at least up to 6 months. Thereafter, trade balance will begin to improve in the long run and will begin to have a surplus. This phenomenon is called a J-curve because the net trade balance is plotted on the vertical axis while time is plotted on the horizontal axis. When trade balance responds to an increase in exchange rate, the graph looks like a curve of the letter J.

The second phenomenon is the Marshall-Lerner condition. Huchet-Bourdon and Korinek [2] mention to say that this condition gives an explanation to why trade balance does not improve when the value of a nation's currency reduces. The Marshall-Lerner condition states that, for a depreciation in exchange rate to have a positive impact on trade balance, the sum of the price elasticity of exports and price elasticity of imports should be greater than one in absolute terms. Just like the J-curve effect, an increase in the exchange rate will cause the price of exports to reduce. This means that imports will become expensive and their quantity demand will reduce.

The Dornbusch overshooting model (exchange rate overshooting hypothesis) argues that the interaction between monetary shocks and sticky prices drives the high levels of volatility in exchange rate. In the short-run, the level of foreign exchange rate rises at a very high level when there are changes in monetary shocks. Therefore, the equilibrium level will be reached in a short period of time when prices in the financial market change. As prices of goods respond to the change in prices in the financial market, their reaction will be neutralized by the exchange rate volatility causing a long-term equilibrium effect.

A trade deficit is said to be good for an economy or bad for an economy. The same belief is true for a trade surplus. However, Suranovic [10] makes emphasis on the fact that trade deficits should not be viewed with any interest because they are too small to warrant any positive or negative interpretation.

The exchange rate is known to have negative effects in the domestic markets and causes high risks to many exporters. These effects are reflected in the economy through the direction of the balance of payment. When exports are less than imports there will be an imbalance favouring a deficit. This has a bearing on economic growth and related particularities. For instance, any shock that targets the export sector will impact on both employment and foreign exchange earnings. Thus, it is important to investigate the impact of exchange rate volatility on trade balance [11]. The objectives of this study are: to analyse the kind of relationship between exchange rate volatility and trade balance in selected SACU countries and also to determine the impact of exchange rate volatility on trade balance across SACU countries.

Different approaches in many countries have been used to analyse the relationship between exchange rate volatility and trade balance such as the Vector Error Correction Model (VECM), Error Correction Model (ECM), and the Generalised Autoregressive Conditional Heteroscedastic (GARCH) model. With these approaches various results have been found.

2. LITERATURE REVIEW

Many researchers have used different approaches in analysing the relationship between exchange rate volatility and trade balance. Abdalla [8] used the Generalized Autoregressive Heteroscedastic Model approach to model the exchange rate volatility in a panel of nineteen of the Arab countries. The study looked at daily observations over a period of 1st January 2000 and 19th November 2011. The results suggest that negative shocks have a higher next period volatility than positive shocks. It concluded that exchange rate volatility can be modelled by the class of GARCH models.

In 2010, Goyal and Arora [12] used the GARCH model to analyse exchange rate volatility and the effectiveness of Central Bank actions in India. This study used time series data of daily observations from 1st November 2005 to 31st December 2018 and monthly observations from January 2002 to December 2008. Findings show that Central Bank communications outperforms more traditional policy variables.

In 2015, Ntawihebasenga, Mung'atu and Mwita [1] applied the GARCH approach to modelling volatility in Rwanda exchange rate returns. The data used in this study was the daily exchange rate series for the period June 2009 to June 2014. Results in this study showed that the GARCH model is a perfect fit in modelling the Rwanda exchange rate returns.

3. METHODOLOGY

Data used in this study was obtained from the World Bank data base for the period 1986-2016. The indicators used are: terms of trade which serves as a proxy for trade balance, real effective exchange rate, domestic real GDP (Gross Domestic Product) which serves as a proxy for countries' competitiveness, and FDI (Foreign Direct Investment) percentage of GDP which serves as a proxy for foreign real GDP.

This study used the Hausman test as the first test to determine whether the random effects model is preferred to the fixed effects model. The second tests conducted were the Phillips Peron test and the Pedroni Cointegration test to ascertain whether the data is stationary or not and for cointegration respectively. A Granger causality test was also performed to ascertain causality and the direction of causality. For illustration on the equations of the Granger causality tests, a bivariate linear autoregressive model of two variables X_1 and X_2 is used as follows:

$$X_1(t) = \sum_{j=1}^{p} A_{11,j} X_1(t-j) + \sum_{j=1}^{p} A_{12,j} X_2(t-j) + E_1(t)$$

$$X_2(t) = \sum_{j=1}^{p} A_{21,j} X_1(t-j) + \sum_{j=1}^{p} A_{22,j} X_2(t-j) + E_2(t) \quad (1)$$

Where p is the maximum number of lagged observations included in the model; A is the matrix that contains the coefficients of the model (i.e. the contributions of each lagged observation to the predicted values of $X_1(t)$ and $X_2(t)$ at time t, E_1 and E_2 are residuals for each time series.

