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The Effect of Exchange Rate Shocks on Economic Growth in the Common Monetary Area in Southern Africa

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Abstract: *The Common Monetary Area (CMA) presents an interesting case study because its economies employ two types of exchange rates: flexible (as in South Africa) and fixed (as in Lesotho, Eswatini, and Namibia). South Africa's flexible rate is plagued by an unstable exchange rate, which affects other CMA member countries and significantly impacts economic growth. Therefore, this study explores the asymmetric effects of exchange rate shocks on economic growth by employing the panel non-linear autoregressive distributed lag (PNARDL) technique. The research utilizes panel annual data ranging from 1992 to 2022. The PNARDL estimates reveal that both negative and positive changes in the exchange rate significantly impede economic growth in the CMA in both the short and long run. Moreover, it is noted that there is an asymmetric impact of the exchange rate in the long run. The implication of this study is that the significant impact of exchange rate asymmetry is notable in the CMA region. This study suggests that policymakers should implement policies that actively support exports, such as offering export incentives or reducing trade barriers. The findings of the research also reveal that appreciation hurts economic growth. Therefore, this study further recommends that policymakers may explore enacting policies to expand the economy by reducing import dependence and addressing structural factors that impede export competitiveness.*

JEL classification: F19, F31, F63
Key words: Exchange rate, GDP, Economic growth, CMA

1. INTRODUCTION

The Trilateral Monetary Agreement entered into force on 1 April 1986, among the economies of Lesotho, Eswatini (previously known as Swaziland), and South Africa, establishing the Common Monetary Area (CMA). Later, in 1992, the economy of Namibia joined the CMA (Masha et al. 2007). This agreement, as well as the corresponding bilateral agreements between South Africa and each of the three smaller members, offers a framework for the exchange rate and monetary policy of these economies. The key target of the CMA is to promote the constant economic development and progression of the less developed economies (Seoela 2022). Notably, the economies of Lesotho, Eswatini, and Namibia have fixed their respective currencies to the South African rand. Furthermore, these currencies are fixed at a 1:1 exchange rate. Additionally, Lesotho, Eswatini, and Namibia operate under a fixed exchange rate regime, while South Africa operates under a flexible exchange rate regime.

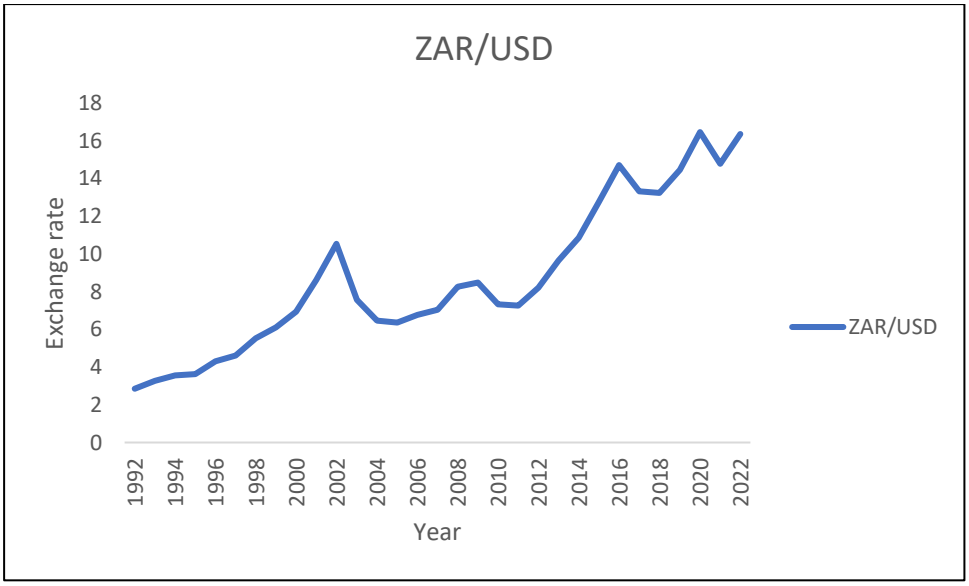
Froyen (2009) defines the exchange rate as the valuation of a domestic state's currency in relation to external currencies. The exchange rate is acknowledged as a critical link between a domestic economy and the worldwide economy. In academic and policy discussions, it has been known that an inadequately managed exchange rate can have a damaging effect on a country's economic growth rate (Rodrik 2008). Inappropriate measures in place to control the exchange rate have the possibility of resulting in unfavorable global trade ties, which can harm a country's foreign trade, cause market distortions, and lead to misallocation of resources (International Monetary Fund 2023). An adequately managed exchange rate provides an appropriate economic climate, which is required for favorable international ties and investments, potentially contributing to higher economic growth.

A stable, long-run economic growth necessitates stable trade and foreign exchange markets to guarantee a stable exchange rate policy and favorable international trade ties (Kogid et al. 2012). Nonetheless, an unstable exchange rate affects economic growth. In developing economies, exchange rate misalignment has frequently manifested as overvaluation, which has a negative impact on tradable goods by lowering producer prices. In support, Rodrik (2008) further argues that overvalued currencies are linked with a shortage in foreign currency, budget deficits, and an unstable business cycle, all of which are detrimental to economic growth. In

short, overvaluation is detrimental to economic growth, but undervaluation stimulates economic growth.

