REVISITING THE NEW OPEN ECONOMY MACROECONOMICS HYPOTHESIS

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ABSTRACT

The determinants of exchange rate volatility continue to be a contentious topic in international economics, with no clear consensus due to the use of diverse theoretical models. This study revisits the New Open Economy Macroeconomics (NOEM) hypothesis to provide fresh insights into the drivers of exchange rate volatility in South Africa over the period 1990–2023. Employing quarterly data and the nonlinear autoregressive distributed lag (NARDL) framework, the study leverages the NOEM model's ability to integrate both monetary and non-monetary factors—a particularly relevant feature given South Africa's post-1995 trade liberalisation and increasing global economic integration.The NARDL approach enables the analysis of asymmetric responses of exchange rate volatility to positive and negative shocks in key macroeconomic variables, including oil prices, inflation, trade openness, interest rates, and GDP. The results reveal pronounced short- and long-run asymmetries. In the short run, negative oil price shocks amplify volatility, whereas positive shocks are largely inconsequential. GDP fluctuations display nuanced effects, with both positive and negative changes contributing to volatility reduction. Increases in trade openness significantly lower volatility, while reductions exacerbate instability. Inflation exerts long-run asymmetric effects, with positive shocks driving higher volatility. Interest rates, in contrast, remain largely insignificant across both horizons. The error correction term suggests that approximately 16% of disequilibria are corrected annually, confirming a gradual adjustment toward equilibrium.By revisiting the NOEM framework, this study underscores the necessity of incorporating asymmetries into exchange rate modelling and policy formulation. It makes a distinct contribution to the limited South African literature by demonstrating how oil price shocks, inflation, and trade openness asymmetrically influence rand volatility. Policy recommendations arising from these findings include strengthening trade openness, diversifying the economy, refining inflation-targeting mechanisms, and implementing measures to mitigate the impact of adverse oil price shocks.

Keywords: Exchange Rate Volatility, New Open Economy Macroeconomics, Nonlinear Autoregressive Distributed Lag, Asymmetric Effects, Trade Openness, Oil Price Shocks.

1. INTRODUCTION

The literature does not provide a consensus on the macroeconomic determinants of exchange rate volatility. This is due to the employment of several methodologies based on various theoretical models of exchange rate determination (Obstfeld and Rogoff, 1995; Rogoff, 2002). Some studies investigate the causes of exchange rate volatility using a specific exchange rate level model, while others use a synthesis of exchange rate level models (Meese and Rogoff, 1983).

Specific models include: (1) studies based on monetary models of exchange rate level determination that focus on monetary variables as determinants of exchange rate volatility (Frenkel, 1976; Bilson, 1978); (2) the Optimum Currency Areas (OCA) model, which focuses on trade links, asymmetry or similarity of economic shocks to production, country size, and geographic factors as causes of exchange rate volatility (Mundell, 1961; McKinnon, 1963); and (3) the New Open Economy Macroeconomics (NOEM) model, which emphasizes the role of monetary and non-monetary variables in explaining exchange rate volatility (Obstfeld and Rogoff, 1995; Lane, 2001).

Studies that synthesise exchange rates employ factors from different specific models deemed significant in understanding exchange rate fluctuations in the countries of their studies (Calderón and Kubota, 2018; Dagume, 2022). Others, however, find no correlation between macroeconomic fundamentals and exchange rate volatility (Meese and Rogoff, 1983), providing credence to the importance of non-macroeconomic causes of exchange rate volatility.

Considering this, the current study seeks to test the validity of the New Open Economy Macroeconomics model by analysing the causes of exchange rate volatility in South Africa, using time series data from 1990 to 2023 and the nonlinear autoregressive distributed lag (NARDL) approach (Pesaran et al., 2001; Shin et al., 2014; Ilu, 2020; Mpofu, 2016).

The study seeks to address the following research questions:

- Is there a long-run relationship between exchange rate volatility and its determinants in South Africa?
- Are there short-run dynamics among exchange rate volatility and its explanatory variables?