It should be noted that researchers have used different techniques in estimating exchange rate volatility. However, Dlamini [13] and Shipanga [11] used the GARCH model to estimate exchange rate volatility. With the use of time series data, this study uses the panel data model and adopts the general framework of the GARCH model, GARCH (p , q), from Abdalla [8], which is expressed as follows:

$$\sigma_t^2 = \omega + \sum_{j=1}^{q} \alpha_j \varepsilon_{t-1}^2 + \sum_{t=1}^{p} \beta_i \sigma_{t-1}^2 \quad (2)$$

Where p is the number of lagged σ^2 terms and q is the number of lagged ε^2 terms. This study adapts the fixed effects model specification used by Shipanga [11], which is as follows:

$$TB_{it} = \mu + \delta_1(V)_{t-1} + \delta_2(GDP)_{t-1} + \delta_3(FDI)_{t-1} + e_{it} \quad (3)$$

Where TB_t is the Trade Balance at time t; V is the exchange rate volatility; GDP is the domestic real GDP; FDI is the foreign real GDP; μ is a constant term; δ_1, δ_2, and δ_3, are coefficients for exchange rate volatility, domestic real GDP and foreign real GDP respectively; and e_t is the residual term. This is a panel regression equation used to capture both the time dimension (t) and the cross-sectional dimension (i) i.e. the number of countries.

The first step in estimating the GARCH is to test whether there is an ARCH effect. This is done by testing the presence of heteroscedasticity. The ARCH model is a special case of the GARCH model. These two models are better explained in terms of ARMA. Abdalla [8] states that the test procedure is performed by obtaining the residuals e_t from the Ordinary Least Squares regression of the conditional mean equation which could be a combination of autoregressive (AR) and moving average (MA) process (i.e. ARMA process) or AR and MA separately. After obtaining the residuals, the next step is to regress the residual squares by its values from the past. Then test the null hypothesis that there are no ARCH effects in the residuals. Contrary to the null is the alternative hypothesis that provides that there is an ARCH effect.

Bollerslev (1986) and Taylor (1986) cited in David, Dikko and Gulumbe [6] state that the GARCH model allows the conditional variance to be explained by information in the past, such as shocks and variances. Ever since exchange rate volatility has been increasing after the Bretton Woods system ended, the ARCH models became more popular [7].

4. RESULTS

4.1 Hausman Test

Results in Table 1 shows that the model that was ran is the correct effects model for determining the relationship between trade balance and the rest of the variables in this study. The p-value which is equal to 0.000 is less than α=0.05. Hence, the null hypothesis of random effect been correct has been rejected.

Table 2 shows the estimated results of the preferred model which is the fixed effects model. The results in Table 2 indicate that the coefficient of GDP (Growth Domestic Product) is positive while the coefficients of V (exchange rate volatility) and FDI (Foreign Direct Investment) are negative. This implies that a 1% increase in Growth Domestic Product will lead to a 53% increase in trade balance. This also shows that there is a positive relationship between Growth Domestic Product and trade balance. On the other hand, there is a negative relationship between trade balance and exchange rate volatility, and between trade balance and Foreign Direct Investment.

4.2 Stationarity or Unit Root Test

In testing for stationarity, the Augmented Dickey-Fuller (ADF) Fisher test and Phillips-Peron (PP) Fisher test were used. The use of more than one test is to compare the results and ensure strong results. Table 3 shows the results of unit root test in levels and first difference. The results in Table 3 shows that Foreign Direct Investment (FDI) is stationary in levels with the exception of the rest of the variables. These variables were further differenced once and became stationary.

4.3 Cointegration Test

After establishing the order of integration of the variables, testing for cointegration was done. This was done in order to test for the presence of any long-run relationship. Table 4 shows the results obtained from the panel cointegration test based on Pedroni Residual Cointegration. The results in Table 4 show that the p-values are greater than the critical values. This shows that there is no cointegration implying that there is no long-run relationship among the variables.

