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Dynamic Connectivity and Spillover of Fluctuations between Energy Prices and Currency Rates with News-based Uncertainty as a Moderator

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Abstract: This study quantitatively examined the connectivity in the transmission of volatility between oil prices, and currency exchange rates whereby news-based uncertainty plays a moderating role in low income countries of Africa. The estimation of quarterly series spans the period 2019Q1 to 2024Q2. The multivariate-GARCH estimation techniques were executed. The findings indicated that there was a strong fluctuation spillover impact between the oil market and the foreign currency rate in low-income countries. The mean variation in oil prices among the low-income nations under investigation is a noteworthy 1.24. Uncertainty scores based on news were high, at 3.43. Additionally, the average local currency exchange rate to the US dollar was 1732.8. The result uphold the empirical incidence of oil price volatility spillover on exchange rate and exchange rate volatility spillover on oil price; and the significant connectivity of news-based uncertainty with variations in foreign exchange rates in Africa. The variation scores associated with oil prices, currency exchange rates and the uncertainty in news signified surpassing volatility in the oil and exchange markets. This result demonstrates the significance of the business cycle theory, a cornerstone of economics that explains how the economy fluctuates over time. According to the model results, these cyclical swings are an inherent feature of the financial markets and are influenced by a number of variables; such as uncertainty in news. The results of this investigation are consistent with earlier findings of related researches whereby variation in the financial performance of the business enterprises have been attributed to variations in the depreciation of the local currency exchange rates within the period of our study.

Keywords: multivariate-GARCH estimation techniques, low income nations in Africa, volatility spillover, news-based uncertainty, currency exchange rate

JEL classification: A20, B34, D26

1. Introduction

Oil price shocks have historically played a significant role in affecting the foreign exchange rates of countries in Africa and Europe. Oil price variability and

exchange rate problems have significant impacts on African economies. Most low income nations in Africa heavily relies on oil exports as a major source of revenue, and fluctuations in oil prices can lead to economic instability and uncertainty (Abiad, & Qureshi, 2023). When oil prices drop, African countries often struggle to balance their budgets and meet their financial obligations, leading to inflation, reduced revenue, and economic downturns. Additionally, the exchange rate problems caused by oil price uncertainty can further exacerbate economic challenges, making it difficult for low income African countries to attract foreign investment and grow their economies. When the price of oil fluctuates; it can greatly impact the economies of these regions, as they are major players in the global oil market. These oil price shocks can lead to currency depreciation or appreciation, depending on the specific circumstances of each country (Chen et al., 2024; Umoru, et al., 2023; Usman et al., 2023). In Africa, many countries rely heavily on oil exports for their economic growth and stability. When oil prices rise, these countries benefit from increased revenues and a stronger currency. However, when oil prices fall, their economies suffer, leading to a devaluation of their currency. This can have wide-reaching effects on the overall economic health of these nations, as it can increase the cost of imports and lead to inflation.

Oil price shocks can also have indirect effects on foreign exchange rates in Africa. For example, when oil prices rise, it can lead to a decrease in global demand for oil, which can in turn affect the demand for goods and services in these regions. This can lead to a decrease in export revenues, affecting the overall balance of trade and leading to currency depreciation. Furthermore, oil price shocks can also impact the investment climate in Africa. When oil prices fluctuate, it can lead to uncertainty in the markets, affecting investor confidence and leading to capital outflows. This can further exacerbate the currency depreciation or appreciation in these regions, as investors seek to protect their assets in more stable currencies.

In Africa, news-based uncertainty often leads to fluctuations in foreign exchange rates due to various factors such as political instability, social unrest, and economic uncertainties. African countries with weak governance structures and vulnerable economies are particularly susceptible to news events that can lead to sudden changes in foreign exchange rates. For example, a political coup in a country can trigger a sell-off of the local currency, leading to depreciation in foreign exchange rates (Bush, & Noria, 2021). Several studies have looked at how the exchange rate has changed over time, focusing on the trend towards short-term equilibrium (Odey & Agunobi, 2024; Akani, 2024). Additionally, they

discuss how foreign currency dynamics affect global investment and finance (Salisu, Rufai, and Nsonwu, 2024; Urgessa, 2024). Recent studies on the dynamic determinants of foreign exchange in Africa and the ASEAN region using ARCH/GARCH, FIGARCH, FIEGARCH and the few that have been conducted have all been national studies (Irmiya, Agbo, & Odumu, 2023; Urgessa, 2024; Salisu, Rufai, & Nsonwu, 2024). Even when it is the case that numerous researches have been carried out in African nations on exchange rate fluctuation and oil price shock (Bigerna 2024; Adi et al., 2022); the researchers are yet to find the most recent research that deployed a combination of GARCH models in modeling exchange volatility clustering, oil price volatility and news-based uncertainty as a control variable in low income nations of Africa. This study sought to fill this research gap. It is against this gap that the present study examines the volatility spillover on oil prices, news-based uncertainty and exchange rates of developing African nations.