CMA economies, like any developing economy, are known for experiencing instabilities in the value of their currencies relative to the U.S dollar. Since the adoption of a flexible exchange rate system along with an inflation framework in South Africa, the rand has encountered substantial instabilities in its exchange rate relative to major currencies. These instabilities of the rand are passed on to the currencies of CMA member economies. For instance, the depreciation of the rand's exchange rate against the U.S. dollar is connected to the depreciation of currencies of all other CMA members against the U.S. dollar and vice versa. Considering the information above, Figure 1 provides a graphical plot of the history of the annual exchange rate between the rand and the U.S. dollar. This graphical plot uses the rand, as it is a currency of the anchor economy in the CMA region.

Figure 1. South African rand/United States dollar trends



Source: Author's own plot with data from World Bank**.**

Figure 1 exhibits that the annual exchange rate of the rand (ZAR) to the U.S. dollar ($) has been on an upward trend, devaluing since 1992. The exchange rate rose to R10.54 to $1 in 2002 from R2.85 to $1 in 1992. This was attributed to internal and external crises, such as the Brazilian currency crisis in 1999. Between 2003 and 2007, it was somewhat stronger, as it hit R6.36 to

$1 in 2005. Moreover, the rand has been weakening since 2010, the exchange rate of the rand to the U.S dollar was R7.54 in January 2010 and has recently recorded an amount of R16.56 in 2022 (South African Reserve Bank 2023). This was attributed to a continuous stream of structural and political challenges, which intensified currency rate instability (Muzekenyi et al. 2019). Since the currencies of Lesotho, Eswatini, and Namibia are fixed to the rand at a 1:1 basis, this implies that these currencies are automatically affected by the rand. The examined pattern simply demonstrates the instability of the South African rand relative to the U.S. dollar for the period being studied.

A depreciated rand has numerous negative repercussions for customers in the CMA member economies. Interest rates rise as the local currency falls due to inflationary forces from a weak currency. Consequently, small businesses, homeowners, and people who are in debt suffer. Building upon this information, this investigation seeks to improve scientific knowledge on the subject by focusing on the period from 1992 to 2022, as the exchange rate remains unpredictable. In addition, several recent studies have attempted to clarify the connection between economic growth and the exchange rate globally (Amassoma and Odeniyi 2016; Abdinur 2022; Hussain et al. 2019; Idris 2019; Vorlak et al. 2019). However, the effect of exchange rate shocks on economic growth for some CMA member economies has been investigated by few authors, and in recent years, there has been a scarcity of research (Muzekenyi et al. 2019). As a result, this current study attempts to fill in the gap by investigating the influence of exchange rate shocks on economic growth in the CMA economies collectively. Thus, this study aims to uncover the asymmetric effect of exchange rate shocks on economic growth in the CMA. The Common Monetary Area (CMA) presents an interesting case study because its economies employ two types of exchange rates: flexible (as in South Africa) and fixed (as in Lesotho, Eswatini, and Namibia). South Africa's flexible rate is plagued by an unstable exchange rate, which affects other CMA member countries and impacts economic growth. The importance of this study is to provide significant insight into the impact of the exchange rate on economic growth for policymakers.

2. LITERATURE REVIEW

Before proceeding to the methodology, it is important to review the literature on the relationship between exchange rate shocks and economic growth, encompassing both empirical and theoretical perspectives. Rodrik (2008) provides a great summary of orthodox economic theory. Orthodox economic theory holds that the depreciation of a currency accelerates economic growth, while the appreciation of the currency damages growth. Furthermore, the depreciation of the currency generates an expenditure-switching effect, shifting local demand away from imports and toward domestically produced import-competing commodities. It also boosts exports by improving international competitiveness. These two factors together have an expansionary influence on general economic activity. According to Khondker et al. (2012), depreciation, on the other hand, can reduce an economy's production growth for a variety of reasons. The most prominent of these reasons is the increase in import prices hurting national production. Depreciation raises the cost of traded commodities, which contributes to the general price level and has a negative influence on real balance. This will therefore lead to decreased output and aggregate demand.

To date, various studies conducted around the world exhibit that the real exchange rate plays a crucial part in affecting economic growth. However, the findings are contradictory and diverse, implying a positive and negative relationship between these two variables. Additionally, these studies are mostly based on the linear relationship between these two variables. For instance, Vorlak et al. (2019) have investigated the influence of the exchange rate on economic growth in Cambodia spanning from 1995 to 2017 (time series data). This investigation has been carried out using an ordinary least squares (OLS) regression model. The results demonstrated that the exchange rate and trade openness have significant influence on economic growth as represented by gross domestic product (GDP). According to the findings, the exchange rate affects GDP positively, and trade openness affects GDP negatively. Furthermore, it has been shown that variables such as inflation, foreign direct investment, and broad money have no significant influence on GDP in Cambodia. According to the study's conclusion, it recommended that the authority should carry out strict local economic transformation, such as monetary policy, trade liberalization, and export promotion, to improve the economic base, thus attracting foreign investors into the economy.

Using the vector error correction model (VECM), Idris (2019) has been able to study the impact of the exchange rate on economic growth in Nigeria spanning from 1980 to 2017 (time series data). The findings demonstrate the existence of an equilibrium and long-run relationship between economic growth and the exchange rate. Furthermore, it has been reported that the exchange rate significantly contributes to the acceleration of economic growth in Nigeria. These results align with those reported by Vorlak et al. (2019). Idris (2019) suggested that policymakers in Nigeria should exercise great care in decision-making, mainly regarding matters connected to the exchange rate, in order to leverage its beneficial and important impact towards creating a justifiable economic growth. Similarly, Amassoma and Odeniyi (2016) investigated this relationship and discovered an insignificant positive influence of exchange rate fluctuation on Nigerian economic growth in both the short run and long run.