4.4 The Granger Causality Test

The results in Table 5 show that the probability between trade balance and Gross Domestic product is 0.0005, which is less than the critical value 0.01. This implies that trade balance can help predict Gross Domestic Product. Table 5 also shows that the probability (0.0948) between exchange rate volatility and trade balance is below the critical value 0.1, while the probability (0.0355) between exchange rate volatility and Gross Domestic Product is below the critical value 0.01. This implies that exchange rate volatility can help predict both trade balance and Gross Domestic Product.

Table 1. Hausman test

Cross-section random effects test comparisons				
Variable	**Fixed**	**Random**	**Var (Difference)**	**Prob.**
V	-1158069	293038114	172308940	0.000
GDP	0.525380	-0.220149	0.004902	0.000
FDI	-8189884	310459746	351122913	0.000

Table 2. Estimation results of Fixed effects model

Variable	Coefficient	t-statistic	Probability
Constant	-5.23E+10	-8.407610	0.000
V	-1.16E+09	-1.321192	0.1890
GDP	0.525380	7.237974	0.000
FDI	-8.19E+08	-0.964306	0.3369

Table 3. Panel unit root tests: ADF-Fisher and PP-Fisher in levels and first difference

Variable	Model specification	Augmented Dickey-Fuller Fisher chi square		Phillips-Peron Fisher chi-square		Order of integration
		Level	First difference	Level	First difference	
FDI_t	Intercept	0.0084**	0.000**	0.000**	0.000**	0
	Intercept and trend	0.0011**	0.000**	0.000**	0.000**	0
GDP_t	Intercept	1.000	0.0001**	1.00	0.000**	1
	Intercept and trend	0.852	0.0002**	0.943	0.000**	1
V_t	Intercept	1.000	0.0004**	1.000	0.000**	1
	Intercept and trend	0.714	0.007**	0.984	0.001**	1
TB_t	Intercept	0.984	0.000**	0.998	0.000**	1
	Intercept and Trend	0.917	0.0001**	0.995	0.000**	1

*Note: ** rejection of the null hypothesis at 5%*

Table 4. Pedroni residual cointegration test

	Panel		Group	
	Statistic value	Prob. value	Statistic value	Prob. value
Variance ratio	1.237434	0.1080	-	-
Rho statistic	1.188866	0.8828	2.011714	0.9779
PP statistic	1.836209	0.9668	2.382325	0.9914
ADF statistic	0.206039	0.5816	0.200744	0.5796

Note: Test critical value is at 1%, 5% and 10%

Table 5. Granger causality test

Regressor	Dependent variable in regression			
	TB	V	GDP	FDI
TB	0.00	0.1795	0.0005**	0.5680
V	0.0948*	0.00	0.0355**	0.5305
GDP	0.8531	0.7544	0.00	0.1331
FDI	0.3277	0.4163	0.9104	0.00

Note: a) TB denotes trade balance, V denotes exchange rate volatility, GDP denotes Gross Domestic Product, and FDI denotes Foreign Direct Investment.
*b) * and ** means rejection on null hypothesis of no Granger causality at 10% and 1% respectively*

4.5 Descriptive Statistics of the Yearly Exchange Rate Series

As shown in Table 6, skewness and kurtosis clearly indicates the departure from normality. The skewness of the South African Rand, Swaziland Lilangeni and the Namibian Dollar shows that their data is positive and moderately skewed implying that the model produces moderately accurate results. While the Botswana Pula shows that its data is positive and fairly symmetrical implying that the model produces fairly accurate results.

The values of kurtosis for all four currencies show that they have a similar sharpness in the peak of their data distributions. The value of standard deviation for all four currencies is close to the acceptable value of 1. This means that the dispersion of data is not far from the mean, implying that performance of future predictions in returns is very good.

4.6 Heteroscedasticity Test (Testing for ARCH Effect)

Table 7 shows the results of the heteroscedasticity test where ZAR represents the South African Rand, BWP represents the Botswana Pula, SZL represents the Swaziland Lilangeni and NAD represents the Namibian Dollar. As shown in Table 7 the P-values of the

South African Rand and the Namibian Dollar shows that they have an ARCH effect and therefore, these variables require to be estimated using the GARCH. The Botswana Pula and the Swaziland Lilangeni have no ARCH effect and as such, for them there is no need to proceed to the GARCH.

4.7 Estimation Results of GARCH Model

The Autoregressive Conditional Heteroscedasticity (ARCH) Model and Generalized ARCH Model are used as volatility models for a variable whose variance is not constant. The ARCH is a special case of the GARCH. The GARCH model is used to extract the volatility series. Table 8 shows estimation results of the GARCH model.