In doing so, the following hypothesis is formulated:

The New Open Economiy Macroeconomics Hypothesis still ?holds in South Africa

2. METHODOLOGY

Theoretical Framework

The New Open Economy Macroeconomics (NOEM) model forms the basis of the study (Obstfeld and Rogoff, 1995; Lane, 2001). The model is appropriate for analysing South Africa's economic openness and the volatility of exchange rate fundamentals because the country serves as a good case study following the 1995 capital account liberalisation, which resulted in trade openness (Aron and Muellbauer, 2007). Furthermore, unlike models that rely solely on monetary or optimum currency areas to determine exchange rates, this model stresses the importance of both monetary and non-monetary variables in explaining exchange rate volatility (Rogoff, 2002).

Monetary models cannot reproduce or forecast exchange rate swings, showing that monetary variables are only one of multiple factors influencing exchange rate volatility (Meese and Rogoff, 1983). Thus, the literature based on the New Open Economy Macroeconomics model contends that non-monetary factors have acquired importance in explaining exchange rate volatility (Mpofu, 2016).

The Empirical Model

The study follows Ilu's (2020) model in using the NARDL model. Given the tendency of the presence of asymmetries and other stylized effects in the series, Shin et al (2011) proposed the NARDL as an extension of the conventional ARDL model to capture the long-run impact of positive and negative effects of the independent variables on the dependent variable in a relationship.

Therefore, this facilitates the examination of the positive and negative effects of the explanatory variable, where the short-run and long-run nonlinearities are introduced through positive and negative partial sum decomposition of the explanatory variable. The empirical model of exchange rate volatility in time t is stated as follows:

$$ERV_t = f(TOPEN, OPRICE, INF_t, INT_t, GDP_t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where $ERV_t TOPEN_t$ represent trade openness, $OPRICE_t$ represents oil price. INF_t *is* a proxy for the inflation rate, INT_t *is* a proxy for the interest rate, and GDP_t.

To test the asymmetric assumption, the NARDL model (which is, an asymmetric expansion of the linear ARDL model) is used. The model allows the decomposition of the independent variables into both positive and negative partial sum of processes to investigate the nonlinear characteristics.

$$\Delta EXR_t = \alpha_0 + \partial_1 EXR_{t-1} + \partial_2 GDP_{t-1} + \partial_3 INFR_{t-1} + \partial_4 INTR_{t-1} + \partial_5 OP_{t-1} + \sum_{i=0}^{n}\beta_1 \Delta EXR_{t-1} + \sum_{i=0}^{n}\beta_2 \Delta GDP_{t-1} + \sum_{i=0}^{n}\beta_3 \Delta INFR_{t-1} + \sum_{i=0}^{n}\beta_4 \Delta INTR_{t-1} + \sum_{i=0}^{n}\beta_5 \Delta OP_{t-1} + \varepsilon_t - \ldots\ldots \quad (2)$$

If the impact of the explanatory variables on the dependent variable has the same magnitude of changes in the two cases (positive and negative), the relationship is symmetric. However, if the impact has a different magnitude of changes, the relationship is asymmetric. The NARDL model denotes the positive partial sum of changes in X by X^+ and the negative partial sum of changes in X by X^-.

The asymmetric error-correction form of our empirical model, as proposed by Pesaran et al. (2001) and Shin et al. (2014), is as follows:

$$\Delta ERV_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta ERV_{t-i} + \sum_{i=0}^{q} \alpha_{21} \Delta TOPEN_{t-i}^{+} + \sum_{i=0}^{q} \alpha_{22} \Delta TOPEN_{t-i}^{-} + \sum_{i=0}^{q} \alpha_{31} \Delta OPRICE_{t-i}^{+} + \sum_{i=0}^{q} \alpha_{32} \Delta OPRICE_{t-i}^{-} + \sum_{i=0}^{q} \alpha_{41} \Delta INF_{t-i}^{+} + \sum_{i=0}^{q} \alpha_{42} \Delta INF_{t-i}^{-} + \sum_{i=0}^{q} \alpha_{41} \Delta INT_{t-i}^{+} + \sum_{i=0}^{q} \alpha_{42} \Delta INT_{t-i}^{-} + \sum_{i=0}^{q} \alpha_{41} \Delta GDP_{t-i}^{+} + \sum_{i=0}^{q} \alpha_{42} \Delta IGDP_{t-i}^{-} + (\varphi_{11}^{+} \Delta ERV_{t-1}^{+} + \varphi_{12}^{-} \Delta ERV_{t-1}^{-}) + +(\varphi_{21}^{+} \Delta OPEN_{t-1}^{+} + \varphi_{22}^{-} \Delta OPEN_{t-1}^{-}) + (\varphi_{31}^{+} \Delta OPRICE_{t-1}^{+} + \varphi_{32}^{-} \Delta OPRICE_{t-1}^{-} + \sum_{i=0}^{q} \alpha_{41} \Delta INF_{t-i}^{+} + \sum_{i=0}^{q} \alpha_{42} \Delta INF_{t-i}^{-} + \sum_{i=0}^{q} \alpha_{41} \Delta INT_{t-i}^{+} + \sum_{i=0}^{q} \alpha_{42} \Delta INT_{t-i}^{-}) + \rho y_{t-1} + \mu_t \ldots\ldots\ldots\ldots (3)$$