Muzekenyi et al. (2019) have explored the influence of the exchange rate on economic growth in South Africa spanning from 1994Q1 to 2015Q4. The analysis was carried out using the VECM. The results show that the exchange rate negatively impacts economic growth in both the short run and long run in South Africa. This contradicts the findings of Idris (2019). The findings further show that the foreign direct investment exerts a notable negative influence on economic growth. This contradicts the discoveries of Vorlak et al. (2019). While other variables, such as the money supply, fixed capital formation, and interest rate, have no significant influence. Muzekenyi et al. (2019) suggested that the flexible exchange rate system implemented in South Africa should be retracted and replaced with a fixed exchange rate system.

In support of the negative influence of the exchange rate on economic growth, Barguellil et al. (2018) adopted the generalized method of moments (GMM) technique to analyze the impact of exchange rate volatility on economic growth for 45 emerging nations from 1985 to 2015. The findings exhibit that volatility in the exchange rate has a negative influence on economic growth. It has been further reported that the influence of the exchange rate is greatly influence by financial openness and the exchange rate system. The results are comparable to those of Janus and Riera-Crichton (2015).

Khandare (2017) examined the influence of fluctuations in the exchange rate on economic growth in India from 1987 to 2014. The author employs both a correlation analysis and multiple

regression modeling to evaluate any possible relationship between the phenomena under investigation. The results of the correlation analysis exhibit that there is a positive insignificant correlation between economic growth and the exchange rate. However, the regression analysis shows a negative association between the two variables.

Using the ordinary least squares regression model, Abdinur (2022) has been able to study the effect of exchange rate movements on economic growth in Somalia from 2005 to 2020. It has been shown that the exchange rate has a positive and significant influence on economic growth. Furthermore, it has been reported that inflation has an insignificant influence on economic growth in Somalia. These results align with the findings reported by Vorlak et al. (2019).

On the other hand, researchers have been keen on quantifying the asymmetric effect of the exchange rate on economic growth. Bahmani-Oskooee and Mohammadian (2018) have quantified the asymmetric influence of exchange rate fluctuations on internal production in emerging economies. The analysis was carried out using non-linear autoregressive distributed lag (NARDL). In comparison to the linear model, the study revealed that the nonlinear autoregressive model performs better and produced results that corroborate the asymmetric effects of exchange rate fluctuations on internal production in many economies in the sample, both in the long and short run.

Similarly, Hussain et al. (2019) examined the likelihood of asymmetric effect of the exchange rate on economic growth in Pakistan from 1972 to 2014. The analysis was carried out using NARDL. The research showed that the depreciation of the exchange rate negatively affects economic growth, while appreciation has a positive influence on economic growth. In both the long and short term, the results further confirm the asymmetric impact of the exchange rate on economic growth in Pakistan. Based on the findings, Hussain et al. (2019) recommended that, to attain the goal of sustainable growth, exchange rate regulation should prioritize restoring stability and pursuing a stronger currency in Pakistan.

The above studies reveal conflicting and inconsistent results on the connection between economic growth and the exchange rate. Some of the literature supports a positive influence, whereas others indicate a negative influence of exchange rates on economic growth. Nonetheless, most of the studies evaluated share a common characteristic: they all assume that exchange rate fluctuations have symmetric impacts on economic growth as represented by gross domestic product (GDP). That is, a depreciation and appreciation of the exchange rate have the

same influence on GDP in the same direction. However, Bahmani-Oskooee and Fariditavana (2016) contends that the effect of depreciation on GDP differs from that of appreciation due to changes in traders' expectations. It is noteworthy that asymmetric shocks lead to heterogeneous responses, whereas symmetric shocks lead to homogeneous responses across economic factors. Therefore, these studies have failed to account for the asymmetric effect of the exchange rate on economic growth except for studies by Bahmani-Oskooee and Mohammadian (2018) and Hussain et al. (2019). This supports the necessity of a thorough inquiry, especially for emerging economies where fluctuations in exchange rates impede growth. In addition, the symmetric methods have the shortcoming of neglecting to recognize the likelihood of asymmetric behaviour between the series of the economic variables. In general, economic connections can exhibit asymmetric characteristics, and applying symmetric models may lead to misspecification and biased estimates. As a result, it becomes progressively challenging to find a symmetric method that effectively captures the data, particularly for naturally asymmetric methods. This infers that the time series with asymmetric behaviour cannot be perfectly specified in symmetric methods. Thus, the current research intends to discover the asymmetric effect of the exchange rate on economic growth in the CMA. Moreover, this current study applies an asymmetric method to examine the effect of depreciation and appreciation on economic growth. To the best of the author's knowledge, little to no research has investigated the asymmetric effect of the exchange rate on economic growth in the Southern African Common Monetary Area. This current study is among the first in the CMA region to analyze the asymmetric impact of changes on the exchange rate and is anticipated to contribute to the empirical literature on the topic for the optimal exchange rate management policy to attain desirable objectives.

3. Methodology

This section explains the study's methodology, including model specifications. Additionally, this section covers the pertinent approach and instruments that are used to realize the goals of this study.