In Table 8, the probability of the ARCH term for both currencies is greater than the critical value 0.05. This means that volatility cannot be predicted by the ARCH term. This also applies to the GARCH term since they both have a higher value than the critical value 0.05.

The presence of volatility is determined by summing up the root of the autoregressive model of $\alpha+\beta$, where α is the ARCH term and β is the GARCH term. This is referred to as the rule of thumb, if:

$\alpha+\beta<0.5$, strongly efficient

$0.5\leq\alpha+\beta\leq1$, weak form of efficiency

$\alpha+\beta>1$, no efficiency

Table 8 shows the summation of the ARCH term and GARCH term for the South African Rand and the Namibian Dollar. The summation of the South African Rand is greater than 0.5 but less than 1. In this regard, it supports the weak persistent presence of volatility. However, the R^2 of about 0.548082 suggests that about 55% of the total variation in the regressand is explained by the regressors with 45% accounted for by the error term. The summation of the Namibian Dollar is less than 0.5. This implies that the presence of volatility shocks is strongly persistent. However, the R^2 of about 0.681897 suggests that about 68% of the total variation in the regressand is explained by the regressors with 32% accounted for by the error term.

4.8 E-GARCH Model Results

Table 9 shows the results of the E-GARCH model which represent the long-run volatility and the leverage effect. The leverage effect refers to a negative correlation between the daily asset returns and its changes in volatility. As shown in the table, both leverage effects of -0.371961 for ZAR (South African rand) and -0.020606 for NAD (Namibian dollar) are negative. This means there is negative correlation between asset returns and ZAR, and between asset returns and NAD.

Table 6. Descriptive statistical results

Statistics	ZAR	BWP	SZL	NAD
Mean	6.329112	4.966359	6.329112	6.329112
Median	6.459693	4.949664	6.459693	6.459693
Maximum	14.70961	10.90115	14.70961	14.70961
Minimum	2.036033	1.678941	2.036033	2.036033
Standard deviation	3.257508	2.582934	3.257508	3.257508
Skewness	0.599753	0.485134	0.599753	0.599753
Kurtosis	2.867560	2.432570	2.867560	2.867560
Jarque-Bera (JB)	1.881123	1.631889	1.881123	1.881123
Probability	0.390409	0.442221	0.390409	0.390409
Number of Observations	31	31	31	31

Table 7. Testing for ARCH effect

Currencies	ZAR	BWP	SZL	NAD
ARCH-LM statistic test	2.726368	1.236185	0.930079	3.277237
P-value	0.0109**	0.2267	0.3603	0.0028**

Note: H_0: (a) There is no ARCH effect; (b) Rejection of null hypothesis at 5%

Table 8. GARCH model results

Currencies	ω	α	β	α + β	R-squared	Probability	
						$ARCH(-1)^2$	GARCH(-1)
ZAR	1.04E+21	0.872626	-0.276685	0.595941	0.548082	0.3893	0.6032
NAD	4.72E+18	0.387889	-0.072414	0.315475	0.681897	0.4941	0.9561

Table 9. Estimation results of E-GARCH model

Currencies	C(6) Long-run volatility	C(7) Leverage effect
ZAR	0.784636	-0.371961
NAD	0.588542	-0.020606

4.9 Impulse Response Functions

The Impulse Response Functions was derived from the Panel Vector Autoregressive (VAR) Model. The results of the Impulse Response Functions are shown under appendices.

Appendix A shows the response of TB to shocks in FDI, GDP and exchange rate volatility. The response of TB to shocks in FDI is positive and appears to be permanent but only after seven quarters. This is because the variable found a new level of equilibrium as it did not go back to its initial level of equilibrium. The response of TB to shocks in GDP is negative and appears to have transitory effects due to it going back to zero. The response of TB to shocks in exchange rate volatility is positive and appears to be permanent.

Appendix B shows results of how FDI responds to shocks in GDP, trade balance and exchange rate volatility. FDI responds to both shocks in GDP and exchange rate volatility positively. These shocks have a permanent effect on FDI. However, these permanent effects happen at different periods of time. The permanent effect to shocks in GDP only happens between the sixth quarter and the seventh quarter, while the permanent effect to shocks in exchange rate volatility happens between the fifth quarter and the sixth quarter. The FDI responds to shocks in TB in a negative way. Its response had transitory effects. In the third quarter it went back to zero and then later on the effects became negative again.