The significance of this entire study lies in the fact that it will help financial marketers involved in the foreign currency market by providing them with knowledge about exchange returns, market speculation, and co-volatility in oil shocks so they can make wise judgments. Furthermore, central banks in developed and developing nations have the ability to impact currency exchange rates since they are knowledgeable about how to manage market factors and implement the best policies to achieve desired outcomes. Understanding how to save costs to maximise profit when engaging in international trade and keeping up with market trends can be beneficial for firms, particularly those in developing nations. This study is organized into five sections. Section one is introduction which is divided into, the background to the study, statement of the problem, research questions, objectives of the study, research hypotheses, significance of the study, scope of the study, limitation of the study and organization of the study. The literature review is section two. It captures conceptual issues, theoretical reviews, empirical reviews and the gaps in existing literature. Section three outlines the methodology of the study which includes the theoretical framework, estimation techniques and sources of data. The presentation and discussion of results are done in section four and the summary of findings, recommendations and conclusion of the study are in section five.

2. Literature Review

The nexus between energy prices, exchange rates and consumer price has been empirically researched by Leila et al. (2024), Chen et al (2024), Wang et al. (2024), Gohar et al. (2023), Simona (2023), Li & Chen (2023), Ding et al. (2023), Gong

et al. (2023), Kumeka et al. (2022), Philips et al. (2022), Garzon & Hierro (2022), Adi et al (2022), Gohar et al. (2022b), Gohar et al. (2022c), Balcilar & Usman (2021), Caporin et al. (2021), Zartashia et al. (2021), Küçükefe (2020), Ahmed & Huo (2020), Huynh et al. (2020), Adekoya & Oliyide (2020). Having investigated the co-movements of fluctuations in the exchange rates of 10 countries and energy prices, Leila et al. (2024) reported considerable evidence of a declining connectedness of the volatility transmission between the two markets. The authors also point out that during times of crisis, fluctuations in exchange rates were more prone to shocks in the price of oil than they were during times of stability. Chen et al. (2024) addressed the relationship between oil prices and foreign exchange rates by using the time-varying parameter VAR. They found that, during periods of severe crisis, there was a significant pairwise and rising connectedness between the fluctuations in energy prices and exchange rates. Studies such as those conducted by Wang et al. (2024) and Gohar et al. (2023) have also discovered robust patterns of interdependence among the currency markets.

Significant spillover effects and asymmetric contagion effects were functions of the energy prices taken into consideration for each country that imports crude oil, according to Simona (2023). The research results of Li and Chen (2023) confirm that there are transmission intensity changes between energy costs and the RMB exchange rate. The covariance between fluctuations in energy prices and those in exchange rates and oil prices was econometrically clarified by Ding et al. (2023). The implication associated with the research was that a continuous reduction in the co-movement between the fluctuations of oil prices and currency rates in developing economies is indispensable.

Using a multiple thresholds nonlinear ARDL model, Gong et al. (2023) found significant asymmetric impacts of exchange rate variability on energy consumption in E7 nations. According to Kumeka et al. (2022), own shocks are what drive the dynamic connectedness between energy prices, stock markets, and exchange rates. While Garzon & Hierro (2022) noted empirically that the exchange rate has a dampening influence in oil price pass-through in the Euro area, Philips et al. (2022) found that volatility in the exchange rate is the source of the cyclicality of oil price. Adi et al. (2022) observed that there was a non-reciprocating volatility transmission from the price of Brent oil to the effective exchange rate market, but a considerable reversible volatility transmission between the energy price (Brent oil) and the dollar-naira exchange rate. Changes in commodity prices have an impact on fluctuations in currency exchange rates, according to research by Gohar et al. (2022b) and Gohar et al. (2022c).

Balcilar and Usman's (2021) empirical research reveals significant volatility in both the price of oil and the currency rate. According to Caporin et al. (2021), asymmetric spillover proxy for volatility connectedness is a long-term occurrence, and detrimental volatility connectedness is what drives favorable fluctuations. Substantial empirical evidence of the volatility spillover effect of oil price shocks to foreign exchange markets was identified by Zartashia et al. (2021). In a simulation of the nexus between exchange rate spillover fluctuations and energy prices in Turkey, Küçükefe (2020) found that the response to shocks in energy prices was less severe in terms of magnitude and duration. In Africa, Ahmed & Huo (2020) found that there is a considerable spillover in the return and volatility interactions between oil prices, exchange rates, and stock markets. In the midst of trade policy uncertainty, Huynh et al. (2020) identified a variety of spillover patterns and connections between the currency rates. Adekoya & Oliyide (2020) established a strong connectedness between oil prices, financial markets, and the dollar exchange rate during the COVID-19 pandemic in their study.