The short and long-run asymmetry can be detected using the Wald test. A Wald F-statistics assumes the hypothesis test of joint significance where:

$$\begin{Bmatrix} H_0: \rho = \varphi_{11}^{-} = \varphi_{12}^{+} = \varphi_{21}^{-} = \varphi_{22}^{+} = \varphi_{31}^{+} = \varphi_{32}^{-} = 0 \Rightarrow non\ cointegration \\ H_\alpha: \rho = \varphi_{11}^{-} = \varphi_{12}^{+} = \varphi_{21}^{-} = \varphi_{22}^{+} = \varphi_{31}^{+} = \varphi_{32}^{-} \neq 0 \end{Bmatrix}$$

If the F-statistics is greater than the critical values (Pesaran et al., 2001), the decision is the rejection of the null hypothesis and this means that a long-run relationship can exist.

$$\begin{Bmatrix} H_0 = \rho = 0 \\ H_\alpha \neq \rho \prec 0. \end{Bmatrix}$$

According to Banerjee et al. (1998), if the null hypothesis is rejected the long-run relationship can exist in the presence of an asymmetric effect.

Wald proposed a hypothesis test for the symmetric or asymmetric effect as follows:

We calculate the coefficient of long-run asymmetry:

$$\begin{Bmatrix} \dfrac{-\varphi_{12=L_{M_1^+}}^{+}}{\rho} \\ \dfrac{-\varphi_{22=L_{M_1^-}}^{-}}{\rho} \end{Bmatrix}$$

The hypothesis test for the long-run effect is:

$$\begin{Bmatrix} H_{0:\frac{-\varphi_{11}^{+}}{\rho} = \frac{-\varphi_{12}^{-}}{\rho}} \Rightarrow symmetric\ effect\ of\ TOPEN_{t-1}\ on\ ERV_t\ in\ long\ run \\ H_\alpha: \dfrac{-\varphi^{+}}{\rho} \neq \dfrac{-\varphi^{-}}{\rho} \Rightarrow asymmetric\ effect\ of\ TOPEN_{t-1}\ on\ ERV_t\ in\ long\ run \end{Bmatrix}$$

The hypothesis test for the short-run effect is:

$$\begin{Bmatrix} H_{0:\frac{-\alpha_{21}^{+}}{\alpha_1}=\frac{-\alpha_{22}^{-}}{\alpha_1}} \Rightarrow symmetric\ effect\ of\ TOPEN_{t-1}\ on\ ERV_t\ in\ short\ run \\ H_{\alpha}: \dfrac{-\alpha_{21}^{+}}{\alpha_1} \neq \dfrac{-\alpha_{22}^{-}}{\alpha_1} \Rightarrow asymmetric\ effect\ of\ TOPEN_{t-1}\ on\ ERV_t\ in\ short\ run \end{Bmatrix}$$

The same hypothesis test goes for the short and long-run effects of oil price, inflation, interest rate, and GDP, on exchange rate volatility.

Estimation Techniques

Stationarity testing

The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are utilised. The ADF test is widely employed for evaluating the null hypothesis of a unit root (Guney and Komba, 2016).

The Zivot and Andrews (1992) test is used to check for unit roots allowing for one endogenously determined structural break.