Results of the impulse response of GDP to shocks in the other variables are shown in appendix C. The GDP responds to shocks in all the other three variables negatively. However, these negative effects were only transitory to shocks in FDI and shocks in exchange rate volatility. Results show that the effects from shocks in FDI went back to its original value, zero, in the sixth quarter, while the effects from shocks in exchange rate volatility went back to its original value in the eighth quarter. The response of GDP to shocks in TB appears to have a permanent effect.

Lastly, results of the impulse response of exchange rate volatility to shocks in trade balance, GDP and FDI is shown in appendix D. Exchange rate volatility responds to shocks in Foreign Direct Investment positively. This effect appears to be a permanent one. The response of exchange rate volatility to shocks in GDP is also positive with a permanent effect. This effect becomes permanent in the fourth quarter. On the other hand, the response of exchange rate volatility to trade balance is negative and it appears to have a transitory effect. This effect returns to the value zero in the sixth quarter.

4.10 Forecast Error Variance Decomposition

The Forecast Error Variance Decomposition was derived from the Panel Vector Autoregressive (VAR) Model. ‘‘This technique determines how much of the forecast error variance for any variable in a system is explained by innovations to each explanatory variable, over a series of time horizons’’ [14]. Table 10 below shows the results of Forecast Error Variance Decomposition for trade balance over the horizon of 10 periods.

As shown in Table 10, the forecast error variance decomposition in TB is 98.82906, having the highest share in the first period. It is largely attributed to itself in the first 6 quarters, with a share of 93.34320 in the sixth quarter. Afterwards, the variables FDI and V took a notable share in contributing to the fluctuations of TB. As shown in Table 10, FDI took a notable share of 4.758488 in the eighth period while V contributed by an amount of 5.593798 in the

Table 10. Forecast error variance decomposition for trade balance

		Variance decomposition of TB		
Period	**FDI**	**GDP**	**TB**	**V**
1	0.035663	1.135274	98.82906	0.0000
4	1.422498	1.425751	96.64983	0.501920
6	3.237587	1.156896	93.34320	2.262321
8	4.758488	0.893717	88.75400	5.593798
10	5.840914	0.712080	82.97905	10.46795

Note: FDI denotes Foreign Direct Investment, GDP denotes Gross Domestic Product, TB denotes Trade Balance, and V denotes Exchange Rate Volatility

eighth period. Their contribution continued to increase as the horizon increased. In the tenth period, the contribution of FDI increased to 5.840914 while the contribution of V increased to 10.46795.

5. DISCUSSION

Results from the Hausman test showed that the fixed effects model was preferred to the random effects model. The key result is that there is a negative relationship between trade balance and exchange rate volatility. Once exchange rate volatility increases trade balance will decrease, and vice-versa. The results from the Pedroni Residual Cointegration test indicate that there is no long-run relationship among all the four variables but a short-run relationship. This proves that the exchange rate volatility is sticky in the SACU region.

The results from the E-GARCH model showed that the leverage effects of both currencies are negative. This implies that there will be negative shocks which will cause high volatility in the model. When the asset prices reduce, stock of a companies in the SACU region become riskier, hence they will become more volatile. This effect is generally referred to as been asymmetric. In other words, a fall in stock prices occurs with a larger increase in volatility compared to a fall in volatility which occurs when there is a rise in stock prices. Haas, Krause, Paolella, and Steude (2013) and Park (2011) as cited in Baur and Dimpfl [15] state that the leverage effect usually increases volatility only in bear markets. An increase in this volatility will lead to negative returns in the future.

The negative short-run relationship between exchange rate volatility and trade balance shows possible existence of the J-curve effect and the Marshall-Lerner condition. High volatility caused by negative shocks will decrease the price of exports in the SACU region. The demand in SACU's exports will increase while the demand in imports will decrease. Output and real income in the SACU region will expand because expenditure on domestic output will increase. The SACU region expects to see a reduction in trade deficit in the long-run after experiencing a high volatility in exchange rate. However, trade balance may improve given the sum of the price elasticity of SACU's exports and price elasticity of SACU's imports is greater than one in absolute terms.

From the Granger causality test results, trade balance can help in predicting GDP. This result is not consistent with any of the hypotheses of this study because it is not one of the objectives of this study. However, exchange rate volatility can help in predicting both TB and GDP. Exchange rate volatility been able to predict trade balance is consistent with one of the hypotheses of this study. A change in exchange rate volatility will help the SACU region know the direction in which trade balance will take, giving them an idea on how the economy should react. Since these variables are characterised by a short-run relationship, it is difficult for firms in the SACU region to adjust production in order for them to maintain their profits.