3. Methodology

This study examines oil price shocks and news-based uncertainty impacts on exchange rate returns in low income African nations. Low income countries were restricted to countries classified by the UN as "low income" economies in Africa. Africa is the poorest continent in the World (World Bank, 2024). The UN list of low income African countries includes Sudan, Ethiopia, Mali, Benin Republic, South Sudan, Angola, Gambia, Côte D'Ivoire, Uganda, Liberia, Cabo Verde, Madagascar , Congo, Egypt, Guinea, Somalia, Central African Republic , Burkina Faso, Guinea-Bissau, Chad, Togo, Mozambique, Malawi, Burundi, Djibouti, Comoros, Guinea, Eritrea, Kenya, Mauritania, Eswatini, Lesotho, Zambia, Morocco, Tanzania, Senegal, Sao Tome, Zimbabwe, Tunisia and Zambia. From the UN list, the IMF list of the poorest countries was captured by this study. According to the IMF (2024), the GDP per capital (PPP) of these poorest countries are as follows: South Sudan ($492), Burundi ($936), Central African Republic ($1138), Congo ($1565), Mozambique ($1653), Malawi ($1712), Niger ($1729), Chad ($1863), Liberia ($1881), and Madagascar ($1988). According, it can be deduced from the preceding is that these countries combined suffer from identical economic problems such as weak/inadequate infrastructures, huge unemployment, food insecurity, poor governance, and vulnerability to external shocks. The reason for the choice of countries in Africa is because of high level of dependence of most of the low income Anglophone and Francophone countries in Africa on their European colonies such as Britain and France among others.

Also, the choice of the countries with collective economic characteristics in the continent of African was chosen because the researcher was interested in pooling the data to analyze then under a single nomenclature of low income (developing) countries. The time coverage spans 2019Q1 to 2024Q2. This choice of period was informed by the researcher's interest in modeling volatility spillovers among the variables from the covid-19 to post-covid-19 period where lots of international markets including the crude oil and exchange market was perturbed and market uncertainties was heightened. The inferential statistics were obtained from two techniques which are econometric approaches. The techniques include: the BEKK-GARCH, CCC-GARCH and VEC-GARCH regression equations. The details of all equations are discussed as follows:

$$H_t = A.A^{'} + \sum_{i=1}^{N} D_i (K_{t-i} K_{t-i}^{'}) D_i^{'} + \sum_{k=1}^{k} R_{ik} . H_{t-i} . R_{jk}^{'} \quad (1)$$

Where A is a lower triangular matrix, A_{ik} and R_{ik} are p matrices of parameters. When $N = K = 1$ the model becomes a BEKK as specified in equation (4):

$$H_t = A.A^{'} + D(K_{t-1} K_{t-1}^{'}) D_i^{'} + R_{ik} . H_{t-i} . R_{jk}^{'} \quad (2)$$

The positive value of H_t is the benefit linked with the BEKK model. An arbitrary symmetrical matrix and the parameter matrix's transpose are multiplied by the parameter matrices. The conditional correlation and variance of the constant conditional correlation (CCC) model according to Bollerslev (1990) as cited by He & Teräsvirta, (2004) are given as in equations (3) and (4):

$$\left| H_t \right|_{ij} = h_{it}^{0.5} h_{jt}^{0.5} Q_{ij} \quad (3)$$

$$h_t = A + \sum_{i=1}^{q} D_i K_t + \sum_{j=1}^{p} R_j h_{tj} \quad (4)$$

The first term *A* is a vector of the intercepts with a size of $(N \times 1)$ and the matrices of the coefficients are $(N \times N)$. The conditional variances and covariances in the VEC-GARCH model are functions of the cross products of the returns, the lagged squared returns, and all of the lagged conditional variances and covariances. The definition of the generic VEC model is:

$$Vech(H_t) = \sum_{i=1}^{p} D_i . Vech(K_{t-i} K_{t-i}^{'}) + \sum_{i=1}^{q} R_i . Vech(H_{t-j}) \quad (5)$$

and the case when $p = q = 1$ is defined as

$$Vech(H_t) = A + D.Vech(K_{t-i}K_{t-i}^{'}) + R_i.Vech(H_{t-j}) \quad (6)$$

For a VEC(1,1) model the left term can be expressed as following:

$$Vech = (H_t) \quad (7)$$

$$where \ \ (H_t) = h_{11,t}, h_{12,t} \ \ h_{22,t}$$

The number of parameters of eth VEC model is determined on the basis of $N(N+1)(N(N+1)+1)/2$. The rationales for the chosen multivariate GARCH models are as follows: The BEKK-GARCH equation was used to analyze the volatility of financial assets. The model combines elements of the Bivariate GARCH model to account for time-varying volatility and cross-correlations between different assets (Arfaoui, & Yousaf, 2022). The model is particularly useful for understanding and predicting the volatility of asset returns, which is crucial for risk management and portfolio optimization in financial markets (Usman et al., 2023). In particular, the BEKK-GARCH equation had the ability to capture the dynamic interactions between different assets or variables. By incorporating both own-asset and cross-asset volatility shocks, the model provides a more comprehensive understanding of how shocks in one asset can impact the volatility of other assets. This can be especially important in portfolio management, where investors want to diversify their holdings to reduce risk exposure (Arfaoui & Yousaf, 2022). By accounting for cross-correlations, the BEKK-GARCH equation helps investors make more informed decisions about asset allocation and risk management. On its part, the CCC-GARCH equation specifies that the conditional covariance matrix of asset returns can be modeled using past realized covariances and volatilities, as well as lagged conditional variances from a GARCH process. This allows for a more accurate representation of the non-stationary and non-linear behavior of volatility in financial markets. By incorporating the CCC assumption, which states that changes in asset prices are proportional to changes in covariances, the equation provides a more robust framework for capturing the interdependencies between different assets in a portfolio (Xiao, Xu, Liu, & Liu, 2020).

All equations were estimated using the E-views 13. We calculated the news-based uncertainties based on perception measurement indicators of the CPIA on trade quality and transparency of markets. Transparent news organizations provide accurate and unbiased information, as they are open about their journalistic practices and sources. This is against news sources that are secretive or refuse to disclose their sources may be hiding information that could affect the accuracy of their reports. By examining the transparency of a news outlet,

individuals can better determine the credibility of their information (Olasehinde Williams & Olanipekun, 2022).

4. Results

The presentation of data and interpretation of analysis are provided in this section. From Figures 1 and 2, the OILP, NEWS and EXCH in low income (developing) countries in Africa showed high volatility clustering. This is evident as high rise shocks are followed with higher rise values while low drops are followed with further drops.

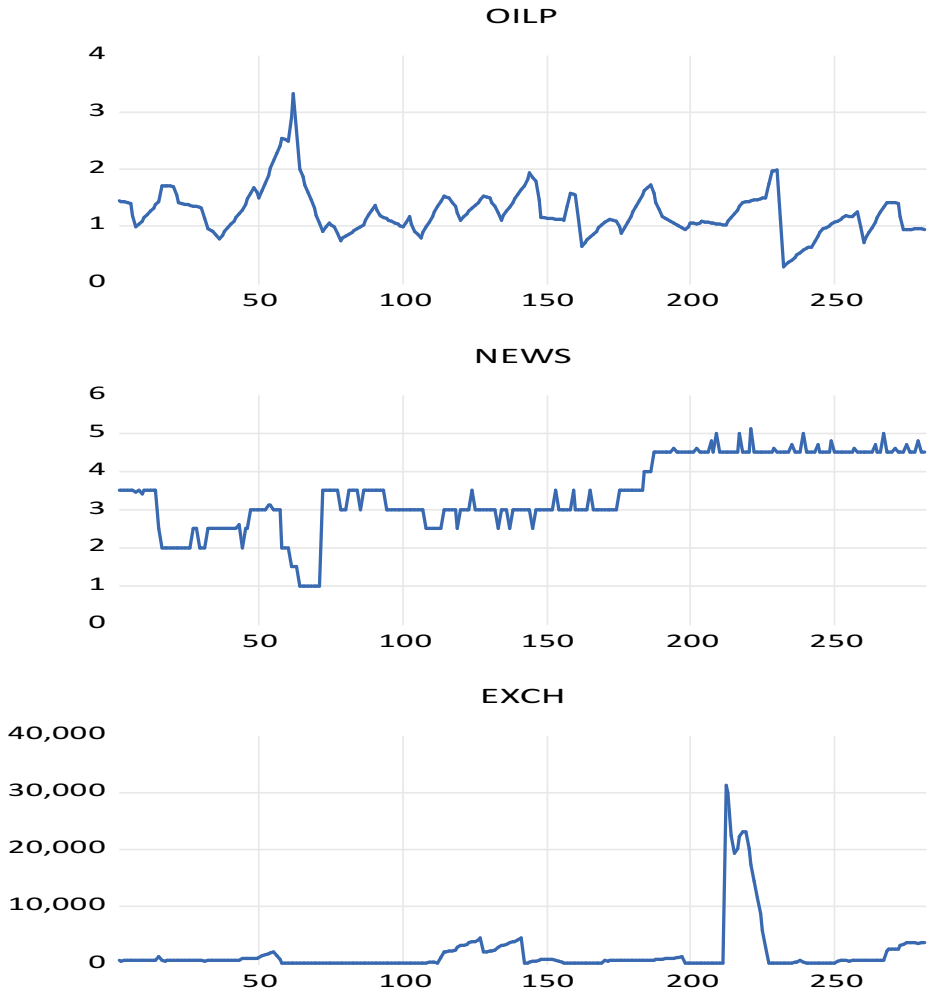

Figure 1: % Change in OILP, NEWS and EXCH of low income countries in Africa

Source: Authors' Regression Plot (E-view version 13)