This study followed and modified the model established by Bahmani-Oskooee and Mohammadian (2018), modeling the relationship between exchange rate and domestic production for emerging economies. The justification for following and modifying the model

established by Bahmani-Oskooee and Mohammadian (2018) was that the authors have utilized asymmetric analysis. Given that this current study also employed asymmetric analysis, it was deemed appropriate to follow and modify the model by Bahmani-Oskooee and Mohammadian (2018). The model is mathematically expressed by Equation (1) below.

$$LnY_t = a + \beta_1 LNM_t + \beta_2 LNG_t + \beta_3 LnREX_t + \beta_4 LnOil_t + \beta_5 LnW_t + \varepsilon_t \quad (1)$$

where *Y* signifies domestic output (real GDP), Ln is logarithm, and REX, oil, *G*, *M*, and *W* represent real exchange rate, oil price, government spending, money supply, and wages, respectively. However, this study modified Equation (1) by adding inflation rate (IFR) and foreign direct investment (FDI), which were relevant variables in this study. Additionally, in this study, variables such as oil price, government spending, money supply, and wages were excluded, as they were not the focus of interest. Therefore, the modified model can be expressed as follows:

$$GDP_{it} = \beta_{0i} + \beta_{1it} EXR_{it} + \beta_{2it} IFR_{it} + \beta_{3it} FDI_{it} \quad (1)$$

Since this study was based on the Common Monetary Area member economies, Equation (2) characterizes modeling from country one to four, thus i = 1, 2, 3, 4 and t = 1992, 1993,…,2022. *GDP* signifies gross domestic product and *EXR*, *IFR*, and *FDI* represent exchange rate, inflation rate, and foreign direct investment, respectively.

Table 1. Data source and index.

Variables	**Index**	**Source**
Gross Domestic Product (GDP)	Annual percentage growth of GDP	World Bank
Exchange rate (EXR)	Official exchange rate (LCU per US$, period average)	
Foreign Direct Investment (FDI)	Foreign direct investment, net inflows (% of GDP)	
Inflation rate (IFR)	Annual percentage	African Development Bank

The research utilized a panel dataset covering the Common Monetary Area member economies, including Lesotho, Eswatini, Namibia, and South Africa, over the period from 1992 to 2022. The panel auto regressive distributed lags (PARDL) approach was used in this study to represent the linear correlation between the explained and explanatory variables in this

investigation. In comparison to empirical research that applied linear modeling approaches, the use of ARDL, which was initially created by Pesaran and Shin (1999), has few benefits. The following are the benefits; despite having a small sample size, the PARDL model consistently yields robust results for both short- and long-run relationships, and to assess for short- and long-run impacts, variables can be integrated to the order of (0), (1), or the mixture of both. In other words, variables integrated to the order of (2) are not allowed. Hence, the following equation outlines the PARDL model to be estimated.

$$\Delta GDP_{it} = \beta_{0i} + \sum_{i=1}^{p1} \beta_{1i} \Delta EXR_{t-i} + \sum_{i=1}^{p2} \beta_2 \Delta IFR_{t-i} + \sum_{i=1}^{p3} \beta_3 \Delta FDI_{t-1} + \beta_5 GDP_{t-1} + \beta_6 EXR_{t-1} + \beta_7 IFR_{t-1} + \beta_8 FDI_{t-1} + \varepsilon_t \quad (3)$$

The explanatory variables in Equation (3) are assumed to have symmetric influence on the explained variable. That is, a depreciation and appreciation of the exchange rate will have the same influence on GDP in the same direction. However, the effect of depreciation on GDP differs from that of appreciation due to changes in traders' expectations (Bahmani-Oskooee and Fariditavana 2016). Hence, the above model is estimated by a panel non-linear autoregressive distributed lag (PNARDL). PNARDL model essentially decomposes changes of the variables under consideration into partial sums (Granger and Yoon 2002). Furthermore, it shows that when the positive and negative elements of a time series are cointegrated, then a "secret cointegration" exists, and linear cointegration is one specific type of secret cointegration that is a component of nonlinear cointegration. Shin et al. (2014) created a nonlinear ARDL approach by including a decomposed partial sum element.

In jointly modeling the cointegration dynamics and asymmetries, PNARDL model outperforms present modeling methods, such as the error correction model (ECM), the Markov-switching ECM, the threshold ECM, and the smooth transition ECM. Aside from its estimating simplicity, the PNARDL model provides more significant flexibility in loosening the hypothesis that time series must be integrated in the same order, in contrast to the ECM, which is influential in this regard. In addition, PNARDL model accurately distinguishes between the lack of cointegration, nonlinear cointegration, and linear cointegration (Shin et al. 2014). Hence, to estimate the asymmetric effects of exchange rate on economic growth in the CMA member economies, PNARDL model was employed. To proceed, the first changes in exchange rates were created, which would include positive changes represented by $\Delta LNEXR^{+}$ and negative changes represented by $\Delta LNEXR^{-}$. Following that, two new time series variables were created, one

representing depreciation denoted by POS_t and the other representing appreciation denoted by NEG_t as a partial sum of positive and negative changes.

$$POS_t = \sum_{i=1}^{t} \Delta EXR_i^+ = \sum_{i=0}^{t} max(\Delta LNEXR_i, 0) \quad (4)$$

$$NEG_t = \sum_{i=1}^{t} \Delta EXR_i^- = \sum_{i=0}^{t} min(\Delta LNEXR_i, 0) \quad (5)$$

where Δ operator represents difference, β_{ni} represents short-run effects, β_i represents long-run effects, and lags order is given by $\sum_{i=1}^{Pn}$.