The exchange rate overshooting hypothesis is consistent with the result that exchange rate volatility is sticky in the SACU region. This implies that the interaction between monetary shocks and sticky prices explains the stickiness of the exchange rate volatility. As the prices of goods in the SACU region react to changes in prices in the financial market, a long-term equilibrium effect will be reached. If the exchange rate overshooting hypothesis is correct, then the SACU region will expect to have its trade deficit cleared in the short-run. According to results from estimating the GARCH model, volatility shocks are temporary. Hence, the SACU region experiencing equilibrium in the short-run.

6. CONCLUSION

This paper shows that there is a negative relationship between exchange rate volatility and trade balance with a short-run relationship among the variables; exchange rate volatility, trade balance, foreign direct investment and gross domestic product. Therefore, the alternative hypothesis for this study of an existence of a short-run relationship between exchange rate volatility and trade balance was accepted. This short-run relationship implies that exchange rate volatility in the SACU region is flexible. This may cause easy variation on the trade balance.

Findings show that shocks in exchange rate volatility will improve trade balance. This means that appreciation of currencies in the SACU region will deteriorate trade balance and lead to trade deficit. This study shows that trade balance can be predicted by exchange rate volatility in the SACU region. For example, if exchange rate is devalued or increases trade balance will decrease. With a high increase in exchange rate the SACU region will predict a trade deficit, which is not good for the economy. This characteristic of predicting may help the economy decide on ways of overcoming the unwanted outcome.

With many macroeconomic variables (such as inflation and interest rate) affecting trade volume in the market, the study suggests that taking these variables into account when modelling exchange rate volatility against trade balance would be very important. This would give a clear and complete picture on the relationship between exchange rate volatility and trade balance.

Overall, there is proof that there is a relationship between exchange rate volatility and trade balance in the SACU region. There is a positive impact between these two variables in the short-run. Furthermore, this study recommends all Central Banks in the SACU region to intervene in order to mitigate exchange rate volatility.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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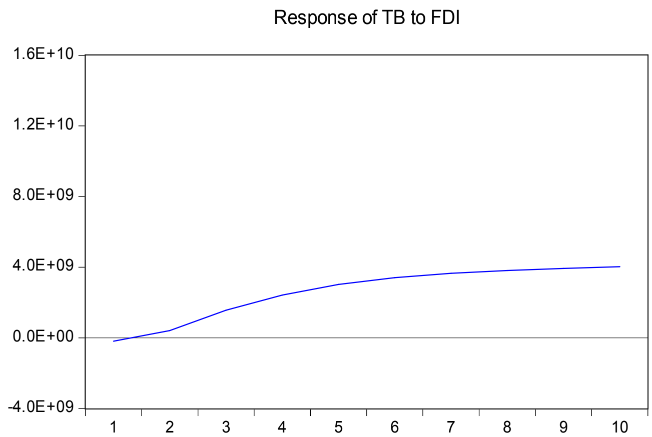
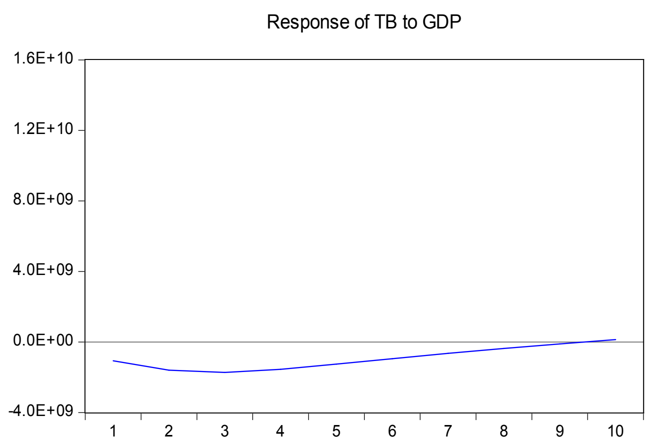
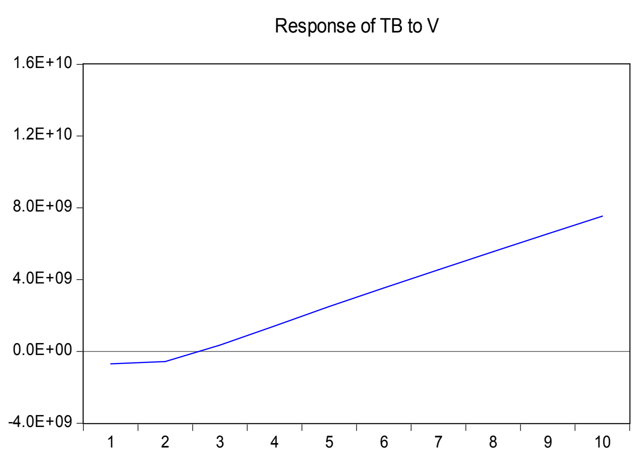
APPENDICES