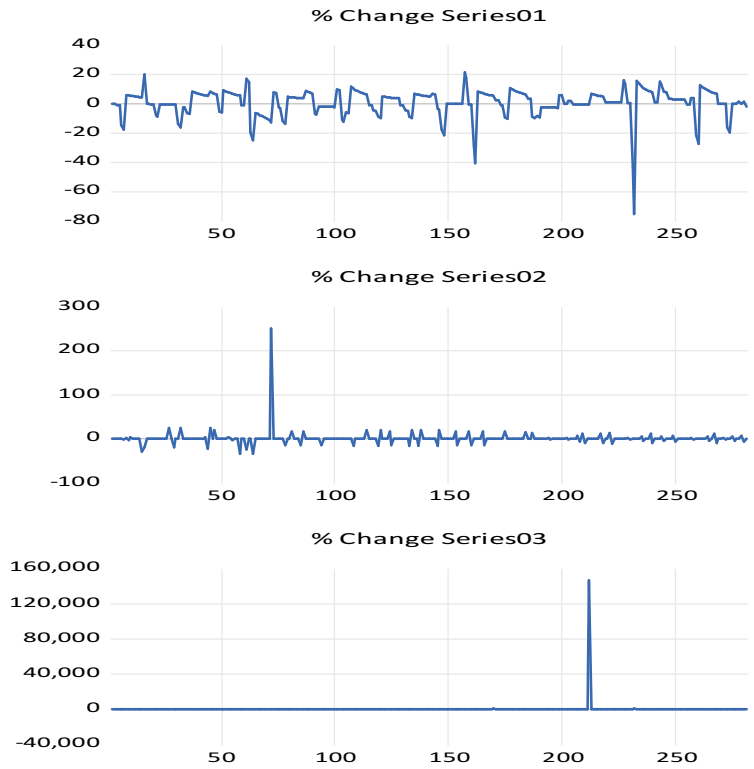

Figure 2: % Change in OILP, NEWS and EXCH of low income countries in Africa

Source: Authors' Regression Plot (E-view version 13)

Table 1 shows 1.24 mean oil price variation. News based uncertainties ratings was higher at 3.43 in underdeveloped countries than 3.2 score rating in developed countries. Also, exchange was high given a rate of 1732.8 to the US dollar. The

Table 1: Statistical Presentation of Series

Statistics	*OILP*	*NEWS*	*EXCH*
Mean	1.240569	3.430427	1732.816
Median	1.160000	3.500000	520.7766
Maximum	3.330000	5.100000	31269.66
Minimum	0.280000	1.000000	2.306001
Std. Dev.	0.398622	0.955197	4449.113
Skewness	1.336480	-0.316360	4.473007
Kurtosis	7.289211	2.512810	23.80963
Jarque-Bera	299.0548	7.466260	6007.219
Probability	0.000000	0.023918	0.000000
Observations	281	281	281

Source: Authors' Regression (E-view version 13)

standard deviation values of the OILP, NEWS and EXCH had higher standard scores indicating higher volatility in the oil and exchange markets. The full series are not normalized according to the Jarque Bera test ($p<0.05$).

The equation estimation methods used are restricted to three (3) multivariate-GARCH (M-GARCH) estimation techniques. These include: Baba, Engle, Kraft and Kroner (BEKK-GARCH), Constant Conditional Correlation (CCC-GARCH) and Vector Conditional (VECH-GARCH). These models were used to determine the best fit for volatility spillover estimation for developing/ low income countries in Africa. The results from the analysis are presented as follows. From Table 2, the mean equations of the BEKK-GARCH shows that oil price volatility spillover on exchange rate was insignificant ($p=0.8597$) while exchange rate volatility spillover on oil price was significant ($p=0.0504$). Also, news based uncertainties volatility spillover on exchange rate was significant ($p=0.0000$) while exchange rate volatility spillover on news based uncertainties (NEWS) was insignificant ($p=0.9014$).

The variance equations and covariance specification of the diagonal BEKK-GARCH coefficients are all significant ($p=0.05$). This shows that BEKK-GARCH sufficiently estimate oil price (OILP) volatility spillover on exchange rate and exchange rate (EXCH) volatility spillover on oil price (OILP) in low income nations in Africa. Since the BEKK-GARCH model combines elements of the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model with the Bivariate GARCH model to account for time-varying volatility and cross-correlations between different assets, the result shows that increase in exchange returns and news based uncertainties has direct significant impact on volatility shocks in oil price and exchange rate respectively.