Examining the likelihood of a long- and short-run non-linear correlation between exchange rate and gross domestic product necessitates the use of an asymmetric effects test (Wald test) on long-run coefficients. As a result, the following null hypotheses (long-run effects) will be tested:

$$H_0^1 = \beta_7 POS_{t-1} = \beta_8 NEG_{t-1}$$

The positive and negative long-run effects are determined as follows:

$$LR_{POS} = \frac{-\beta_7^{POS}}{\beta_6 GDP_{t-1}}, LR_{NEG} = \frac{-\beta_8^{NEG}}{\beta_6 GDP_{t-1}}$$

Rejecting the null hypothesis of either long- or short-run symmetry suggests that PNARDL (non-linear) should be utilized to investigate the relationship between gross domestic product and explanatory variables under consideration.

Before estimating the model, this study initiated with descriptive statistics, correlation analysis, cross-sectional dependence assessment, unit root test for optimal lag selection, and asymmetric cointegration tests. This ensured that the pre-estimation tests are satisfied, and the appropriate model is estimated.

4. RESULTS

In order to estimate Equation (5), it important to begin with descriptive statistics, correlation analysis, cross-sectional dependence, and unit root tests. Following that, it is the optimal lag section and asymmetric cointegration tests. After the estimation of Equation (5), the panel causality and diagnostic tests are analyzed to determine the quality of the estimated model. The following sections serve as the foundation for the empirical analysis: the Brock–Dechert–Scheinkman (BDS) test of nonlinearity for identifying serial dependency in the series, unit root recognition in the series, and PNARDL model for decomposing the exchange rates into negative and positive signs.

4.1. Descriptive Statistics

Descriptive statistics are concise informative coefficients that summarize a particular set of data. These statistics can be categorized into measurements of central tendency and variability, where central tendency encompasses the mean, median, and mode, while variability includes standard deviation, variance, minimum, and maximum values.

Table 2 presents the summary statistics, indicating that GDP has the lowest value among all the variables under investigation, with a minimum value of −8.1014. In contrast, the inflation rate exhibits the highest value of 17.6946. The standard deviation suggests that the data for the variables under investigation are closely clustered around the mean. The median value of GDP suggests that 50% of the data points have a smaller value or are equal to 3.1481.

Table 2: Summary statistics of the variables

Variables	Mean	Std.Dev	Min	Max	Median
EXR	8.7199	3.9805	2.8520	16.4703	7.5647
GDP	2.7862	2.7370	-8.1014	12.2696	3.1481
FDI	2.7285	2.6034	-2.7389	10.6635	2.2222
IFR	6.9269	2.9531	1.3735	17.6946	6.3347

Source: Author's own.

4.2 BDS test of nonlinearity

The BDS test, devised by Brock et al. (1996), is commonly used to identify nonlinearities. The BDS test was used to determine if the unstructured and dateless panel data series were identically distributed or independent. The null hypothesis of BDS test infers that the data are independent and identically distributed. Therefore, in the event that the BDS test's null hypothesis is rejected, we can conclude that the PNARDL model is more appropriate for the investigation than symmetrical modeling approaches. Table 3 presents the findings of the BDS test.

Table 3. BDS test of nonlinearity.

Nonlinearity Confirmatory Test Dimensions	BDS t-statistics			
	EXR	GDP	FDI	IFR

M=2	0.1326***	0.0234***	0.0417***	0.0344***
M=3	0.2085***	0.0384***	0.0631***	0.0554***
M=4	0.2609***	0.0429***	0.0848***	0.0578***
M=5	0.2922***	0.0488***	0.0977***	0.0534***
M=6	0.3074***	0.0489***	0.1035***	0.0501***

Source: Author's own. Note: *** correspond to significance at 1% which infers the rejection of the null hypothesis. We chose dateless and unstructured panel data for this test to execute that BDS test on panel data sets.

Table 3 displays the findings of the BDS test. The findings refute the null hypothesis of independent and identical distributions. All of the t-statistic values for each variable are significant, demonstrating this. Furthermore, this verifies that the null hypothesis of non-linearity cannot be rejected, as all the associated probability values are less than the 1% significance level. The BDS test findings suggest a non-normal distribution of data, indicating the existence of nonlinearity in the panel data of CMA member economies.

4.3 Cross-Sectional Dependence Test

Cross-sectional dependence (CSD) is usually present in panel data. Ignoring CSD can result in inaccurate and ineffective regression estimates. The chosen member economies of the monetary area share certain common elements of the exchange rate and inflation rate due to the formation of the common monetary area. Therefore, we employ Pesaran (2004) CSD tests to examine the presence of CSD in the dataset. The null hypothesis of the CSD test infers that there is no cross-section dependence in the panel data.

Table 4 reveals that the null hypothesis of no cross-sectional dependence in the panel data is rejected for all the variables. Therefore, this confirms the existence of cross-sectional dependence in the panel data.

Table 4: CSD test

Pesaran's CSD tests	**Statistics**			
	EXR	**GDP**	**FDI**	**IFR**

Pesaran scaled LM test	51.9601***	14.0454***	0.9795	29.0439***
Pesaran CD test	13.6380***	7.2696***	-0.1388	10.1724***

Source: Author's own. Note: *** correspond to significance at 1% which infers the rejection of the null hypothesis.