Appendix A: Impulse response of Trade Balance (Response to Generalized One S.D Innovation)

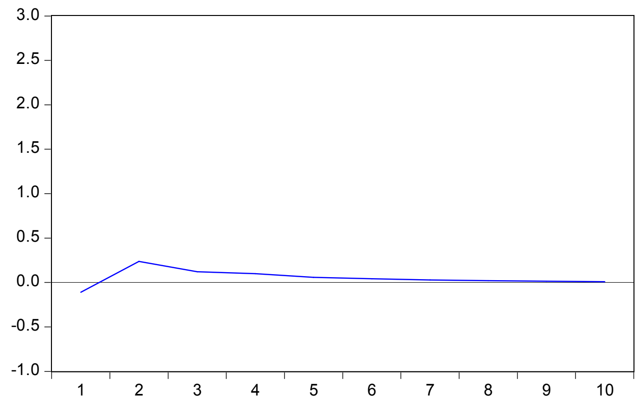




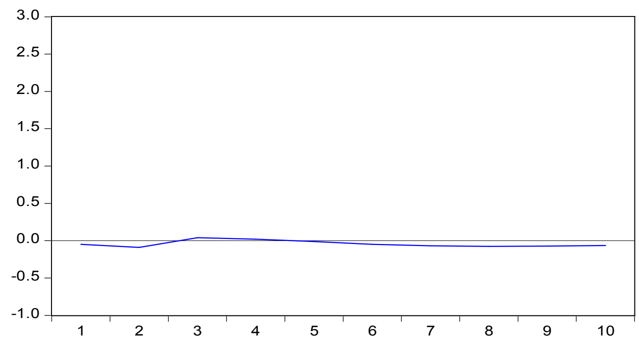


Appendix B: Impulse response of Foreign Direct Investment (Response to Generalized One S.D Innovation)