From Table 3, the mean equations of the CCC-GARCH shows that oil price volatility spillover on exchange rate was insignificant ($p=0.000$) while exchange rate volatility spillover on oil price was significant ($p=0.000$). Also, news based uncertainties volatility spillover on exchange rate was significant ($p=0.0000$) while exchange rate volatility spillover on news based uncertainties was equally significant ($p=0.0000$). This shows that the mean constant conditional coefficient of the GARCH equation is significant. The conditional covariance matrix of returns shows that past realized covariances and volatilities, as well as lagged conditional variances from the GARCH process are significant. Holding the assumption that the volatility conditions are constant overtime, the co-volatility between the oil and exchange market shows high level of reciprocal relationship and interdependence. The variance equations and covariance specification of the CCC-GARCH coefficients are all significant ($p<0.05$). This shows that CCC-

GARCH sufficiently estimate oil price volatility spillover on exchange rate and exchange rate volatility spillover on oil price in low income nations in Africa.

From Table 4, the mean equations of the VEC-GARCH shows that oil price volatility spillover on exchange rate was insignificant (p=0.000) while exchange rate volatility spillover on oil price was insignificant (p=0.9667). Also, news based uncertainties volatility spillover on exchange rate was significant (p=0.0049) while exchange rate volatility spillover on news based uncertainties was insignificant (p=0.8981). This shows that the mean vector conditional coefficient of the GARCH equation is significant. Holding the assumption that the volatility conditions are constant overtime, the co-volatility between the oil and exchange market shows high level of reciprocal relationship and interdependence. The variance equations and covariance specification of the CCC-GARCH coefficients are all significant ($p<0.05$). This shows that VEC-GARCH only sufficiently measures the long-term dynamic interactions between the variables and the oil price volatility spillover on exchange rate in low income nations in Africa but not the other way round.

4.1. Discussion of Results

The result from the models showed that oil market and foreign exchange rate demonstrated high volatility spillover effect in low income nations. Most developing African countries have significant mean oil price variation which was reported as 1.24. News based uncertainties ratings was higher at 3.43 in underdeveloped countries. Also, the average exchange rate of local currencies to the US dollar stood at 1732.8. Based on standard deviation values, the OILP, NEWS and EXCH had higher standard scores; indicating higher volatility in the oil and exchange markets. This result demonstrates the significance of the business cycle theory, a cornerstone of economics that explains how the economy fluctuates over time. According to the idea, these cyclical swings are an inherent feature of the economic system and are influenced by a number of variables; such are changes in the confidence of businesses and consumers, modifications to laws, and outside shocks like pandemics or natural disasters. The results of this investigation are consistent with those of Akani (2024), who discovered that 83.6 and 90.2 percent of the variation in the financial performance of the small and medium-sized enterprises quoted can be attributed to variations in the depreciation of the naira exchange rate over the study's period. Moreover, the official naira exchange rate selling, official naira exchange rate, and average naira exchange rate have a positive and significant relationship with the financial performance of the quoted small and medium-sized enterprises, while the average

Table 2: BEKK-GARCH Results for Low Income Countries of Africa

Variables	*Coefficient*	*Std. Error*	*z-Statistic*	*Prob.*	*Variables*	*Coefficient*	*Std. Error*	*z-Statistic*	*Prob.*
C	1507.353*	257.6396	5.850626	0.0000	C	-2198.491*	125.8056	-17.47531	0.0000
OILP	34.53438	195.4443	0.176697	0.8597	NEWS	755.5138*	38.98007	19.38205	0.0000
C	1.027387*	0.014328	71.70242	0.0000	C	3.000001*	0.000143	21023.41	0.0000
EXCH	3.49E-06*	1.78E-06	1.956342	0.0504	EXCH	-1.99E-10	1.60E-09	-0.123861	0.9014
	Variance Equation Coefficients					*Variance Equation Coefficients*			
C(5)	88798.81	30314.36	2.929266	0.0034	C(5)	15308.72	3990.822	3.835981	0.0001
C(6)	0.002624	0.000552	4.754625	0.0000	C(6)	1.36E-11	3.33E-12	4.073660	0.0000
C(7)	1.378366	0.089291	15.43671	0.0000	C(7)	1.746201	0.193631	9.018205	0.0000
C(8)	1.250010	0.087648	14.26178	0.0000	C(8)	1.829715	0.201004	9.102889	0.0000
C(9)	-0.069360	0.020112	-3.448728	0.0006	C(9)	0.310105	0.023762	13.05023	0.0000
C(10)	0.293671	0.032465	9.045870	0.0000	C(10)	-0.000108	2.51E-05	-4.315953	0.0000
	Covariance specification: Diagonal BEKK					*Covariance specification: Diagonal BEKK*			
	Coef.	*Std. Error*	*z-Statistic*	*Prob.*		*Coef.*	*Std. Error*	*z-Statistic*	*Prob.*
M(1,1)	88798.81	30314.36	2.929266	0.0034	M(1,1)	15308.72	3990.822	3.835981	0.0001
M(2,2)	0.002624	0.000552	4.754625	0.0000	M(2,2)	1.36E-11	3.33E-12	4.073660	0.0000
A1(1,1)	1.378366	0.089291	15.43671	0.0000	M(1,1)	15308.72	3990.822	3.835981	0.0001
A1(2,2)	1.250010	0.087648	14.26178	0.0000	M(2,2)	1.36E-11	3.33E-12	4.073660	0.0000
B1(1,1)	-0.069360	0.020112	-3.448728	0.0006	M(1,1)	15308.72	3990.822	3.835981	0.0001
B1(2,2)	0.293671	0.032465	9.045870	0.0000	M(2,2)	1.36E-11	3.33E-12	4.073660	0.0000