To determine if certain coefficients are substantially different from zero, thereby indicating the presence of short-run asymmetry, the Wald test is used .

Diagnostic Tests

Autocorrelation, heteroscedasticity tests were conducted to check for model specification.

Data

This study utilizes a quarterly data time series covering the period from January 2015 to July 2023 obtained from the South African Reserve Bank (SARB), World Bank, and Statistics South Africa online websites. The analysis of the data was conducted using EViews 12 software.

The Results

The results of the NARDL model are presented in Table 1, below.

Table 1. NARDL - ECM

Variable	**Coefficient**	**Std. Error**	**t-statistic**	**Prob**
ECM (-1)	-.1608686	.01609	-9.99	0.000
OP_Pos	.0497431	.0298683	1.67	0.096
OP_Neg	.0614417	.0256186	2.40	0.017
GDP_Pos	-.041657	.018379	-2.27	0.024
GDP_Neg	-.0411243	.01864	-2.21	0.028
INTER_Pos	.032713	.020511	1.59	0.111
INTER_Neg	-.00542	.016572	-0.33	0.743
INF_Pos	-.006547	.013362	-0.49	0.624
INF_Neg	.0055046	.013732	0.40	0.689
TO_Pos	-.0352147	.0184264	-1.91	0.051
TO_Neg	-.031878	.0183023	-1.74	0.082

Error Correction Model

The error correction model known as ECM (-1), is negative and statistically significant, with a coefficient of -0.16. This indicates that approximately 16% of deviations from the long-run equilibrium are corrected annually, suggesting a gradual adjustment process towards equilibrium.

In the short run, positive changes in OP do not significantly impact EXCH, as indicated by an insignificant coefficient. However, negative changes in OP have a significant positive effect on EXCH, implying that decreases in OP lead to increased exchange rate volatility.

Both positive and negative changes in GDP significantly affect EXCH. Positive GDP changes are associated with a decrease in EXCH, while negative GDP changes also lead to a decrease in EXCH, suggesting a complex relationship between GDP fluctuations and exchange rate volatility.

INTER and INF are found to be statistically insignificant in influencing EXCH in the short run. TO exhibits a significant negative effect on EXCH when increasing, indicating that higher trade openness reduces exchange rate volatility. Negative changes in TO are insignificant, suggesting asymmetry in the impact of trade openness on exchange rate volatility.

Table 2. NARDL (Long Run)

Variable	Coefficient	Std. Error	t-statistic	Prob
OP_Pos	.3819686	.197258	1.94	0.053
OP_Neg	-.0378188	.19295	-0.20	0.845
GDP_Pos	-.0364124	.047303	-0.77	0.442
GDP_Neg	-.0570276	.048049	-1.19	0.235
INTER_Pos	.0754758	.108053	0.70	0.485
INTER_Neg	-.0265249	.0822129	-0.32	0.747
INF_Pos	.065313	.033436	1.95	0.051
INF_Neg	-.011111	.033219	-0.33	0.738
TO_Pos	-.0546452	.0348934	-1.57	0.118
TO_Neg	-.119001	.036405	-3.27	0.001

Long-Run Coefficients

In the long run, positive changes in OP significantly increase EXCH, indicating that rising oil prices contribute to higher exchange rate volatility. Negative changes in OP are insignificant. This implies that there is an asymmetric long-run relationship between the two variables.

Positive changes in INF have a significant positive effect on EXCH, suggesting that higher inflation rates lead to increased exchange rate volatility. Negative changes in INF are insignificant. INTER and GDP are both statistically insignificant in the long run, indicating no substantial impact on EXCH over the extended period.

Positive changes in TO are insignificant, while negative changes significantly decrease EXCH, implying that reductions in trade openness exacerbate exchange rate volatility.

Asymmetric effect

The asymmetric effects results are shown in Table 3.