4.4 Unit Root Test

Before estimating the regression model, the author checks for stationarity of the variables through Pesaran CIPS in order to be sure that none of the variables is integrated at order 2. The author employs a second-generation unit root because there is cross-section dependence in the panel data.

Table 5 reveals that all the variables are integrated at level or I(0). Therefore, PNARDL would not break down.

Table 5: Second-generation unit root

Variables	**Intercept**		**Intercept and trend**		**Integration order**
	t-statistic	**p-value**	**t-statistic**	**p-value**	
EXR	-2.2343	<0.10*	-3.0167	<0.05**	I(0)
GDP	-5.0313	<0.01***	-5.1169	<0.01***	I(0)
FDI	-3.2394	<0.01***	-4.5899	<0.01***	I(0)
IFR	-4.0242	<0.01***	-3.9610	<0.01***	I(0)

Source: Author's own. Note: ***, **, * correspond to significance at 1, 5, and 10%.

4.5 Asymmetric Cointegration Test

Before performing the asymmetric cointegration test, we evaluate whether the variables under investigation are cointegrated in a linear manner. The panel cointegration test proposed by Westerlund (2007) is appropriate, as the series demonstrate cross-sectional dependence. In order to account for cross-sectional dependence when executing the test, we calculate robust critical values, which come from 300 bootstrap replications. The null hypothesis of this test states that there is no linear cointegration, and it is thus rejected when the robust *p*-value is less than the significance threshold of 5%. Therefore, the following table presents the Westerlund (2007) panel cointegration test.

The findings, reported in Table 6, demonstrate that there is no linear cointegration among the variables under investigation in the CMA. The robust *p*-values exceed the significance of 5%, indicating that the null hypothesis is not rejected. The lack of linear cointegration implies that any shock to the system will have a long-lasting impact on the economy if the variables are considered in their original form. As such, shocks and variations in the variables under investigation require special consideration. Since there is no evidence of cointegration between the variables under investigation, it is important to examine any potential cointegration between the series' positive and negative components. Therefore, we separate GDP, the exchange rate, FDI, and inflation into cumulative shocks that are positive and negative.

Table 6: Westerlund (2007) panel cointegration test

Statistics	**Value**	**z-value**	**p-value**	**Robust p-value**
Gt	-4.710	-4.607	0.0000	0.097
Ga	-12.359	0.788	0.785	0.243
Pt	-11.930	-7.441	0.0000	0.240
Pa	-14.622	-0.645	0.260	0.383

Source: Author's own

In this study, the asymmetric cointegration correlation is established by distinguishing between the effect of positive shocks and negative shocks utilising the Hatemi-J (2020) asymmetric cointegration test. The assessment for hidden cointegration is conducted on the residuals of both the positive and negative components of the variables under examination. Disintegrated components are scrutinized for CSD using the Pesaran CSD test, leading to the rejection of the null hypothesis of no CSD. However, the existence of CSD in the disintegrated components implies that the CIPS Pesaran (2007) second-generation unit root test is suitable for finding asymmetric cointegration between the variables. The null hypothesis for CIPS tests is that the series is stationary. Therefore, Table 7 provides the asymmetric cointegration results.

Table 7: Hatemi-J (2020) asymmetric cointegration test

Variables in the model	**CSD test on the residuals**	**Unit root test on the residuals**	**Decision regarding the residuals**

$(GDP^{+}, EXR^{+}, FDI^{+}, IFR^{+})$	0.7216(0.4705)	-6.3726(<0.01)***	**Stationary**
$(GDP^{-}, EXR^{+}, FDI^{+}, IFR^{+})$	6.4082(0.0000)	-5.5180(<0.01)***	**Stationary**
$(GDP^{+}, EXR^{-}, FDI^{-}, IFR^{-})$	1.3047(0.1920)	-6.0777(<0.01)***	**Stationary**
$(GDP^{-}, EXR^{-}, FDI^{-}, IFR^{-})$	6.7541(0.0000)	-3.2178(<0.01)***	**Stationary**

Source: Author's own. Note: *** correspond to significance at 1%.

The above table shows that the variables are stationary. As such, this indicates an asymmetric form in the cointegration relationship between the variables. However, long-run cointegration is not observable in a linear sense but rather in a non-linear manner. Based on the asymmetric analysis, a non-linear model can provide a more accurate estimation of the connection.

4.6 Optimal Lag Length

Once establishing the presence of cointegration in both the positive and negative components of the variables, it is suitable to model the correlation using the panel non-linear ARDL approach. Furthermore, the error correction model is also calculated in this model. To do this, the pool group mean estimate method is utilized. This tool is particularly appropriate for this analysis due to its reliability in modeling long-run relationships in the framework of panel data (Pesaran et al. 1999). This can yield useful insights because the data come from few economies with similar features. This analysis relies on the effect of the disintegrated component of the explanatory variable (EXR). However, before estimating the PNARDL model, we have to establish the optimal lag length for the PNARDL model. This is achieved by using EViews auto selection with an application of the Akaike information criterion (AIC), Schwarz information criterion (SIC), and Hannah Quinn criterion (HQIC) information criteria. All these selection criteria should have lower statistics (Menegaki 2019). To obtain accurate estimates, all information criteria should have a smaller statistic. Hence, Table 8 provides the optimal lag length.