Source: Authors' Regression (E-view version 13)

Table 4: VEC-GARCH Results for Low Income Countries of Africa

Variables	*Coefficient*	*Std. Error*	*z-Statistic*	*Prob.*	*Variables*	*Coefficient*	*Std. Error*	*z-Statistic*	*Prob.*
Constant	599.7477*	56.75690	10.56696	0.0000	Constant	-1455.262	777.2418	-1.872341	0.0612
OILP	-294.8180*	54.74451	-5.385344	0.0000	OILP	750.3368*	266.4327	2.816234	0.0049
Constant	6.670894*	0.541492	12.31947	0.0000	Constant	3.083196*	0.032665	94.38802	0.0000
EXCH	7.22E-06	0.000173	0.041760	0.9667	EXCH	2.12E-06	1.66E-05	0.128049	0.8981
	Variance Equation Coefficients					*Variance Equation Coefficients*			
C(5)	1.422447	0.415051	3.427162	0.0006	C(5)	4195370.	89184.36	47.04155	0.0000
C(6)	0.187114	0.029070	6.436589	0.0000	C(6)	0.055022	0.005990	9.185386	0.0000
C(7)	0.679720	0.018742	36.26656	0.0000	C(7)	0.861839	0.229863	3.749353	0.0002
					C(8)	-0.033030	0.010363	-3.187393	0.0014
	Transformed Variance Coefficients					*Covariance specification: Diagonal VECH*			
	Coefficient	Std. Error	z-Statistic	Prob.		Coefficient	Std. Error	z-Statistic	Prob.
M	1.422447	0.415051	3.427162	0.0006	M(1,1)	4195370.	89184.36	47.04155	0.0000
A1	0.187114	0.029070	6.436589	0.0000	M(2,2)	0.055022	0.005990	9.185386	0.0000
B1	0.679720	0.018742	36.26656	0.0000	A1	0.861839	0.229863	3.749353	0.0002
					B1	-0.033030	0.010363	-3.187393	0.0014

Source: Authors' Regression (E-view version 13)

Table 3: CCC-GARCH Results for Low Income Countries of Africa

Variables	*Coefficient*	*Std. Error*	*z-Statistic*	*Prob.*	*Variables*	*Coefficient*	*Std. Error*	*z-Statistic*	*Prob.*
Constant	669.1728*	29.52863	22.66183	0.0000	Constant	-238.4241*	21.98305	-10.84582	0.0000
OILP	-116.0678*	24.49856	-4.737741	0.0000	NEWS	240.2599*	6.799338	35.33577	0.0000
Constant	1.101785*	0.007821	140.8723	0.0000	Constant	2.961218*	0.003223	918.8830	0.0000
EXCH	1.27E-05*	1.39E-06	9.097161	0.0000	EXCH	9.23E-05*	9.06E-07	101.8036	0.0000
	Variance Equation Coefficients					*Variance Equation Coefficients*			
C(5)	3950.739	1153.619	3.424647	0.0006	C(5)	3272.758	1082.518	3.023282	0.0025
C(6)	1.624263	0.355995	4.562595	0.0000	C(6)	2.295325	0.699233	3.282630	0.0010
C(7)	-0.004792	0.001856	-2.581321	0.0098	C(7)	0.028136	0.053092	0.529956	0.5961
C(8)	0.003094	0.000955	3.239912	0.0012	C(8)	0.002436	0.000641	3.799332	0.0001
C(9)	1.477126	0.381173	3.875208	0.0001	C(9)	2.737827	0.774562	3.534677	0.0004
C(10)	0.089130	0.038432	2.319168	0.0204	C(10)	-0.003893	0.001541	-2.526467	0.0115
C(11)	0.402096	0.070941	5.668074	0.0000	C(11)	-0.648196	0.060673	-10.68344	0.0000
	Covariance specification: Constant Conditional Corr.					*Covariance specification: Constant Conditional Corr.*			
	Coefficient	*Std. Error*	*z-Statistic*	*Prob.*		*Coefficient*	*Std. Error*	*z-Statistic*	*Prob.*
A1(1)	1.624263	0.355995	4.562595	0.0000	A1(1)	2.295325	0.699233	3.282630	0.0010
B1(1)	-0.004792	0.001856	-2.581321	0.0098	B1(1)	0.028136	0.053092	0.529956	0.5961
M(2)	0.003094	0.000955	3.239912	0.0012	M(2)	0.002436	0.000641	3.799332	0.0001
A1(2)	1.477126	0.381173	3.875208	0.0001	A1(2)	2.737827	0.774562	3.534677	0.0004
B1(2)	0.089130	0.038432	2.319168	0.0204	B1(2)	-0.003893	0.001541	-2.526467	0.0115
R(1,2)	0.402096	0.070941	5.668074	0.0000	R(1,2)	-0.648196	0.060673	-10.68344	0.0000