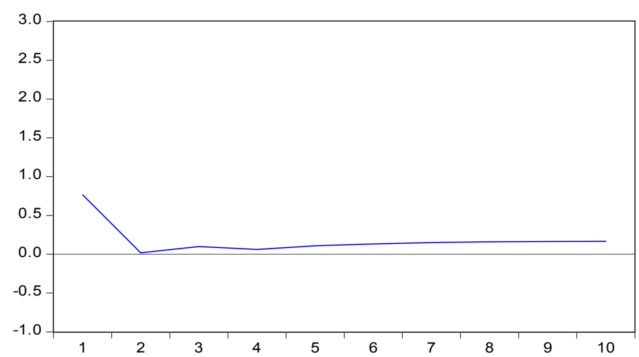
Response of FDI to GDP



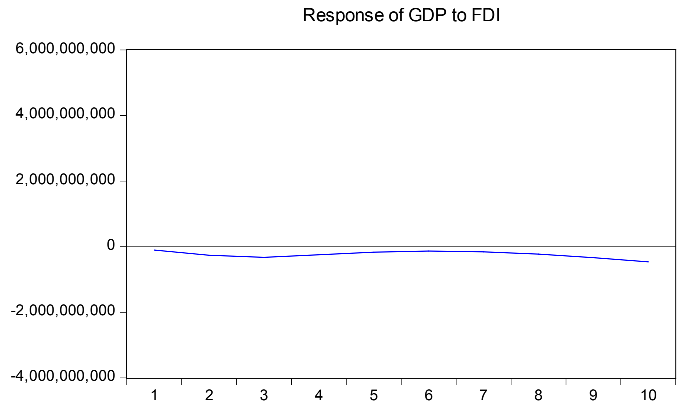
Response of FDI to TB

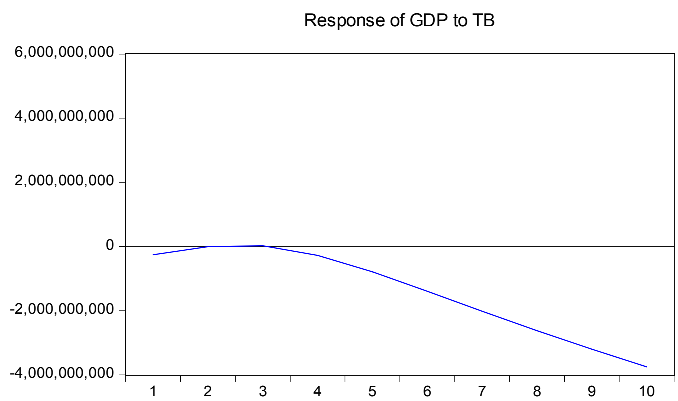


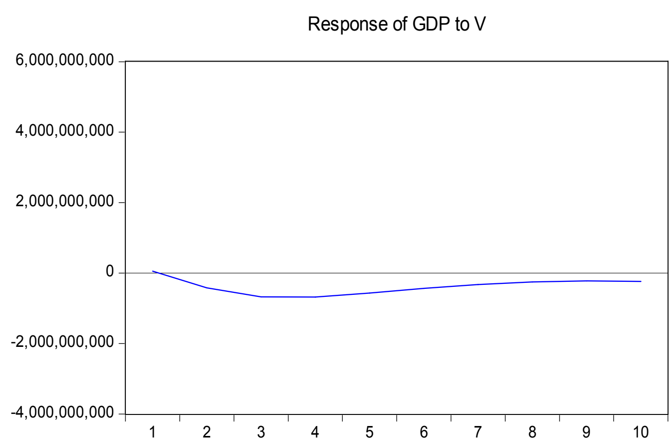
Response of FDI to V



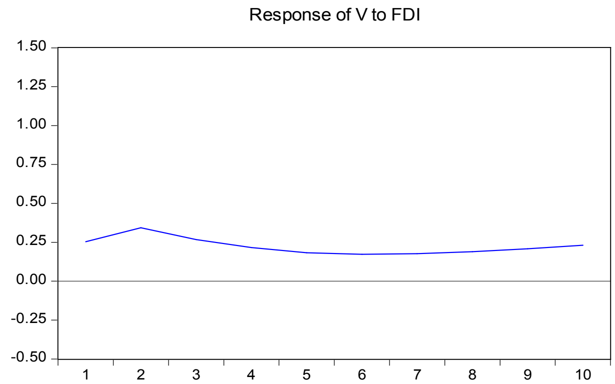
Appendix C: Impulse response of Gross Domestic Product (Response to Generalised One S.D Innovations)

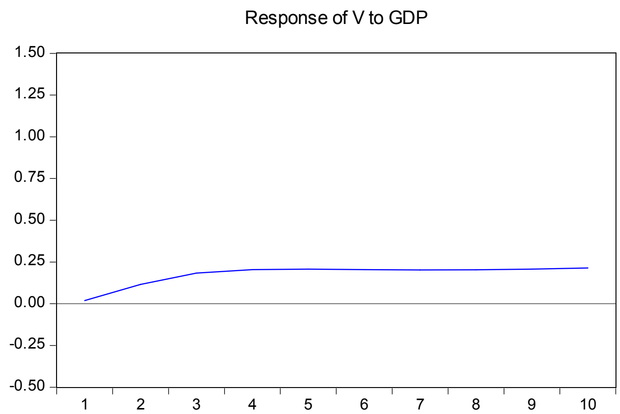


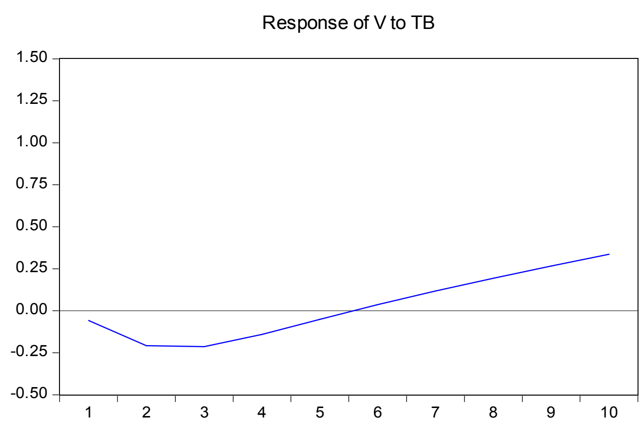




Appendix D: Impulse response of Exchange Rate Volatility (Response to Generalised One S.D Innovations)







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