Table 8: Optimal lag length

Model	**AIC**	**SIC**	**HQIC**	**Specification**
6	4.3672*	5.9207	4.9976	ARDL(2.3.3.3.3)

3	4.3905	5.8468	4.9814	ARDL(1.3.3.3.3)
9	4.4017	6.0523	5.0714	ARDL(3.3.3.3.3)
5	4.4992	5.6643	4.9719	ARDL(2.2.2.2.2)
2	4.5058	5.5738	4.9391*	ARDL(1.2.2.2.2)
8	4.5348	5.7969	5.0469	ARDL(3.2.2.2.2)
1	4.6139	5.2936	4.8897	ARDL(1.1.1.1.1)
4	4.6706	5.4473*	4.9858	ARDL(2.1.1.1.1)
7	4.6997	5.5735	5.0542	ARDL(3.1.1.1.1)

Notes: * correspond to the lag length selected by the information criterion. Source: Author's own.

Table 8 demonstrates that the AIC has the smallest value, leading to the selection of the optimal model as ARDL(2.3.3.3.3). As a result, the PNARDL model to be estimated is PNARDL(2.3.3.3.3). Table 9 presents the short and long run estimates of PNARDL.

4.7 Short- and long-run estimates

Table 9: short- and long-run estimates of PNARDL

Long run estimates- **Explained variable**: GDP				
Variables	Coefficient	St. Error	t-statistic	p-value
EXRPOS	-0.7568	0.1009	-7.5036	0.0000***
EXRNEG	-0.7236	0.1039	-6.9609	0.0000***
FDI	-0.0519	0.1452	-0.3577	0.7218
IFR	-0.9552	0.1215	-7.8613	0.0000***
Short run estimates				
ECM	-0.9453	0.1751	-5.3988	0.0000***
ΔGDP	0.0628	0.1284	0.4887	0.6268
ΔEXRPOS	-0.7529	0.2406	-3.1295	0.0027***
ΔEXRNEG	-0.8799	0.2842	-3.0959	0.0030***
ΔFDI	0.1472	0.0797	1.8468	0.0697*
ΔIFR	0.6323	0.2741	2.3211	0.0237**

Source: Author's own. Notes: ***, **, * correspond to statistical significance at 1, 5 and 10% respectively. POS/NEG expresses exchange rate's positive and negative parts, respectively.

Contrary to expectations, the results presented in Table 9 indicate that depreciation and appreciation have similar effects on economic growth. The long-run results reveal that depreciation, represented by EXRPOS, has a negative and significant impact on economic

growth, represented by GDP. In other words, a one-unit increase in the exchange rate leads to a 0.7568 unit decrease in GDP in the CMA. This finding is consistent with the results obtained by Hussain et al. (2019) regarding the impact of depreciation. In addition, appreciation is projected to reduce GDP by 0.7236 units. This finding deviates from the finding obtained by Hussain et al. (2019) regarding the impact of appreciation. Furthermore, these findings diverge from orthodox economic theory, which suggests that the depreciation of a currency stimulates economic growth but aligns with the perspective that the appreciation of the currency damages growth. The negative impact of depreciation could be attributable to the weak local currency, which affects import prices and consequently harms local production. Depreciation raises the cost of international trade, leading to higher local prices and therefore decreased aggregate demand and local production. In addition, this finding regarding the effect of changes in the exchange rate suggests that during episodes of depreciation or appreciation of the South African rand, policy measures taken by the South African Reserve Bank (SARB) may affect the economic condition in Eswatini, Lesotho, and Namibia, exposing them to an increased risk of economic crises. Fluctuations in the rand have far-reaching effects on economic growth and development within the CMA economies.

The long-run results further indicate that the inflation rate has a negative and significant impact on economic growth. Specifically, a one-unit increase in the inflation rate leads to a 0.9552 unit decrease in GDP. This result contradicts the Philips curve model, which posits a positive relationship between inflation and economic growth, as higher inflation is typically associated with a low unemployment rate. Surprisingly, the results also indicate that foreign direct investment does not have a significant effect on economic growth. That is, a one-unit increase in foreign direct investment would barely lead to a 0.0519 unit decrease in GDP. This suggests that foreign direct investment in the countries under consideration does not lead to increased employment. Consequently, foreign direct investment does not stimulate economic growth.

In the short run, the error correction term (ECM) is negative and significant. This implies that the spend of adjustment is 95%. The CMA member economies move swiftly to achieve a stable state as the spend of adjustment is higher. The results of depreciation and appreciation of the exchange rate are similar even in the short run. However, inflation and foreign direct investment affect economic growth positively in the short run.

Table 10 presents the results of the Wald test for the long-run asymmetric effect. This test is used to examine the existence of asymmetry in the estimated long-run correlation.

Table 10: Long-run asymmetric effect results.

Asymmetric Null Hypothesis	**Long-run**	
	t-statistic	**p-value**
EXRPOS=EXRNEG	-27.3334	0.0000***

Source: Author's own. Notes: *** correspond to statistical significance at 1%.

Table 10 show that the long-run correlation of the exchange rate demonstrates the presence of an asymmetric effect. In other words, the long-run effect of the exchange rate on economic growth is best captured with PNARDL.

4.8 Granger Causality test

The asymmetric panel Granger Causality test results are presented in Table 11. This is due to the existence of asymmetric cointegration relationships between economic growth and the partial positive and negative decompositions of the exchange rate.