Source: Authors' Regression (E-view version 13)

naira cross exchange rate has a significant negative relationship with the return on investment of the quotes.

The outcome of the research on the other hand, is at odds with that of Odey and Agunobi (2024), who discovered that the GDP of the real sector is not much boosted by the coefficient of FX. The outcome in terms of the coefficient's sign also deviates with the empirical results of Ukangwa, Onyenze, and Uke-ejibe (2023), which discovered that the exchange rate only has a negative and substantial influence on Nigeria over the long term. Additionally, the outcome differs with that of Ikwuagwu and Yagboyaju (2023), who discovered a weak and negative correlation between EXR and oil trade across the time period. Although not statistically significant; our results contradict those of Agu, Obodoechi, and Nebo (2022), who showed that the exchange rate had a negative impact on Nigeria's balance of payments. Mores, the outcome is consistent with Mohammed and Nuhu's (2021) findings, which showed that openness and exchange rate have a negative effect on balance of payments. The Granger causality test results, however, showed that there is unidirectional causation originating from exchange rate.

The two stages of the economic cycle, the expansionary and contractionary phases can be used to understand the implications of the switching regimes between periods of high and low volatility. Prior to COVID19, there were an expansion phase of the business cycle, which is characterized by a rise in economic activity that results in higher earnings, more jobs being created, and more consumers spending. High levels of confidence and investment marked this time period as companies looked to take advantage of the expanding demand for goods and services. But the cycle enters a contraction phase when the economy peaks and demand starts to decline due to the epidemic and industry lockout.

A contraction phase is characterized by a slowdown in economic activity, which results in lower consumer spending, income declines, and job losses. Pessimism and risk aversion characterized this time period as companies became more cautious when making investments. The economy eventually hits a low point before the cycle is restarted with a fresh phase of growth. All things considered, the business cycle theory emphasizes how critical it is to comprehend the cyclical nature of economic activity and the possibility of both expansion and contraction. Policymakers may lessen the effects of economic swings and encourage long-term stability in the stock and exchange markets by learning about the business cycle. The business cycle theory is still a useful tool for economists and policymakers to negotiate the market's uncertainties in the complicated global economy of today.

5. Conclusion

In this study, we deployed the multivariate GARCH models to evaluate interactions and spillover of fluctuations between energy prices, and currency rates with uncertainty in news playing a moderation role for the poorest nations of Africa. Overall, the estimations found significant oil price volatility spillover on exchange rate and exchange rate volatility spillover on oil price; and also a significant volatility spillover on exchange rate but not the other way round. The results revealed that oil price volatility spillover on exchange rate exist in low income countries in Africa. The study's findings and empirical analysis support the following recommendations: To strengthen the home currency and stop future depreciation of local currencies in low income African countries, the government should promote use of foreign currencies in their domestic market to maintain surplus trade balance. To be able to withstand any shock that might cause detrimental fluctuation in the foreign exchange rate market in low income economies in Africa, the government should maintain an emergency reserve of foreign currency such as the US dollar. This could equip the governments to raise its supply of foreign currency to the foreign exchange market during periods of high exchange rates and decrease it during periods of low exchange rates in low income economies. The apex bank could effectively control the degree of exchange rate volatility utilizing the availability of foreign currency in the foreign exchange market if the top bank of nations is able to boost the amount of foreign currency in its treasuries. There is need for African governments to pool resources to develop strategies to mitigate the impact of oil price fluctuation and exchange rate problems on their economies. This could involve diversifying their sources of revenue, and investing in renewable energy sources.

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