Table 3. NARDL

Variable	Coefficient	F-Stat	P>F

OP_Pos	0.309	2.86	0.091
OP_Neg	-0.382	6.156	0.013
GDP_Pos	-0.259	5.392	0.020
GDP_Neg	0.256	5.092	0.024
INTER_Pos	0.203	2.651	0.104
INTER_Neg	0.034	.1071	0.744
INF_Pos	-0.041	.2401	0.624
INF_Neg	-0.034	.1613	0.688
TO_Pos	-0.219	3.689	0.055
TO_Neg	0.198	3.056	0.081

The Wald test indicates significant long-run asymmetry for INF, while no significant asymmetry is detected for interest rate (INTER). This suggests that positive and negative changes in inflation rate (INF) have different long-run effects on exchange rate (EXCH), whereas interest rate (INTER) does not exhibit asymmetric behaviour in influencing exchange rate volatility.

Diagnostic Tests

After estimating the model, four diagnostic tests were reported, namely, normality. Ramsey RESET, autocorrelation, and heteroscedasticity tests

Results show that the residuals are normally distributed. This is demonstrated by the p-value associated with the p-value of the JB statistic of 0.6668 , which is above 0.05.

Ramsey results reveal that there was no misspecification in the model. The Probability of the F-statistic of 0.8933, which is above 0.05, implies the absence of misspecification.

The null hypothesis of autocorrelation is that there is no autocorrelation in the residuals. Results show that there was no autocorrelation in the model. The probability of the F-statistic turned out to be 0.0701 is below 0.05. Hence, we fail to reject the null hypothesis of no autocorrelation.

The Breusch-Pagan heteroskedasticity test results show that there is no heteroskedasticity in the model. The Probability of the F-statistic turned out to be 0.5667, which is above 0.05. Hence, we fail to reject the null hypothesis of no heteroskedasticity.

Key Findings

The study finds that exchange rate volatility in South Africa is significantly shaped by macroeconomic variables, with notable short- and long-term asymmetries. The Error Correction Model (ECM) shows that about 16% of deviations from equilibrium are corrected annually, indicating gradual adjustment. In the short run, negative oil price shocks raise volatility, while positive shocks are insignificant. Positive GDP changes reduce volatility, but negative changes also decrease it, reflecting a complex link between GDP and volatility. Interest rates and inflation are insignificant, whereas rising trade openness reduces volatility.

In the long run, positive oil price and inflation shocks increase volatility, while negative changes are insignificant. Trade openness has asymmetric effects: positive changes are insignificant, but reductions heighten volatility. The Wald test confirms long-run inflation asymmetry, and cointegration tests support a stable long-run relationship.

These findings align with Mpofu (2016) on openness reducing rand volatility but contrast with Calderón and Kubota (2018), who argue that openness increases volatility. Dagume (2022) also finds volatility interacts positively with GDP growth and openness.

Theoretically, the results highlight the need to account for asymmetries in policy design. Practically, they emphasize enhancing trade openness and monitoring oil price shifts to curb volatility and support stability.

The study fails to reject the null hypotheses that The New Open Economy Macroeconomics holds in South Africa, since it reveals that non- monetary variables (trade openness and oil prices) significantly affect exchange rate volatility

Policy Implications

Based on the study's findings, several policy measures can help mitigate exchange rate volatility in South Africa. Enhancing trade openness through liberalization, favorable trade agreements, and reduced barriers can stabilize the currency by diversifying markets. Managing oil price shocks is crucial, as negative shocks have stronger effects, requiring strategies such as petroleum reserves, energy diversification, and hedging mechanisms. Strengthening inflation control remains vital, with stable inflation within target ranges reducing volatility. Economic diversification across manufacturing, agriculture, and services can lessen dependence on a narrow set of exports, while macroprudential policies can safeguard financial stability by regulating capital flows and exchange rate risk. Finally, effective coordination of fiscal and monetary policies can reinforce stability, reduce borrowing pressures, and support sustainable growth.

Contribution and Novelty of the Study

This study fills a gap in the limited South African literature on the causes of exchange rate volatility, extending work such as Mpofu (2016). It investigates key determinants of volatility and offers policy-relevant insights for stabilizing the economy. Its novelty lies in applying the NARDL model to examine the asymmetric effects of oil prices, inflation, and trade openness, capturing how positive and negative shocks affect volatility differently. Unlike prior research, it emphasizes the role of trade openness, showing that increases reduce volatility while decreases worsen it. By integrating these perspectives, the study provides a nuanced understanding of exchange rate dynamics in South Africa and contributes to strategies for promoting economic stability.

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