Table 11: Results of asymmetric panel causality

Null hypothesis	Obs	F-stat	P value	Conclusion
EXRNEG does not Granger Cause GDP	116	6.9722	0.0014***	EXRNEG ⇒ GDP
GDP does not Granger Cause EXRNEG		15.4373	1.E-06	
EXRPOS does not Granger Cause GDP		7.3176	0.0010***	EXRPOS ⇔ GDP
GDP does not Granger Cause EXRPOS		7.4665	0.0009***	

Source: Author's own. Notes: *** correspond to statistical significance at 1%.

Under the 1% level of significance, Table 11 indicates that appreciation affects economic growth, but economic growth does not affect appreciation. Additionally, the Granger causality test results demonstrate bidirectional causality between depreciation and economic growth.

4.9 Diagnostic test

The diagnostic tests performed in the PNARDL model are presented in Table 12. These tests comprise a normality test and cross-section independence tests.

Table 12: Results of Diagnostic tests

Diagnostic tests	**Type of the test**	**T stat**	**P value**
Normality test	Jacque-Bera	4.1662	0.1245
Cross-Section Independence tests	Peseran cross-section dependence test	2.3736	0.0176**
	Bias corrected LM dependence test	1.3266	0.1846
	Peseran scaled LM dependence test	1.4006	0.1613
	Breusch and Pagan LM dependence test	10.8520	0.0931

Source: Author's own. Notes: ** correspond to statistical significance at 5%.

Table 12 shows that the *p*-value of the normality test is above the 5% level of significance. Therefore, the author does not reject the null hypothesis, indicating that residuals are not normally distributed. This implies that residuals are normally distributed. Furthermore, Table 12 reveals that, out of the four cross-sectional dependence tests, three demonstrate that there is no cross-sectional dependence across individuals in the model. Given that the p-value of these tests is greater than the 5% level, the author fails to reject the null hypothesis, implying that there is no cross-sectional dependence.

5. DISCUSSION OF RESULTS AND POLICY CONSIDERATIONS/IMPLICATIONS

This study investigated the effect of exchange rate shocks on economic growth in the Common Monetary Area in Southern Africa. The rationale behind conducting this study is rooted in the belief that fluctuations in exchange rates have a substantial influence on key macroeconomic indicators, such as economic growth, primarily through their effects on net exports and investments. As a result, the goal of this study was to examine the asymmetric effect of exchange rate shocks on economic growth in the Common Monetary Area in Southern Africa. The Common Monetary Area member economies have pegged their currencies with the South African Rand, which has been unstable and weak against major currencies. The reason for focusing on the asymmetric model is that the linear may lead to a biased conclusion. Furthermore, this study asserts to be among the first to evaluate the asymmetric impact of

exchange rate shocks the Common Monetary Area in Southern Africa using panel non-linear autoregressive distribution lag model for the period from 1992 to 2022.

The empirical literature shows that exchange rate depreciation hurts economic growth in developing countries (Hussain et al. 2019). Indeed, the current research showed similar discoveries that depreciation decreases economic growth in the Common Monetary Area. This justifies why the economic growth of the Common Monetary Area members has been slow despite the rand's depreciation. The case is also the same with appreciation, as it hurts economic growth.

Contrary to expectations, none of the exchange rate fluctuations, whether positive or negative, contribute to economic growth in the CMA region. This suggests that, while a weaker local currency makes exports cheaper, it fails to stimulate economic growth and instead hinders it. Similarly, a stronger currency makes imports cheaper and thus stimulates economic growth. Hypothetically, when the local currency strengthens, imports become less costly, which could potentially stimulate economic activity. However, this is not the case according to the findings of this study.

Instead, this discovery regarding the impact of exchange rate fluctuations suggests that, during episodes of depreciation or appreciation of the South African rand, policy measures implemented by the South African Reserve Bank (SARB) may exacerbate the economic situation in Eswatini, Lesotho, and Namibia, thereby increasing their vulnerability to economic crises. This is indeed concerning, as Eswatini, Lesotho, and Namibia do not have full control over their exchange rate policy, and pegging the exchange rate does not seem to produce the desired outcome of promoting constant economic growth and the progression of the less developed economies in the CMA region.

Therefore, policy implication arising from the knowledge that depreciation hurts economic growth is that policymakers should focus their efforts on attracting foreign countries to purchase goods and services from Common Monetary Area member economies. This is because goods and services become more affordable for them, thereby stimulating economic growth. Furthermore, policymakers could implement policies that actively support exports, such as offering export incentives or reducing trade barriers. The findings of the study also reveal that appreciation hurts economic growth. Therefore, this study further recommends that

policymakers may explore enacting policies to expand the economy by reducing import dependence and addressing structural factors that impede export competitiveness.

In addition to the above policy implication, given that Eswatini, Namibia, and Lesotho have aligned their exchange rates with South Africa and cannot independently conduct discrete monetary policies, this study suggests that policymakers should consider implementing expansionary fiscal policy by increasing government expenditure. This could offset the effects of depreciation and appreciation, as they are contractionary, thus stimulating investment and consumption to boost their individual economies. This policy recommendation should also be applied in South Africa.

The research's main limitation is the lack of available studies focusing on the asymmetric impact of exchange rate shocks on economic growth, which could have greatly aided in comparing results. Most of the available literature focuses on the symmetric impact of exchange rate shocks. Therefore, future studies should explore more asymmetric relationships in specific countries within the Common Monetary Area.

Disclosure statement

There are no competing interests to declare.

Data availability statement

Data for this study were obtained from public sources.

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